Atlantic spotted dolphin (Gulf of Mexico Stock) ... 5
Atlantic spotted dolphin (Puerto Rico and US Virgin Islands Stock) ... 14
Atlantic spotted dolphin (Western North Atlantic Stock) ... 24
Atlantic white-sided dolphin (Western North Atlantic Stock) ... 33
Blainville's beaked whale (Western North Atlantic Stock) ... 39
Blue whale (Western North Atlantic Stock) ... 45
Clymene dolphin (Northern Gulf of Mexico Stock) ... 51
Common bottlenose dolphin (GoMx BSE/Apalachee Bay Stock) ... 58
Common bottlenose dolphin (GoMx BSE/Barataria Bay Stock) ... 69
Common bottlenose dolphin (GoMx BSE/Calcasieu Lake Stock) ... 81
Common bottlenose dolphin (GoMx BSE/Caloosahatchee River Stock) ... 93
Common bottlenose dolphin (GoMx BSE/Choctawhatchee Bay Stock) ... 103
Common bottlenose dolphin (GoMx BSE/Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay Stock) 115
Common bottlenose dolphin (GoMx BSE/Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock) ... 125
Common bottlenose dolphin (GoMx BSE/Estero Bay Stock) ... 135
Common bottlenose dolphin (GoMx BSE/Florida Keys - Southwest Marathon Key to Marquesas Keys Stock) ... 145
Common bottlenose dolphin (GoMx BSE/Galveston Bay, East Bay, Trinity Bay Stock) ... 155
Common bottlenose dolphin (GoMx BSE/Laguna Madre Stock) ... 167
Common bottlenose dolphin (GoMx BSE/Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock) ... 177
Common bottlenose dolphin (GoMx BSE/Mississippi River Delta Stock) ... 187
Common bottlenose dolphin (GoMx BSE/Mississippi Sound, Lake Borgne, Bay Boudreau Stock) ... 199
Common bottlenose dolphin (GoMx BSE/Mobile Bay, Bonsecour Bay Stock) ... 212
Common bottlenose dolphin (GoMx BSE/Nueces Bay, Corpus Christi Bay Stock) ... 224
Common bottlenose dolphin (GoMx BSE/Pensacola Bay, East Bay Stock) ... 234
Common bottlenose dolphin (GoMx BSE/Perdido Bay Stock) ... 246
Common bottlenose dolphin (GoMx BSE/Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay Stock) ... 258
Common bottlenose dolphin (GoMx BSE/Sabine Lake Stock) ... 268
Common bottlenose dolphin (GoMx BSE/Sarasota Bay, Little Sarasota Bay Stock) ... 279
Common bottlenose dolphin (GoMx BSE/St. Andrew Bay Stock) ... 291
Common bottlenose dolphin (GoMx BSE/St. Joseph Bay Stock) ... 304
Common bottlenose dolphin (GoMx BSE/St. Joseph Sound, Clearwater Harbor Stock) ... 316

Common bottlenose dolphin (GoMx BSE/St. Vincent Sound, Apalachicola Bay, St. George Sound Stock) 327
Common bottlenose dolphin (GoMx BSE/Tampa Bay Stock) 340
Common bottlenose dolphin (GoMx BSE/Terrebonne Bay, Timbalier Bay Stock) 351
Common bottlenose dolphin (GoMx BSE/Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay Stock) 363
Common bottlenose dolphin (GoMx BSE/Waccasassa Bay, Withlacoochee Bay, Crystal Bay Stock) 374
Common bottlenose dolphin (GoMx BSE/West Bay Stock) 384
Common bottlenose dolphin (GoMx BSE/Whitewater Bay Stock) 395
Common bottlenose dolphin (Gulf of Mexico, Continental Shelf Stock) 405
Common bottlenose dolphin (Gulf of Mexico, Eastern Coastal Stock) 415
Common bottlenose dolphin (Gulf of Mexico, Northern Coastal Stock) 425
Common bottlenose dolphin (Gulf of Mexico, Oceanic Stock) 435
Common bottlenose dolphin (Gulf of Mexico, Western Coastal Stock) 445
Common bottlenose dolphin (Biscayne Bay Stock) 457
Common bottlenose dolphin (Central Georgia Estuarine System Stock) 467
Common bottlenose dolphin (Charleston Estuarine System Stock) 477
Common bottlenose dolphin (Florida Bay Stock) 489
Common bottlenose dolphin (Indian River Lagoon Estuarine System Stock) 500
Common bottlenose dolphin (Jacksonville Estuarine System Stock) 513
Common bottlenose dolphin (Northern Georgia/Southern South Carolina Estuarine System Stock) 524
Common bottlenose dolphin (Northern North Carolina Estuarine System Stock) 536
Common bottlenose dolphin (Northern South Carolina Estuarine System Stock) 548
Common bottlenose dolphin (Puerto Rico and US Virgin Islands Stock) 558
Common bottlenose dolphin (Southern Georgia Estuarine System Stock) 571
Common bottlenose dolphin (Southern North Carolina Estuarine System Stock) 582
Common bottlenose dolphin (Western North Atlantic, Northern and Southern Migratory Coastal Stocks) 593
Common bottlenose dolphin (Western North Atlantic: South Carolina-Georgia, Northern Florida, and Central Florida Coastal Stocks) 603
Common bottlenose dolphin (Western North Atlantic, Offshore Stock) 613
Common dolphin, short-beaked (Western North Atlantic Stock) 622
Cuvier’s beaked whale (Gulf of Mexico Stock) 630
Cuvier’s beaked whale (Puerto Rico and US Virgin Islands Stock) 641

Cuvier's beaked whale (Western North Atlantic Stock) 651
False killer whale (Northern Gulf of Mexico Stock) 660
False killer whale (Western North Atlantic Stock) 666
Fin whale (Western North Atlantic Stock) 671
Fraser's dolphin (Gulf of Mexico Stock) 678
Fraser's dolphin (Western North Atlantic Stock) 685
Gervais beaked whale (Western North Atlantic Stock) 691
Gray seal (Western North Atlantic Stock) 697
Harbor porpoise (Gulf of Maine/Bay of Fundy Stock) 704
Harbor seal (Western North Atlantic Stock) 712
Harp seal (Western North Atlantic Stock) 720
Hooded seal (Western North Atlantic Stock) 727
Humpback whale (Gulf of Maine Stock) 733
Killer whale (Gulf of Mexico Stock) 742
Killer whale (Western North Atlantic) 749
Kogia sp. (Northern Gulf of Mexico Stock Group) 755
Kogia sp. (Western North Atlantic Stock Group) 763
Melon-headed whale (Northern Gulf of Mexico Stock) 770
Melon-headed whale (Western North Atlantic Stock) 778
Mesoplodont group (Northern Gulf of Mexico Stock Group) 784
Minke whale (Canadian East Coast Stock) 7φ2
North Atlantic right whale (Western Atlantic Stock) 799
Northern bottlenose whale (Western North Atlantic Stock) 812
Pantropical spotted dolphin (Gulf of Mexico Stock) 817
Pilot whale, long-finned (Western North Atlantic Stock) 823
Pilot whale, short-finned (Northern Gulf of Mexico Stock) 830
Pilot whale, short-finned (Puerto Rico and US Virgin Islands Stock) 837
Pilot whale, short-finned (Western North Atlantic Stock) 846
Pygmy killer whale (Northern Gulf of Mexico Stock) 853
Pygmy killer whale (Western North Atlantic Stock) 859
Rice's whale (Gulf of Mexico Stock) 864
Risso's dolphin (Northern Gulf of Mexico Stock) 870
Risso's dolphin (Western North Atlantic Stock) 878

Rough-toothed dolphin (Gulf of Mexico Stock) 886
Rough-toothed dolphin (Western North Atlantic Stock) 893
Sei whale (Nova Scotia Stock) 899
Sowerby's beaked whale (Western North Atlantic Stock) 905
Sperm whale (Northern Gulf of Mexico Stock) 912
Sperm whale (North Atlantic Stock) 920
Sperm Whale (Puerto Rico and US Virgin Islands Stock) 929
Spinner dolphin (Northern Gulf of Mexico Stock) 937
Spinner dolphin (Puerto Rico and US Virgin Islands Stock) 945
Stenella sp. (Western North Atlantic Stock Group) 952
Striped dolphin (Northern Gulf of Mexico Stock) 960
Striped dolphin (Western North Atlantic Stock) 968
True's beaked whale (Western North Atlantic Stock) 973
White-beaked dolphin (Western North Atlantic Stock) 979

Atlantic spotted dolphin − *Stenella frontalis*

Gulf of Mexico Stock

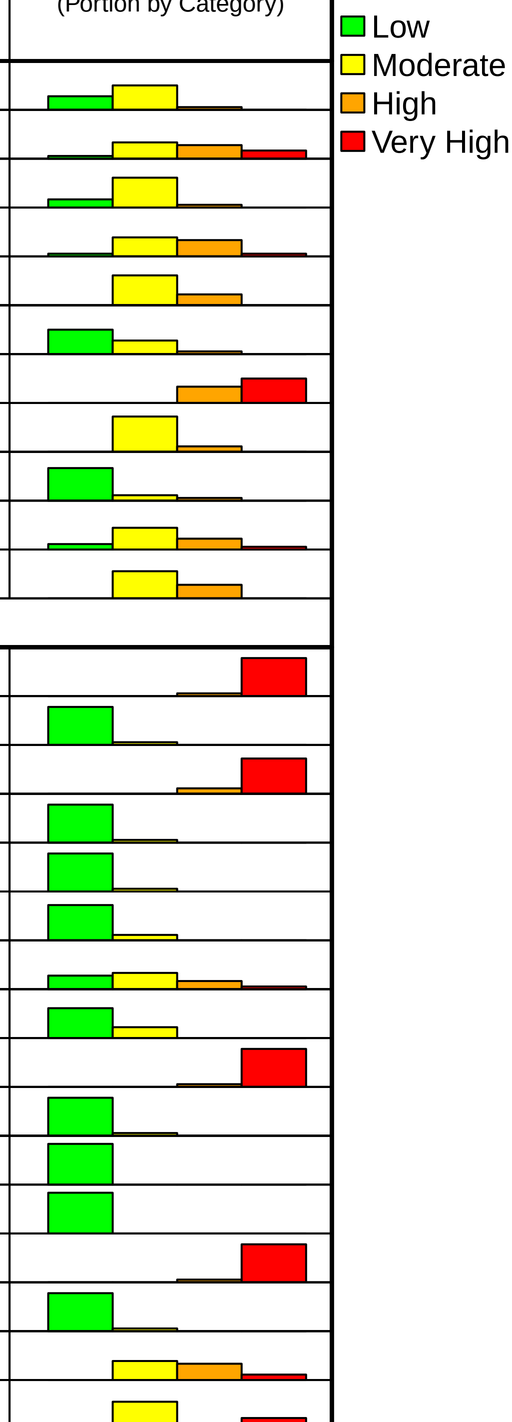
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Stenella frontalis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	2.0	
	Habitat Specificity	2.7	2.0	
	Site Fidelity	1.9	1.3	
	Lifetime Reproductive Potential	2.5	2.0	
	Generation Length	2.3	2.0	
	Reproductive Plasticity	1.5	1.0	
	Migration	3.6	2.3	
	Home Range	2.1	1.7	
	Stock Abundance	1.3	2.3	
	Stock Abundance Trend	2.3	0.7	
	Cumulative Stressors	2.3	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	3.0	
	Sea Surface Temperature (Change in variability)	1.1	3.0	
	Air Temperature (Change in mean)	3.9	3.0	
	Air Temperature (Change in variability)	1.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	2.0	2.7	
	Sea Surface Salinity (Change in variability)	1.3	2.7	
	Ocean pH (Change in mean)	3.9	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	3.0	
	Dissolved oxygen (Change in variability)	1.1	3.0	
	Circulation	2.7	2.3	
	Sea level rise	2.6	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Atlantic spotted dolphin (Gulf of Mexico Stock)

Stenella frontalis

CVA Results Summary

Overall Climate Vulnerability Rank: High (80% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (3.93), Ocean pH (Standard anomaly) (3.93), Sea Surface Temperature (Standard anomaly) (3.93), and Air Temperature (Standard anomaly) (3.87).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (3.60) and Habitat Specificity (2.67)

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 85% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Atlantic spotted dolphin Northern Gulf of Mexico Stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico (Hayes et al. 2022).

Prey/Diet Specificity

Atlantic spotted dolphins in the Gulf of Mexico have been observed feeding on clupeid fishes (order Clupeiformes; Fertl and Würsig 1995). They have also been observed feeding in the vicinity of shrimp trawlers (Fertl and Leatherwood 1997).

Prey and diet information for Atlantic spotted dolphins in the western North Atlantic was found only in the Bahamas, where Atlantic spotted dolphins have been well-studied since the 1980's. In the Bahamas, lizardfish (order Aulopiformes, family Synodontidae) constituted >30% of female Atlantic spotted dolphin diet during all reproductive states. Other major components of the diet included fish in the orders Beloniformes (halfbeaks [family Hemiramphidae], flyingfish [family Exocoetidae], needlefish [family Belonidae]), Anguilliformes (small eels [family Congridae]), Pleuronectiformes (flounders [family Bothidae]), Perciformes (jacks [family Carangidae], mackerel [family Scombridae], and tilefish [family Malacanthidae]), Labriformes (razorfish [family Labridae]), and Tetradontiformes (filefish [family Monacanthidae]) (Malinowski and Herzing 2015). Atlantic spotted dolphins have been observed chasing and catching flying fish (order Beloniformes) in the Bahamas (MacLeod et al. 2004).

Analysis of stomach contents of two Atlantic spotted dolphins in the Canary Islands showed the presence of cephalopods of the order Oegopsida (genera *Hisitiotheuthis* and *Enoploteuthis*) and crustaceans of the infraclass Cirripedia (Fernandez et al. 2009).

In Brazil, four studies combined for stomach content analysis of 26 individuals (Di Beneditto et al. 2001; Melo et al. 2010; Lopes et al. 2012). These studies listed a total of six cephalopod species and 18 fish species as prey items of Atlantic spotted dolphin. Melo et al. (2010) reported *Porichthys porosissimus* (order Batrachoidiformes) as the main fish species found in 10 stomachs of stranded dolphins. Di Beneditto et al. (2001) reported *Orthopristis ruber* (order Perciformes) as the main fish species found in six incidentally captured dolphins. Both studies reported the squid *Doryteuthis plei* (order Myopsida) was the most important cephalopod prey. Based on stomach content analysis of nine *S. frontalis* incidentally caught in fishing operations in southeastern Brazil, dolphins assessed preyed on at least eight different fish species of the order Perciformes (families Trichiuridae, Carangidae, Sparidae, Sciaenidae, and Scombridae), order Gadiformes (family Merluccidae), Order Clupeiformes (family Engraulidae), Order Anguilliformes (family Congridae), order Myopsida (family Loliginidae), order Sepiida (family Sepiolidae), order Octopoda (family Tremoctopodidae), and order Oegopsida (family Thysanoteuthidae), and order Decapoda (family Penaeidae; Lopes et al. 2012). Lopes et al. (2012) found *Trichiurus lepturus* was the most important fish species represented and *Doryteuthis plei* was the most represented cephalopod species.

Habitat Specificity

The larger coastal ecotype of Atlantic spotted dolphin inhabits the continental shelf and is usually found inside or near the 200m isobath, usually at least 8 to 20 km offshore (Perrin et al. 1987, 1994; Davis et al. 1998; Rice 1998; Herzing and Perrin 2018). The smaller island and offshore ecotype is known to occur in the Atlantic Ocean but not in the Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2003; Mullin and Fulling 2004).

Atlantic spotted dolphins are often sighted beyond the shelf break in the Caribbean, Gulf of Mexico, and off the Atlantic U.S. coast (Mills and Rademacher 1996; Roden and Mullin 2000; Fulling et al. 2003; Mullin and Fulling 2003; Mullin et al. 2004).

In the Gulf of Mexico, Atlantic spotted dolphins occur primarily in continental shelf waters 10-200m deep and slope waters <500m deep, though a difference is seen between the eastern and western Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Griffin and Griffin (2003) noted a primary depth range of 20-50m in the eastern Gulf of Mexico. Mullin et al. (2004) found that Atlantic spotted dolphins were sighted in waters with a bottom depth typically <300 m. A single satellite-tagged Atlantic spotted dolphin released in the Gulf of Mexico was found to prefer shallow-water habitat (<30 m in depth; Davis et al. 1996).

Off Brazil, Atlantic spotted dolphins are seen in waters less than 1000m in depth (Moreno et al. 2005).

Site Fidelity

Information regarding Atlantic spotted dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Herzing (1997) reported Atlantic spotted dolphin mean calving interval of 2.96 years (SD = 1.224) with a range of 1-5 years in Lower Bahama Bank.

In the Bahamas, Herzing (1997) estimated age at sexual maturation for females at 8 to 15 years of age. Taylor et al. (2007) reported Atlantic spotted dolphin age at first reproduction of 12 years and age at last reproduction of 31 years based on values reported by Herzing (1997) and Perrin et al. (1994).

Generation Length

Taylor et al. (2007) reported Atlantic spotted dolphin generation length of 18.6 years at r = 0.01 and 18.3 years at r = 0.0 based on data from the Bahamas (Herzing 1997).

Reproductive Plasticity

Herzing (1997) reported peak calving periods in early spring and late fall for Atlantic spotted dolphin on Lower Bahama Bank.

Information regarding specific breeding locations and habitat was not found in the literature.

Malinowski and Herzing (2015) found that pregnant and lactating females had lower nutritional intake than non-reproductively active females in Lower Bahama Bank.

Migration

In the Gulf of Mexico, Griffin and Griffin (2004) reported higher densities of Atlantic spotted dolphin on the west Florida continental shelf during November through May compared to June through October. Griffin et al. (2005) suggested that Atlantic spotted dolphins more often feed over the continental shelf in winter than summer. High numbers of resighted individuals in Lower Bahama Bank in successive years suggest a stable resident population of Atlantic spotted dolphins (Herzing 1997).

Home Range

Information about Atlantic spotted dolphin home range in the Gulf of Mexico was not found in the literature.

Elsewhere, groups have shifted home ranges, such as in 2013 when half of the Little Bahama Bank Atlantic spotted dolphin community relocated 161 km south to Great Bahama Bank, which is home to a separate community of resident spotted dolphins (Herzing et al. 2017).

Stock Abundance

The abundance is estimated at 21,506 individuals (CV=0.26) based on the combined estimate of abundance from 2017 continental shelf aerial surveys and 2017-2018 vessel surveys in oceanic waters (Garrison et al. 2020; Garrison et al. 2021; Hayes et al. 2022). Previously, the stock was estimated at 37,611 individuals (CV=0.28) based on the combined estimate of abundance for both the outer continental shelf (fall surveys, 2000–2001) and oceanic waters (spring and summer surveys, 2003–2004; Waring et al. 2016).

Stock Abundance Trend

Three point estimates of Atlantic spotted dolphin abundance have been made based on data from surveys in 2009 (1,161; CV=1.021), 2017 (3,267; CV=0.52), and 2018 (8,178; CV=0.55). Pairwise comparisons of the log-transformed means were conducted between years, and found significant differences between the 2009 and 2018 estimates (see Garrison et al. 2020 and Hayes et al. 2022).

Cumulative Stressors

Atlantic spotted dolphins in the Gulf of Mexico interact with pelagic longline and shrimp trawl fisheries (Hayes et al. 2022). During the period 2015–2019, an estimated 36 Atlantic spotted dolphins (CV=0.47) were killed by interactions with the shrimp otter trawl fishery in the Gulf of Mexico (when all unidentified marine mammal interactions with the fishery were assumed to be Atlantic spotted dolphins; Soldevilla et al. 2021). Atlantic spotted dolphins are known to strand within the Gulf of Mexico (Hayes et al. 2022; also see NOAA National Marine Mammal Health and Stranding Response Database).

The Atlantic spotted dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016; Aichinger Dias et al. 2017; Takeshita et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015). Atlantc spotted dolphins have also been included in UMEs in 1999–2000 and 2005–2006 due to brevetoxin (Twiner et al. 2012; Litz et al. 2014).

Distribution and Sightings

Density model results for Atlantic spotted dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Braulik, G. and T.A. Jefferson. 2018. *Stenella frontalis*. The IUCN Red List of Threatened Species 2018: e.T20732A50375312. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20732A50375312.en

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy and U.S. Fleet Forces Command, Hampton, Virginia. Contract #N62470-02-D-9997, CTO 0030.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Herzing, D.L. and W.F. Perrin. 2018. Atlantic Spotted Dolphin: Stenella frontalis. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 40-42. doi: 10.1016/B978-0-12-804327-1.00050-9

Literature Cited

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Davis, R.W., G.A.J. Worthy, B. Würsig, S.K. Lynn, and F.I. Townsend. 1996. Diving behavior and at-sea movements of an Atlantic spotted dolphin in the Gulf of Mexico. Marine Mammal Science 12(4):569–581. doi: 10.1111/j.1748-7692.1996.tb00069.x

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Di Beneditto, A.P.M., R.M.A. Ramos, S. Siciliano, R.A. dos Santos, G. Bastos, and E. Fagundes-Neto. 2001. Stomach contents of delphinids from Rio de Janeiro, southeastern Brazil. Aquatic Mammals 27(1):24–28.

Fernández, R., M.B. Santos, M. Carrillo, M. Tejedor, and G.J. Pierce. 2009. Stomach contents of cetaceans stranded in the Canary Islands 1996–2006. Journal of the Marine Biological Association of the United Kingdom 89(5):873–883. doi: 10.1017/s0025315409000290

Fertl, D. and S. Leatherwood. 1997. Cetacean interactions with trawls: A preliminary review. Journal of Northwest Atlantic Fishery Science 22:219–248. doi: 10.2960/J.v22.a17

Fertl, D. and B. Würsig. 1995. Coordinated feeding by Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Aquatic Mammals 21(1):3–5.

Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101(4):923–932.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Griffin, B.R. and N.J. Griffin. 2004. Temporal variation in Atlantic spotted dolphin (*Stenella frontalis*) and bottlenose dolphin (*Tursiops truncatus*) densities on the West Florida Continental Shelf. Aquatic Mammals 30(3):380–390. doi: 10.1578/am.30.3.2004.380

Griffin, R.B. and N.J. Griffin. 2003. Distribution, habitat partitioning, and abundance of Atlantic spotted dolphins, bottlenose dolphins, and loggerhead sea turtles on the eastern Gulf of Mexico continental shelf. Gulf of Mexico Science 21(1):23–34. doi: 10.18785/goms.2101.03

Griffin, R.B., C. Hu, and N.J. Griffin. 2005. Movement patterns of Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in relation to oceanographic fronts. Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, 12-16 December. p. 112.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Herzing, D.L. 1997. The life history of free-ranging atlantic spotted dolphins (*Stenella frontalis*): Age classes, color phases, and female reproduction. Marine Mammal Science 13(4):576–595. doi: 10.1111/j.1748-7692.1997.tb00085.x

Herzing, D.L., B.N. Augliere, C.R. Elliser, M.L. Green, and A.A. Pack. 2017. Exodus! Large-scale displacement and social adjustments of resident Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. PLoS ONE 12(8):e0180304. doi: 10.1371/journal.pone.0180304

Herzing, D.L. and W.F. Perrin. 2018. Atlantic spotted dolphin: *Stenella frontalis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 40–42. doi: 10.1016/B978-0-12-804327-1.00050-9

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lopes, X.M., M.C.d.O. Santos, E. da Silva, M. Bassoi, and R.A. dos Santos. 2012. Feeding habits of the Atlantic spotted dolphin, *Stenella frontalis*, in southeastern Brazil. Brazilian Journal of Oceanography 60(2):189–198. doi: 10.1590/S1679-87592012000200009

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Malinowski, C.R. and D.L. Herzing. 2015. Prey use and nutritional differences between reproductive states and age classes in Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. Marine Mammal Science 31(4):1471–1493. doi: 10.1111/mms.12238

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Melo, C.L.C., R.A. Santos, M. Bassoi, A.C. Araújo, J. Lailson-Brito, P.R. Dorneles, and A.F. Azevedo. 2010. Feeding habits of delphinids (Mammalia: Cetacea) from Rio de Janeiro State, Brazil. Journal of

the Marine Biological Association of the United Kingdom 90(8):1509–1515. doi: 10.1017/s0025315409991639
Mills, L.R. and K.R. Rademacher. 1996. Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Gulf of Mexico Science 14(2):114–120. doi: 10.18785/goms.1402.08
Moreno, I.B., A.N. Zerbini, D. Danilewicz, S. de Oliveira Sa, P.C. Simões-Lopes, J. Lailson-Brito, and A.F. Azevedo. 2005. Distribution and habitat characteristics of dolphins of the genus *Stenella* (Cetacea: Delphinidae) in the Southwest Atlantic Ocean. Marine Ecology Progress Series 300:229–240. doi: 10.3354/meps300229
Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603–613.
Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x
Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06
National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.
Perrin, W.F., D.K. Caldwell, and M.C. Caldwell. 1994. Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier, 1829). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, London, UK. pp. 173–190.
Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, M.C. Caldwell, P.J.H. Bree, and W.H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* spp. Marine Mammal Science 3(2):99–170. doi: 10.1111/j.1748-7692.1987.tb00158.x
Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for Atlantic spotted dolphin (*Stenella frontalis*) for the U.S. Gulf of Mexico version 4.3, 2015-09-03, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 70 p.
Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.
Soldevilla, M.S., L.P. Garrison, E. Scott-Denton, and J.M. Nance. 2015. Estimation of marine mammal bycatch mortality in the Gulf of Mexico shrimp otter trawl fishery. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-672. 70 p. doi: 10.7289/V5SF2T46
Soldevilla, M.S., L.P. Garrison, E. Scott-Denton, and J. Primrose. 2021. Estimated bycatch mortality of marine mammals in the Gulf of Mexico shrimp otter trawl fishery during 2015 to 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-749. 78 p. doi: 10.25923/kftx-x751
Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. The Deepwater Horizon oil spill marine mammal injury assessment. Endangered Species Research 33:95–106. doi: 10.3354/esr00808

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Atlantic spotted dolphin − *Stenella frontalis*

Puerto Rico and US Virgin Islands Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 70% of scores ≥ 2

	Stenella frontalis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	2.1	2.0	
	Site Fidelity	2.4	1.7	
	Lifetime Reproductive Potential	2.5	2.0	
	Generation Length	2.3	2.0	
	Reproductive Plasticity	1.7	1.0	
	Migration	3.4	2.0	
	Home Range	2.7	2.0	
	Stock Abundance	2.5	1.0	
	Stock Abundance Trend	2.6	0.7	
	Cumulative Stressors	2.9	1.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.0	
	Sea Surface Temperature (Change in variability)	1.7	2.0	
	Air Temperature (Change in mean)	3.3	2.0	
	Air Temperature (Change in variability)	1.3	2.0	
	Precipitation (Change in mean)	1.3	2.0	
	Precipitation (Change in variability)	1.5	2.0	
	Sea Surface Salinity (Change in mean)	2.6	2.0	
	Sea Surface Salinity (Change in variability)	1.7	2.0	
	Ocean pH (Change in mean)	3.6	2.0	
	Ocean pH (Change in variability)	1.7	2.0	
	Sea ice coverage (Change in mean)	1.3	1.3	
	Sea ice coverage (Change in variability)	1.3	1.3	
	Dissolved oxygen (Change in mean)	3.5	2.0	
	Dissolved oxygen (Change in variability)	1.9	2.0	
	Circulation	2.9	1.0	
	Sea level rise	1.6	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Atlantic spotted dolphin (Puerto Rico and US Virgin Islands Stock)

Stenella frontalis

CVA Results Summary

Overall Climate Vulnerability Rank: High (51% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.60), Dissolved oxygen (Standard anomaly) (3.53), and Sea Surface Temperature (Standard anomaly) (3.53).

Biological Sensitivity: Moderate. FIve sensitivity attributes scored greater than 2.5: Migration (3.40), Cumulative Stressors (2.93), Home Range (2.73), Species Abundance Trend (2.60), and Lifetime Reproductive Potential (2.53).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 70% of the data quality scores were 2 or greater. 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Puerto Rico and U.S. Virgin Islands Atlantic spotted dolphin stock includes individuals that are found in the waters of the U.S. Exclusive Economic Zone surrounding Puerto Rico and the U.S. Virgin Islands (Waring et al. 2012). It is considered a separate stock for management purposes, but no information exists to differentiate this stock from the western North Atlantic and Gulf of Mexico stocks (Waring et al. 2012).

Prey/Diet Specificity

Prey and diet information for Atlantic spotted dolphin in the western North Atlantic was found only in the Bahamas, where Atlantic spotted dolphin has been well-studied since the 1980's. In the Bahamas, lizardfish (order Aulopiformes, family Synodontidae) constituted >30% of female Atlantic spotted dolphin diet during all reproductive states. Other major components of the diet include fish in the orders Beloniformes (halfbeaks [family Hemiramphidae], flying fish [family Exocoetidae], needlefish [family Belonidae]), Anguilliformes (small eels [family Congridae]), Pleuronectiformes (flounders [family Bothidae]), Perciformes (jacks [family Carangidae], mackerel [family Scombridae], and tilefish [family Malacanthidae]), Labriformes (razorfish [family Labridae]), and Tetradontiformes (filefish [family Monacanthidae]; Malinowski and Herzing 2015). Atlantic spotted dolphins have been observed chasing and catching flying fish (order Beloniformes) in the Bahamas (MacLeod et al. 2004).

Atlantic spotted dolphins in the Gulf of Mexico have been observed feeding on clupeid fishes (order Clupeiformes; Fertl and Würsig 1995). They have also been observed feeding in the vicinity of shrimp trawlers (Fertl and Leatherwood 1997).

Stomach contents of three Atlantic spotted dolphins that stranded in Puerto Rico consisted of squid beaks from *Illex sp.* (Mignucci-Giannoni 1996). Atlantic spotted dolphins off Puerto Rico have been observed feeding on flying fish (Rodriguez-Ferrer et al. 2018).

Analysis of stomach contents of two Atlantic spotted dolphins in the Canary Islands showed the presence of cephalopods of the order Oegopsida (genera *Hisitiotheuthis* and *Enoploteuthis*) and crustaceans of the infraclass Cirripedia (Fernandez et al. 2009).

In Brazil, four studies provided stomach content analyses of 26 individuals (Di Beneditto et al. 2001; Melo et al. 2010; Lopes et al. 2012). These studies listed a total of six cephalopod species and 18 fish species as prey items of Atlantic spotted dolphins. Melo et al. (2010) reported *Porichthys porosissimus* (order Batrachoidiformes) as the main fish species found in 10 stomachs of stranded dolphins. Di Beneditto et al. (2001) reported *Orthopristis ruber* (order Perciformes) as the main fish species found in six incidentally captured dolphins. Both of these studies reported that the squid *Doryteuthis plei* (order Myopsida) was the primary cephalopod prey found. Based on stomach content analyses of nine Atlantic spotted dolphins incidentally caught in fishing operations in southeastern Brazil, the dolphins preyed on at least eight different fish species of the order Perciformes (families Trichiuridae, Carangidae, Sparidae, Sciaenidae, and Scombridae), order Gadiformes (family Merluccidae), order Clupeiformes (family Engraulidae), order Anguilliformes (family Congridae), order Myopsida (family Loliginidae), order Sepiida (family Sepiolidae), order Octopoda (family Tremoctopodidae), order Oegopsida (family Thysanoteuthidae), and order Decapoda (family Penaeidae; Lopes et al. 2012). Lopes et al. (2012) found that *Trichiurus lepturus* was the primary fish species represented, and *Doryteuthis plei* was the most represented cephalopod species.

Habitat Specificity

Atlantic spotted dolphins occupy both continental shelf and offshore habitats.

The larger coastal ecotype of Atlantic spotted dolphin inhabits the continental shelf and is usually found inside or near the 200m isobath, usually at least 8 to 20 km offshore (Perrin et al. 1987, 1994; Davis et al. 1998; Rice 1998; Herzing and Perrin 2018). The smaller island and offshore ecotype is known to occur in the Atlantic Ocean but not in the Gulf of Mexico (Perrin et al. 1987; Fulling et al. 2003; Mullin and Fulling 2003; Mullin and Fulling 2004; Adams and Rosel 2006).

In the Gulf of Mexico, Atlantic spotted dolphins occur primarily in continental shelf waters 10-200m deep and slope waters <500m deep, though a difference is seen between the eastern and western Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Griffin and Griffin (2003) noted a primary depth range of 20-50m in the eastern Gulf of Mexico. Mullin et al. (2004) found that Atlantic spotted dolphins were sighted in waters with a bottom depth typically <300 m. A single satellite-tagged Atlantic spotted dolphin released in the Gulf of Mexico was found to prefer shallow-water habitat (<30 m in depth; Davis et al. 1996).

In the Caribbean, Atlantic spotted dolphins are mostly sighted along shelf areas of low sea floor relief or the shelf edge and rarely occur offshore (Mignucci-Giannoni 1998; Rodriguez-Ferrer et al. 2018).

Off Brazil, Atlantic spotted dolphins are seen in waters less than 1000m in depth (Moreno et al. 2005).

Site Fidelity

Information regarding Atlantic spotted dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Herzing (1997) reported Atlantic spotted dolphin mean calving interval of 2.96 years (SD = 1.224) with a range of 1-5 years in Lower Bahama Bank.

In the Bahamas, Herzing (1997) estimated age at sexual maturation for females at 8 to 15 years of age. Taylor et al. (2007) reported Atlantic spotted dolphin age at first reproduction of 12 years and age at last reproduction of 31 years based on values reported by Herzing (1997) and Perrin et al. (1994).

Generation Length

Taylor et al. (2007) reported Atlantic spotted dolphin generation length of 18.6 years at r = 0.01 and 18.3 years at r = 0.0 based on data from the Bahamas (Herzing 1997).

Reproductive Plasticity

Herzing (1997) reported peak calving periods in early spring and late fall for Atlantic spotted dolphins on Lower Bahama Bank.

Information regarding specific breeding locations and habitat was not found in the literature.

Malinowski and Herzing (2015) found that pregnant and lactating females had lower nutritional intake than non-reproductively active females in Lower Bahama Bank.

Migration

High numbers of resighted individuals in Lower Bahama Bank in successive years suggest a stable resident population of Atlantic spotted dolphins (Herzing 1997). In the Gulf of Mexico, Griffin and Griffin (2004) reported higher densities of Atlantic spotted dolphins on the west Florida continental shelf during November through May compared to June through October. Griffin et al. (2005) suggested that Atlantic spotted dolphins more often feed over the continental shelf in winter than summer.

Off Puerto Rico and the Virgin Islands, inshore-offshore seasonal movement is suspected. Atlantic spotted dolphin occurrence peaks in August and January and February (Mignucci-Giannoni 1998). There may be a year-round occurrence of Atlantic spotted dolphins off Puerto Rico (Rodriguez-Ferrer et al. 2018).

Home Range

Information about Atlantic spotted dolphin home range in Puerto Rico and U.S. Virgin Islands waters was not found in the literature.

Elsewhere, groups have moved home ranges, such as in 2013 when half of the Little Bahama Bank Atlantic spotted dolphin community relocated 161 km south to Great Bahama Bank, which is home to a separate community of resident spotted dolphins (Herzing et al 2017).

Stock Abundance

The current abundance for the Puerto Rico and U.S. Virgin Islands stock of Atlantic spotted dolphins is unknown. Several line-transect surveys have been conducted in this area; however, due to few sightings and limitations of the survey vessel, it has not been possible to estimate abundance from these surveys (Waring et al. 2012).

During January-March 1995, a line-transect survey was conducted in deep waters surrounding the Virgin Islands and Puerto Rico that sighted 6 sightings of Atlantic spotted dolphins in U.S. waters (Roden and Mullin 2000; Waring et al. 2012). During February-March 2000, a line-transect survey was conducted in the eastern and southern Caribbean Sea that sighted one Atlantic spotted dolphin (Swartz and Burks 2000; Waring et al. 2012). During February-March 2001, during a line-transect survey in the eastern Bahamas, eastern Dominican Republic, Puerto Rico, and the Virgin Islands, 10 Atlantic spotted dolphins were sighted in U.S. waters (Swartz et al. 2002; Waring et al. 2012).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Waring et al. 2012).

Cumulative Stressors

The Atlantic spotted dolphin has been taken and is still being taken in dolphin fisheries in the southern and eastern Caribbean (e.g., Caldwell et al. 1971; Caldwell and Caldwell 1975; Price 1985; Reeves 1988; Romero et al. 2001; Hoyt and Hvenegaard 2002; Mohammed et al. 2003; Vail 2005; World Council of Whalers 2008).

The Atlantic spotted dolphin may interact with gillnet and longline fisheries (Perrin et al. 1994). However, during the period 2001–2019, no fishing-related mortality or serious injury of Atlantic spotted dolphin was reported in Puerto Rico or the U.S. Virgin Islands waters (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010, 2012a, 2012b, 2013, 2014, 2016, 2017, 2019, 2020a, 2020b, 2021; Waring et al. 2012). This may represent an underestimation because there was no observer coverage within the Caribbean region for six of those years (Fairfield-Walsh and Garrison 2007; Garrison et al. 2009; Garrison and Stokes 2010, 2012b, 2013, 2016).

Legacy impacts on Atlantic spotted dolphins from naval operations at Roosevelt Roads in Puerto Rico that ceased in 2004 are unknown (Waring et al. 2012).

Coastal pollution may be an issue for the Atlantic spotted dolphin Puerto Rico and U.S. Virgin Islands stock. Parts of Vieques Island, Puerto Rico are listed on the U.S. Environmental Protection Agency's (EPA) Superfund National Priorities List due to unexploded ordnance and associated hazardous materials (Whitall et al. 2016; EPA 2018).

Distribution and Sightings

Density model results for Atlantic spotted dolphins in Puerto Rico and U.S. Virgin Island waters are presented by Mannocci et al. (2017).

Further Reading

Braulik, G. and T.A. Jefferson. 2018. *Stenella frontalis*. The IUCN Red List of Threatened Species 2018: e.T20732A50375312. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20732A50375312.en

Department of the Navy. 2002. Marine Resource Assessment for the Puerto Rico/St. Croix Operating Area, Final Report. Naval Facilities Engineering Command, Norfolk, VA. Contract #N62470-95-D-1160, CTO 0030. Prepared by Geo-Marine, Inc, Plano, TX. Norfolk, VA. 273 p.

Herzing, D. L. and W. F. Perrin. 2018. Atlantic Spotted Dolphin *Stenella frontalis*. In: Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. eds. Encyclopedia of marine mammals. Academic Press. p.40-42

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world: A comprehensive guide to their identification. Second edition. San Diego, California: Academic Press.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2011. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-221. 319 p.

Literature Cited

Adams, L.D. and P.E. Rosel. 2005. Population differentiation of the Atlantic spotted dolphin (*Stenella frontalis*) in the western North Atlantic, including the Gulf of Mexico. Marine Biology 148(3):671–681. doi: 10.1007/s00227-005-0094-2

Caldwell, D.K. and M.C. Caldwell. 1975. Dolphin and small whale fisheries of the Caribbean and West Indies: Occurrence, history, and catch statistics — with special reference to the Lesser Antillean island of St. Vincent. Journal of the Fisheries Research Board of Canada 32(7):1105–1110. doi: 10.1139/f75-132

Caldwell, D.K., M.C. Caldwell, W.F. Rathjen, and J.R. Sullivan. 1971. Cetaceans from the Lesser Antillean island of St. Vincent. Fishery Bulletin 69:303–312.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Davis, R.W., G.A.J. Worthy, B. Würsig, S.K. Lynn, and F.I. Townsend. 1996. Diving behavior and at-sea movements of an Atlantic spotted dolphin in the Gulf of Mexico. Marine Mammal Science 12(4):569–581. doi: 10.1111/j.1748-7692.1996.tb00069.x

Di Beneditto, A.P.M., R.M.A. Ramos, S. Siciliano, R.A. dos Santos, G. Bastos, and E. Fagundes-Neto. 2001. Stomach contents of delphinids from Rio de Janeiro, southeastern Brazil. Aquatic Mammals 27(1):24–28.

Environmental Protection Agency (EPA). 2018. Atlantic Fleet Weapons Training Area, Vieques, PR. 28 August 2018, https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Fernández, R., M.B. Santos, M. Carrillo, M. Tejedor, and G.J. Pierce. 2009. Stomach contents of cetaceans stranded in the Canary Islands 1996–2006. Journal of the Marine Biological Association of the United Kingdom 89(5):873–883. doi: 10.1017/s0025315409000290

Fertl, D. and S. Leatherwood. 1997. Cetacean interactions with trawls: A preliminary review. Journal of Northwest Atlantic Fishery Science 22:219–248. doi: 10.2960/J.v22.a17

Fertl, D. and B. Würsig. 1995. Coordinated feeding by Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Aquatic Mammals 21(1):3–5.

Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101(4):923–932.

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.

Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-607. 64 p.

Garrison, L.P. and L. Stokes. 2012. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.

Garrison, L.P. and L. Stokes. 2012. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. National Oceanic and Atmospheric Administration,

National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-632. 61 p.
Garrison, L.P. and L. Stokes. 2013. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-655. 62 p.
Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142
Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316
Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.
Garrison, L.P. and L.W. Stokes. 2021. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2019. doi: 10.25923/asb3-6q44
Griffin, B.R. and N.J. Griffin. 2004. Temporal variation in Atlantic spotted dolphin (*Stenella frontalis*) and bottlenose dolphin (*Tursiops truncatus*) densities on the West Florida Continental Shelf. Aquatic Mammals 30(3):380–390. doi: 10.1578/am.30.3.2004.380
Griffin, R.B. and N.J. Griffin. 2003. Distribution, habitat partitioning, and abundance of Atlantic spotted dolphins, bottlenose dolphins, and loggerhead sea turtles on the eastern Gulf of Mexico continental shelf. Gulf of Mexico Science 21(1):23–34. doi: 10.18785/goms.2101.03
Griffin, R.B., C. Hu, and N.J. Griffin. 2005. Movement patterns of Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in relation to oceanographic fronts. Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, 12-16 December. p. 112.

Herzing, D.L. 1997. The life history of free-ranging atlantic spotted dolphins (*Stenella frontalis*): Age classes, color phases, and female reproduction. Marine Mammal Science 13(4):576–595. doi: 10.1111/j.1748-7692.1997.tb00085.x

Herzing, D.L., B.N. Augliere, C.R. Elliser, M.L. Green, and A.A. Pack. 2017. Exodus! Large-scale displacement and social adjustments of resident Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. PLoS ONE 12(8):e0180304. doi: 10.1371/journal.pone.0180304

Herzing, D.L. and W.F. Perrin. 2018. Atlantic spotted dolphin: *Stenella frontalis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 40–42. doi: 10.1016/B978-0-12-804327-1.00050-9

Hoyt, E. and G.T. Hvenegaard. 2002. A review of whale-watching and whaling with applications for the Caribbean. Coastal Management 30(4):381–399. doi: 10.1080/089207502900273

Lopes, X.M., M.C.d.O. Santos, E. da Silva, M. Bassoi, and R.A. dos Santos. 2012. Feeding habits of the Atlantic spotted dolphin, *Stenella frontalis*, in southeastern Brazil. Brazilian Journal of Oceanography 60(2):189–198. doi: 10.1590/S1679-87592012000200009

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Malinowski, C.R. and D.L. Herzing. 2015. Prey use and nutritional differences between reproductive states and age classes in Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. Marine Mammal Science 31(4):1471–1493. doi: 10.1111/mms.12238

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Melo, C.L.C., R.A. Santos, M. Bassoi, A.C. Araújo, J. Lailson-Brito, P.R. Dorneles, and A.F. Azevedo. 2010. Feeding habits of delphinids (Mammalia: Cetacea) from Rio de Janeiro State, Brazil. Journal of the Marine Biological Association of the United Kingdom 90(8):1509–1515. doi: 10.1017/s0025315409991639

Mignucci-Giannoni, A.A. 1996. Marine mammal strandings in Puerto Rico and the United States and British Virgin Islands. University of Puerto Rico. Dissertation. 247 p.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mohammed, E., L.E. Straker, and C. Jardine. 2003. St. Vincent and the Grenadines: Reconstructed fisheries catches and fishing effort, 1942-2001. Fisheries Centre Research Reports 11(6):95–116.

Moreno, I.B., A.N. Zerbini, D. Danilewicz, S. de Oliveira Sa, P.C. Simões-Lopes, J. Lailson-Brito, and A.F. Azevedo. 2005. Distribution and habitat characteristics of dolphins of the genus *Stenella* (Cetacea: Delphinidae) in the Southwest Atlantic Ocean. Marine Ecology Progress Series 300:229–240. doi: 10.3354/meps300229

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603–613.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06

Perrin, W.F., D.K. Caldwell, and M.C. Caldwell. 1994. Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier, 1829). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, London, UK. pp. 173–190.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, M.C. Caldwell, P.J.H. Bree, and W.H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* spp. Marine Mammal Science 3(2):99–170. doi: 10.1111/j.1748-7692.1987.tb00158.x

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Reeves, R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. Reports of the International Whaling Commission 38(445-447).

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.

Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.

Rodriguez-Ferrer, G., R. Reyes, N.M. Hammerman, and J.E. García-Hernández. 2018. Cetacean sightings in Puerto Rican waters: including the first underwater photographic documentation of a minke whale (*Balaenoptera acutorostrata*). Latin American Journal of Aquatic Mammals 13(1-2):26–36. doi: 10.5597/00246

Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo di Sciara. 2001. Cetaceans of Venezuela: Their distribution and conservation status. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS 151. 60 p.

Swartz, S.L. and C. Burks. 2000. Cruise results, Windwards humpback (*Megaptera novaeangliae*) survey: NOAA ship Gordon Gunter cruise GU-00-01, 9 February to 3 April 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-438. 31 p.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Vail, C. 2005. Socio-economic assessment of marine mammal utilization in the wider Caribbean region: Captivity, viewing and hunting. Information paper presented at the United Nations Environment Programme Regional Workshop of Experts on the Development of the Marine Mammal Action Plan for the Wider Caribbean Region, Barbados, 18-21 July 2005.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Whitall, D.R., A.L. Mason, M.H. Fulton, E.F. Wirth, D. Wehner, A. Ramos, A.S. Pait, B. West, E. Pisarski, B. Shaddrix, and L.A. Reed. 2016. Chemical contaminants in the marine resources of Vieques, Puerto Rico. National Oceanic Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Silver Spring, MD. NOAA Technical Memorandum NOS-NCCOS-223. 70 p. doi: 10.7289/V5/TM-NOS-NCCOS-223

World Council of Whalers. 2008. World whaling – Caribbean. http://www.worldwhalers.com/whaling_around_the_world/caribbean.htm

Atlantic spotted dolphin − *Stenella frontalis*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Stenella frontalis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.2	2.0	
	Habitat Specificity	1.7	2.0	
	Site Fidelity	2.0	2.0	
	Lifetime Reproductive Potential	1.9	2.7	
	Generation Length	1.9	2.0	
	Reproductive Plasticity	1.0	2.0	
	Migration	3.3	1.7	
	Home Range	2.2	1.7	
	Stock Abundance	1.0	3.0	
	Stock Abundance Trend	1.8	1.3	
	Cumulative Stressors	1.3	1.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.3	
	Sea Surface Temperature (Change in variability)	1.0	2.0	
	Air Temperature (Change in mean)	3.0	2.7	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.3	2.3	
	Sea Surface Salinity (Change in mean)	3.3	2.7	
	Sea Surface Salinity (Change in variability)	1.7	2.7	
	Ocean pH (Change in mean)	3.9	3.0	
	Ocean pH (Change in variability)	1.3	2.3	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	3.5	3.0	
	Dissolved oxygen (Change in variability)	1.2	2.3	
	Circulation	2.1	2.7	
	Sea level rise	1.3	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Atlantic spotted dolphin (Western North Atlantic Stock)

Stenella frontalis

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (49% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.87), Dissolved oxygen (Standard anomaly) (3.53), and Sea Surface Temperature (Standard anomaly) (3.53).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Migration (3.33).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 85% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Atlantic spotted dolphin western North Atlantic stock includes individuals that are found in the waters of the U.S. Exclusive Economic Zone in the western North Atlantic (Hayes et al. 2020).

Prey/Diet Specificity

Prey and diet information for Atlantic spotted dolphin in the western North Atlantic was found only in the Bahamas, where Atlantic spotted dolphins have been well-studied since the 1980s. In the Bahamas, lizardfish (order Aulopiformes, family Synodontidae) constituted >30% of female Atlantic spotted dolphin diet during all reproductive states. Other major components of the diet included fish in the orders Beloniformes (halfbeaks [family Hemiramphidae], flyingfish [family Exocoetidae], needlefish [family Belonidae]), Anguilliformes (small eels [family Congridae]), Pleuronectiformes (flounders [family Bothidae]), Perciformes (jacks [family Carangidae], mackerel [family Scombridae], and tilefish [family Malacanthidae]), Labriformes (razorfish [family Labridae]), and Tetradontiformes (filefish [family Monacanthidae]; Malinowski and Herzing 2015). Atlantic spotted dolphins have been observed chasing and catching flying fish (order Beloniformes) in the Bahamas (MacLeod et al. 2004).

Atlantic spotted dolphins in the Gulf of Mexico have been observed feeding on clupeid fishes (order Clupeiformes; Fertl and Würsig 1995). They have also been observed feeding in the vicinity of shrimp trawlers (Fertl and Leatherwood 1997).

Analysis of stomach contents of two Atlantic spotted dolphins in the Canary Islands showed the presence of cephalopods of the order Oegopsida (genera *Hisitiotheuthis* and *Enoploteuthis*) and crustaceans of the infraclass Cirripedia (Fernandez et al. 2009).

In Brazil, four studies combined for stomach content analysis of 26 individuals (Di Beneditto et al. 2001; Melo et al. 2010; Lopes et al. 2012). These studies listed a total of six cephalopod species and 18 fish species as prey items of Atlantic spotted dolphins. Melo et al. (2010) reported *Porichthys porosissimus* (order Batrachoidiformes) as the main fish species found in 10 stomachs of stranded dolphins. Di Beneditto et al. (2001) reported *Orthopristis ruber* (order Perciformes) as the main fish species found in six incidentally captured dolphins. Both studies reported the squid *Doryteuthis plei* (order Myopsida) was the most important cephalopod prey. Based on stomach content analysis of nine Atlantic spotted dolphins incidentally caught in fishing operations in southeastern Brazil, dolphins assessed preyed on at least eight different fish species of the order Perciformes (families Trichiuridae, Carangidae, Sparidae, Sciaenidae, and Scombridae), order Gadiformes (family Merluccidae), Order Clupeiformes (family Engraulidae), Order Anguilliformes (family Congridae), order Myopsida (family Loliginidae), order Sepiida (family Sepiolidae), order Octopoda (family Tremoctopodidae), and order Oegopsida (family Thysanoteuthidae), and and order Decapoda (family Penaeidae; Lopes et al. 2012). Lopes et al. (2012) found *Trichiurus lepturus* was the most important fish species represented and *Doryteuthis plei* was the most represented cephalopod species.

Habitat Specificity

The larger coastal ecotype of Atlantic spotted dolphin inhabits waters over the continental shelf and is usually found inside the 200m isobath, usually at least 8 to 20 km offshore (Perrin et al. 1987, 1994; Davis et al. 1998; Rice 1998; Herzing and Perrin 2018). The smaller island and offshore ecotype is known to occur in the Atlantic Ocean but not in the Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2003; Mullin and Fulling 2004; (Viricel and Rosel 2014). Although the two ecotypes are currently considered a single stock, genetic and morphometric evidence suggests they are on distinct evolutionary trajectories and could be considered distinct subspecies (Viricel and Rosel 2014).

Atlantic spotted dolphins are often sighted beyond the shelf break in the Caribbean, and off the Atlantic U.S. coast (Mills and Rademacher 1996; Roden and Mullin 2000; Fulling et al. 2003; Mullin and Fulling 2003; Mullin et al. 2004).

In the Gulf of Mexico, Atlantic spotted dolphin occurs primarily in continental shelf waters 10-200m deep and slope waters <500m deep, though a difference is seen between the eastern and western Gulf of Mexico (Fulling et al. 2003; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Griffin and Griffin (2003) noted a primary depth range of 20-50m in the eastern Gulf of Mexico. Mullin et al. (2004) found that Atlantic spotted dolphins were sighted in waters with a bottom depth typically <300 m. A single satellite-tagged Atlantic spotted dolphin released in the Gulf of Mexico was found to prefer shallow-water habitat (<30 m in depth; Davis et al. 1996).

Off Brazil, Atlantic spotted dolphins are seen in waters less than 1000m in depth (Moreno et al. 2005).

The Atlantic spotted dolphin, which is endemic to the warm-temperate, subtropical, and tropical Atlantic Ocean, occurs in two forms which vary in size and degree of spotting (Perrin et al. 1987; Perrin 2001; Adams and Rosel 2006). First, there is a large, heavily spotted form which inhabits continental shelf waters generally inside or near the 200m isobath in the western North Atlantic in the Gulf of Mexico, and the Caribbean (e.g., Perrin et al. 1987; Fulling et al. 2003; Mullin and Fulling 2003; Mullin and Fulling 2004; Viricel and Rosel 2014), and second, a smaller, less spotted island and offshore form which occurs in pelagic waters of the the Atlantic Ocean and Caribbean Sea (Perrin et al. 1987; Adams and Rosel 2006). Future study may result in the different forms being made distinct subspecies (Rice 1998).

Site Fidelity

Information regarding Atlantic spotted dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Herzing (1997) reported Atlantic spotted dolphin mean calving interval of 2.96 years (SD = 1.224) with a range of 1-5 years in Lower Bahama Bank.

In the Bahamas, Herzing (1997) estimated age at sexual maturation for females at 8 to 15 years of age. Taylor et al. (2007) reported Atlantic spotted dolphin age at first reproduction of 12 years and age at last reproduction of 31 years based on values reported by Herzing (1997) and Perrin et al. (1994).

Generation Length

Taylor et al. (2007) reported Atlantic spotted dolphin generation length of 18.6 years at r = 0.01 and 18.3 years at r = 0.0 based on data from the Bahamas (Herzing 1997).

Reproductive Plasticity

Herzing (1997) reported peak calving periods in early spring and late fall for Atlantic spotted dolphins on Lower Bahama Bank.

Information regarding specific breeding locations and habitat was not found in the literature.

Malinowski and Herzing (2015) found that pregnant and lactating females had lower nutritional intake than non-reproductively active females in Lower Bahama Bank.

Migration

On Little Bahama Bank, sympatric communities of resident Atlantic spotted dolphins with stable size and social structure coexist with little immigration/emigration (Herzing 1997; Herzing et al. 2017). U.S. Navy assessments of Operating Areas suggested Atlantic spotted dolphins should be expected in the southern Navy Operating Areas in all seasons (DoN 2007, 2008a, 2008b, 2008c), and in the Northeast Operating Areas during the spring, summer, and fall, with greatest occurrence occurring during the summer (DoN 2005).

Home Range

In the Bahamas, groups have moved home ranges, such as in 2013 when half of the Little Bahama Bank Atlantic spotted dolphin community relocated 161 km south to Great Bahama Bank, which is home to a separate community of resident Atlantic spotted dolphins (Herzing et al. 2017).

Information about Atlantic spotted dolphin home range in other areas was not found in the literature.

Stock Abundance

Garrison (2020) and Palka (2020) estimated Atlantic spotted dolphin abundance in the western North Atlantic at 39,921 individuals (CV=0.27) based on 2016 surveys.

Stock Abundance Trend

A statistically significant linear decrease was detected in Atlantic spotted dolphin abundance using a generalized linear model and data from 2016, 2011, and 2004 (Hayes et al. 2020). Atlantic spotted dolphin abundance in the western North Atlantic was estimated at 44,715 individuals (CV=0.43), based on summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy (Waring et al. 2014). The best 2004 abundance estimate for Atlantic spotted dolphins in the western North Atlantic was 50,978 individuals (CV=0.42), based on two 2004 surveys, one from the northern U.S. Atlantic and one from the southern U.S. Atlantic. (Waring et al. 2006).

Cumulative Stressors

The Atlantic spotted dolphin in the western North Atlantic may interact with gillnet and longline fisheries (Perrin et al. 1994). However, in the 2015–2019 time period, no fishery-induced mortality was reported (Garrison and Stokes 2017, 2019, 2020a, 2020b, 2021). Atlantic spotted dolphins are known to strand along the Atlantic coast, with 21 individuals reported stranded between North Carolina and Florida during the period 2013–2017 (NOAA National Marine Mammal Health and Stranding Response Database as cited by Hayes et al. 2020).

Distribution and Sightings

Density model results for Atlantic spotted dolphin in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b).

Further Reading

Braulik, G. and T.A. Jefferson. 2018. *Stenella frontalis*. The IUCN Red List of Threatened Species 2018: e.T20732A50375312. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20732A50375312.en

Department of the Navy. 2009. Marine Resources Assessment for the Chesapeake Bay. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0127. Prepared by Geo-Marine, Inc., Hampton, VA. 393 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Herzing, D.L. and W.F. Perrin. 2018. Atlantic Spotted Dolphin: Stenella frontalis. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 40-42. doi: 10.1016/B978-0-12-804327-1.00050-9

Literature Cited

Adams, L.D. and P.E. Rosel. 2005. Population differentiation of the Atlantic spotted dolphin (*Stenella frontalis*) in the western North Atlantic, including the Gulf of Mexico. Marine Biology 148(3):671–681. doi: 10.1007/s00227-005-0094-2

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Davis, R.W., G.A.J. Worthy, B. Würsig, S.K. Lynn, and F.I. Townsend. 1996. Diving behavior and at-sea movements of an Atlantic spotted dolphin in the Gulf of Mexico. Marine Mammal Science 12(4):569–581. doi: 10.1111/j.1748-7692.1996.tb00069.x

Department of the Navy (DoN). 2005. Marine resource assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Department of the Navy (DoN). 2007. Marine resources assessment update for the Southeastern Florida and AUTEC-Andros Operating Area, Final Report. Naval Facilities Engineering Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0034. Prepared by Geo-Marine, Inc., Hampton, VA. 575 p.

Department of the Navy (DoN). 2008. Marine resources assessment update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Department of the Navy (DoN). 2008. Marine resources assessment update for the Cherry Point Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 643 p.

Department of the Navy (DoN). 2008. Marine resources assessment update for the Virginia Capes Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 711 p.

Di Beneditto, A.P.M., R.M.A. Ramos, S. Siciliano, R.A. dos Santos, G. Bastos, and E. Fagundes-Neto. 2001. Stomach contents of delphinids from Rio de Janeiro, southeastern Brazil. Aquatic Mammals 27(1):24–28.

Fernández, R., M.B. Santos, M. Carrillo, M. Tejedor, and G.J. Pierce. 2009. Stomach contents of cetaceans stranded in the Canary Islands 1996–2006. Journal of the Marine Biological Association of the United Kingdom 89(5):873–883. doi: 10.1017/s0025315409000290

Fertl, D. and S. Leatherwood. 1997. Cetacean interactions with trawls: A preliminary review. Journal of Northwest Atlantic Fishery Science 22:219–248. doi: 10.2960/J.v22.a17

Fertl, D. and B. Würsig. 1995. Coordinated feeding by Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Aquatic Mammals 21(1):3–5.

Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101(4):923–932.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Garrison, L.P. and L.W. Stokes. 2021. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2019. doi: 10.25923/asb3-6q44

Griffin, R.B. and N.J. Griffin. 2003. Distribution, habitat partitioning, and abundance of Atlantic spotted dolphins, bottlenose dolphins, and loggerhead sea turtles on the eastern Gulf of Mexico continental shelf. Gulf of Mexico Science 21(1):23–34. doi: 10.18785/goms.2101.03

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Herzing, D.L. 1997. The life history of free-ranging atlantic spotted dolphins (*Stenella frontalis*): Age classes, color phases, and female reproduction. Marine Mammal Science 13(4):576–595. doi: 10.1111/j.1748-7692.1997.tb00085.x

Herzing, D.L., B.N. Augliere, C.R. Elliser, M.L. Green, and A.A. Pack. 2017. Exodus! Large-scale displacement and social adjustments of resident Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. PLoS ONE 12(8):e0180304. doi: 10.1371/journal.pone.0180304

Herzing, D.L. and W.F. Perrin. 2018. Atlantic spotted dolphin: *Stenella frontalis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 40–42. doi: 10.1016/B978-0-12-804327-1.00050-9

Lopes, X.M., M.C.d.O. Santos, E. da Silva, M. Bassoi, and R.A. dos Santos. 2012. Feeding habits of the Atlantic spotted dolphin, *Stenella frontalis*, in southeastern Brazil. Brazilian Journal of Oceanography 60(2):189–198. doi: 10.1590/S1679-87592012000200009

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Malinowski, C.R. and D.L. Herzing. 2015. Prey use and nutritional differences between reproductive states and age classes in Atlantic spotted dolphins (*Stenella frontalis*) in the Bahamas. Marine Mammal Science 31(4):1471–1493. doi: 10.1111/mms.12238

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Melo, C.L.C., R.A. Santos, M. Bassoi, A.C. Araújo, J. Lailson-Brito, P.R. Dorneles, and A.F. Azevedo. 2010. Feeding habits of delphinids (Mammalia: Cetacea) from Rio de Janeiro State, Brazil. Journal of the Marine Biological Association of the United Kingdom 90(8):1509–1515. doi: 10.1017/s0025315409991639

Mills, L.R. and K.R. Rademacher. 1996. Atlantic spotted dolphins (*Stenella frontalis*) in the Gulf of Mexico. Gulf of Mexico Science 14(2):114–120. doi: 10.18785/goms.1402.08

Moreno, I.B., A.N. Zerbini, D. Danilewicz, S. de Oliveira Sa, P.C. Simões-Lopes, J. Lailson-Brito, and A.F. Azevedo. 2005. Distribution and habitat characteristics of dolphins of the genus *Stenella* (Cetacea: Delphinidae) in the Southwest Atlantic Ocean. Marine Ecology Progress Series 300:229–240. doi: 10.3354/meps300229

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603–613.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Contract number NA-81-FA-C-00023. 246 p.

Perrin, W.F. 2001. *Stenella attenuata*. Mammalian Species 683:1–8. doi: 10.1644/1545-1410(2001)683<0001:SA>2.0.CO;2

Perrin, W.F., D.K. Caldwell, and M.C. Caldwell. 1994. Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier, 1829). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, London, UK. pp. 173–190.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, M.C. Caldwell, P.J.H. Bree, and W.H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* spp. Marine Mammal Science 3(2):99–170. doi: 10.1111/j.1748-7692.1987.tb00158.x

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Viricel, A. and P.E. Rosel. 2014. Hierarchical population structure and habitat differences in a highly mobile marine species: the Atlantic spotted dolphin. Molecular Ecology 23(20):5018–5035. doi: 10.1111/mec.12923

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, C.P. Fairfield, and K. Maze-Foley. 2006. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-194. 346 p.

Atlantic white−sided dolphin − *Lagenorhynchus acutus*

Western North Atlantic Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = High

Data Quality = 89% of scores ≥ 2

	Lagenorhynchus acutus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	3.0	
	Habitat Specificity	2.1	3.0	
	Site Fidelity	1.7	1.7	
	Lifetime Reproductive Potential	1.9	2.7	
	Generation Length	1.7	1.7	
	Reproductive Plasticity	1.5	2.3	
	Migration	2.4	2.7	
	Home Range	1.8	3.0	
	Stock Abundance	1.2	3.0	
	Stock Abundance Trend	1.7	0.7	
	Cumulative Stressors	1.6	2.3	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	3.0	
	Sea Surface Temperature (Change in variability)	1.7	3.0	
	Air Temperature (Change in mean)	2.7	2.3	
	Air Temperature (Change in variability)	1.0	2.3	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.4	2.3	
	Sea Surface Salinity (Change in mean)	1.8	3.0	
	Sea Surface Salinity (Change in variability)	1.9	3.0	
	Ocean pH (Change in mean)	3.0	3.0	
	Ocean pH (Change in variability)	1.3	3.0	
	Sea ice coverage (Change in mean)	1.4	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.3	3.0	
	Dissolved oxygen (Change in variability)	1.5	3.0	
	Circulation	2.1	2.3	
	Sea level rise	1.3	2.7	
	Exposure Score	High		
Overall Vulnerability Rank		Low		

Low

Moderate

High

Very High

Atlantic white-sided dolphin (Western North Atlantic Stock)

Lagenorhynchus acutus

CVA Results Summary

Overall Climate Vulnerability Rank: Low (98% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored 3.0 or greater: Sea Surface Temperature (Standard anomaly) (3.60), Dissolved oxygen (Standard anomaly) (3.33), and Ocean pH (Standard anomaly) (3.00).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 89% of the data quality scores were 2 or greater. 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Atlantic white-sided dolphin western North Atlantic stock includes individuals that are found in the waters of the U.S. Exclusive Economic Zone in the western North Atlantic (Hayes et al. 2022). This stock may consist of three separate units in the Gulf of Maine, Gulf of St. Lawrence and Labrador Sea stocks (Palka et al. 1997).

Prey/Diet Specificity

Stomach-content analysis indicates white-sided dolphins in U.S. waters consume silver hake (*Merluccius bilinearis*), spoonarm octopus (*Bathypolypus bairdii*), haddock (*Melanogrammus aeglefinus*), Atlantic herring (*Clupea harengus*), gadid fishes (codfish and their relatives), sand lances, and several types of squid (Reeves et al. 1999; Craddock et al. 2009). Diet varies by season.

Habitat Specificity

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100-m depth contour (Hayes et al. 2022).

Site Fidelity

Information regarding Atlantic white-sided dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported Atlantic white-sided dolphin interbirth interval of 2.5 years, though some individuals may breed annually (Sergeant et al. 1980). Taylor et al. (2007) reported Atlantic white-sided dolphin age at first reproduction of 10 years and age at last reproduction of 27 and 32 (estimated) years based on information presented by Sergeant et al. (1980).

Generation Length

Taylor et al. (2007) reported generation length of 15.5 years (at r = 0.01) and 15.8 years (at r = 0.0) based on information presented by Sergeant et al. (1980).

Reproductive Plasticity

Calving occurs from May to early August, with a peak in June and July (Weinrich et al. 2001; Hayes et al. 2022).

Migration

Seasonal shifts in distribution have been suggested, with low numbers observed in the region between Georges Bank and the Gulf of Maine from January to May, high numbers from June through September, and intermediate densities from October through December (Payne and Heinemann 1990; Northridge et al. 1997).

Home Range

Information regarding Atlantic white-sided dolphin home range was not found in the literature.

Stock Abundance

Palka (2020) estimated the abundance of the western North Atlantic stock at 93,233 individuals (CV= 0.61), based on summer 2016 surveys from central Virginia to Labrador. Previously, an estimate based on June–August 2011 survey data from central Virginia to the lower Bay of Fundy suggested the population was 48,819 individuals (CV= 0.61; Hayes et al. 2022).

Stock Abundance Trend

A trend analysis has not been conducted for this stock.

Cumulative Stressors

Atlantic white-sided dolphins interact with fisheries in the western North Atlantic. During the period 2013–2017, annual bycatch in the bottom trawl fishery was estimated at 21.36 individuals (CV = 0.21) in the Northeast and 1.93 (CV = 0.94) in the Mid-Atlantic (Lyssikatos et al. 2020). Total annual estimated average fishery-related mortality or serious injury to this stock during 2013–2017 was 26 individuals (CV=0.2; Hayes et al. 2020). During 2013–2017, 123 Atlantic white-sided dolphins stranded on the U.S. and Canadian Atlantic coasts (Hayes et al. 2020). Human interaction was indicated in 5 records during this period, with one classified as a fishery interaction. Mass strandings are common for this species

(Hayes et al. 2020). Based on strandings in Massachusetts between 2000 and 2006, more than two thirds of white-sided dolphins strandings were of unknown cause and 21% were disease-related (Bogomolni et al. 2010). Strandings also occur along Canadian shorelines (Ledwell and Huntington 2010, 2011, 2012a, 2012b, 2013, 2014).

Density Models

Density model results for Atlantic white-sided dolphin in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b).

Further Reading

Braulik, G. 2019. *Lagenorhynchus acutus*. The IUCN Red List of Threatened Species 2019: e.T11141A50361160. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T11141A50361160.en

Cipriano, F. 2018. Atlantic White-Sided Dolphin: *Lagenorhynchus acutus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 42–44. doi: 10.1016/B978-0-12-804327-1.00051-0

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

References

Bogomolni, A.L., K.R. Pugliares, S.M. Sharp, K. Patchett, C.T. Harry, J.M. LaRocque, K.M. Touhey, and M. Moore. 2010. Mortality trends of stranded marine mammals on Cape Cod and southeastern Massachusetts, USA, 2000 to 2006. Diseases of Aquatic Organisms 88(2):143–155. doi: 10.3354/dao02146

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Craddock, J.E., P.T. Polloni, B. Hayward, and F. Wenzel. 2009. Food habits of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) off the coast of New England. Fishery Bulletin 107(3):384–394.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Ledwell, W. and J. Huntington. 2010. Whale, leatherback sea turtles, and basking sharks entrapped in fishing gear in Newfoundland and Labrador and a summary of the strandings, sightings and education work during 2009– 2010. A preliminary report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 20 p.

Ledwell, W. and J. Huntington. 2011. Whale, leatherback sea turtles, and basking sharks entrapped in fishing gear in Newfoundland and Labrador and a summary of the strandings, sightings and education work during 2010– 2011. A preliminary report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 25 p.

Ledwell, W. and J. Huntington. 2012. Incidental entanglements of cetacean and leatherback sea turtles in fishing gear reported during 2011-2012 and a summary of the Whale Release and Strandings Group activities. A preliminary report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 17 p.

Ledwell, W. and J. Huntington. 2012. Incidental entrapments in fishing gear and stranding reported to and responded to by the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2012. Report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 18 p.

Ledwell, W. and J. Huntington. 2013. Incidental entrapments in fishing gear and stranding reported to and responded to by the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2013. Report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 19 p.

Ledwell, W. and J. Huntington. 2014. Incidental entrapments and entanglements of cetaceans and leatherback sea turtles, strandings, ice entrapments reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2014. Report to the Department of Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 23 p.

Lyssikatos, M.C., S. Chavez-Rosales, and J.M. Hatch. 2020. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2013-2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-04. 11 p. doi: 10.25923/5we2-g460

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Northridge, S., M. Tasker, A. Webb, K. Camphuysen, and M. Leopold. 1997. White-beaked *Lagenorhynchus albirostris* and Atlantic white-sided dolphin *L. acutus* distributions in northwest European and U.S. North Atlantic waters. Reports of the International Whaling Commission 47:797–805.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., A. Read, and C. Potter. 1997. Summary of knowledge of white-sided dolphins (*Lagenorhyncus acutus*) from US and Canadian Atlantic waters. Reports of the International Whaling Commission 47:729–734.

Payne, M. and D.W. Heinemann. 1990. A distributional assessment of cetaceans in the shelf and shelf edge waters of the northeastern United States based on aerial and shipboard surveys, 1978–1988. Report to NMFS. 108 p.

Reeves, R.R., C. Smeenk, R.L. Brownell, and C.C. Kinze. 1999. Atlantic white-sided dolphin *Lagenorhynchus acutus* (Gray, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of Marine Mammals. Volume 6: The Second Book of Dolphins and the Porpoises. Academic Press, London, UK. pp. 31–56.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Sergeant, D.E., D.J. St. Aubin, and J.R. Geraci. 1980. Life history and northwest Atlantic status of the Atlantic white-sided dolphin, *Lagenorhynchus acutus*. Cetology 37:1–12.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Weinrich, M.T., C.R. Belt, and D. Morin. 2001. Behavior and ecology of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) in coastal New England waters. Marine Mammal Science 17(2):231–248. doi: 10.1111/j.1748-7692.2001.tb01268.x

Blainville's beaked whale − *Mesoplodon densirostris*

Western North Atlantic Stock

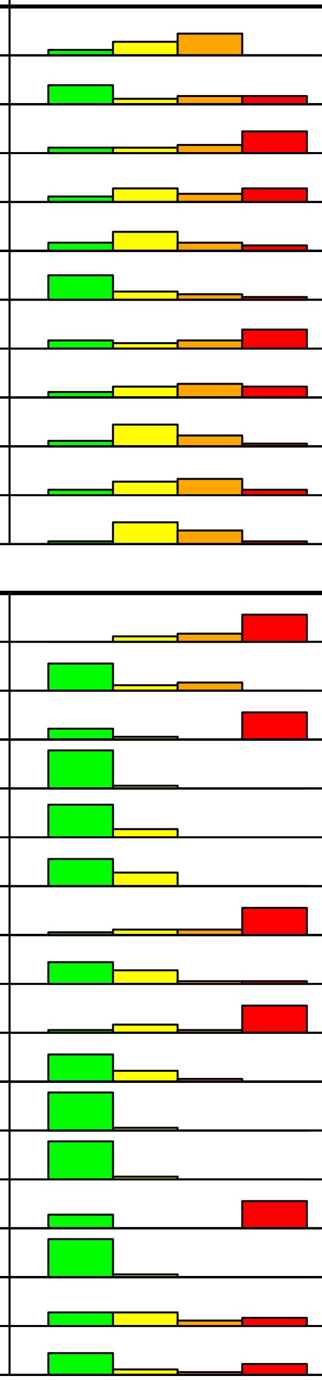
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 37% of scores ≥ 2

	Mesoplodon densirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	1.0	
	Habitat Specificity	2.1	1.7	
	Site Fidelity	3.1	1.3	
	Lifetime Reproductive Potential	2.7	0.7	
	Generation Length	2.3	1.0	
	Reproductive Plasticity	1.7	0.7	
	Migration	2.9	2.0	
	Home Range	2.7	2.0	
	Stock Abundance	2.3	1.0	
	Stock Abundance Trend	2.5	0.0	
	Cumulative Stressors	2.4	1.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.3	
	Sea Surface Temperature (Change in variability)	1.5	2.3	
	Air Temperature (Change in mean)	3.1	1.7	
	Air Temperature (Change in variability)	1.1	1.7	
	Precipitation (Change in mean)	1.2	2.0	
	Precipitation (Change in variability)	1.3	1.7	
	Sea Surface Salinity (Change in mean)	3.4	1.7	
	Sea Surface Salinity (Change in variability)	1.7	1.7	
	Ocean pH (Change in mean)	3.3	1.7	
	Ocean pH (Change in variability)	1.4	1.7	
	Sea ice coverage (Change in mean)	1.1	2.3	
	Sea ice coverage (Change in variability)	1.1	2.3	
	Dissolved oxygen (Change in mean)	3.0	2.0	
	Dissolved oxygen (Change in variability)	1.1	2.0	
	Circulation	2.2	1.3	
	Sea level rise	2.1	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Low

Moderate

High

Very High

Blainville’s beaked whale (Western North Atlantic Stock)

Mesoplodon densirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (41% certainty from bootstrap analysis).

Climate Exposure: High. Five exposure factors scored 3.0 or greater: Sea Surface Temperature (Standard anomaly) (3.53), Sea Surface Salinity (Standard anomaly) (3.40), Ocean pH (Standard anomaly) (3.33), Air Temperature (Standard anomaly) (3.07), and Dissolved oxygen (Standard anomaly) (3.00).

Biological Sensitivity: Moderate. Five sensitivity attributes scored greater than 2.5: Site Fidelity (3.13), Migration (2.93), Home Range (2.73), Lifetime Reproductive Potential (2.73), and Species Abundance Trend (2.53).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 37% of the data quality scores were 2 or greater. 18% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Blainville's beaked whale western North Atlantic stock includes individuals that are found in the waters of the U.S. Exclusive Economic Zone in the western North Atlantic (Hayes et al. 2020).

Prey/Diet Specificity

Stomach content analysis of stranded Blainville’s beaked whales from multiple geographic locations suggests that Blainville’s beaked whale diet consists mainly of cephalopods and fish (Ross 1979; Aguilar et al. 1982; Santos et al. 2007).

Habitat Specificity

Little is known about beaked whale habitat preferences, but Blainville's beaked whales occur in warmer southern waters (MacLeod 2000).

Beaked whale abundance is associated with the Gulf Stream and warm-core rings (Waring et al. 1992). In summer, the continental shelf break off the northeastern U.S. is primary habitat (Waring et al. 2001). Beaked whales south of Georges Bank were found in waters with a mean SST of 20.7° to 24.9°C and a bottom depth of 500 to 2,000 m (Waring et al. 2003). In the Gulf of Mexico, beaked whales are seen in waters with a bottom depth ranging from 420 to 3,487m (Ward et al. 2005). Blainville’s beaked whales in the northern Bahamas are found along shelf waters of canyon walls and in deeper offshore waters, with most time spent along these walls where bottom depths are <800 m (Claridge 2003; MacLeod et al. 2004; MacLeod and Zuur 2005; Claridge 2006).

World-wide, beaked whales normally inhabit continental slope and deep oceanic waters (>200 m) (Waring et al. 2001; Cañadas et al. 2002; Pitman 2002; MacLeod et al. 2004; Ferguson et al. 2006; MacLeod and Mitchell 2006; Ritter and Brederlau 1999; Gannier 2000; MacLeod et al. 2004; Ferguson 2005; MacLeod and Zuur 2005; Claridge 2006) and only occasionally waters over the continental shelf (Pitman 2002). In many locations, occurrence patterns have been linked to physical features such as the continental slope, canyons, escarpments, and oceanic islands (Baird et al. 2004; MacLeod et al. 2004; MacLeod and D'Amico 2006).

Site Fidelity

Information regarding Blainville's beaked whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) estimated Blainville's beaked whale age at last reproduction of 40 years.

Generation Length

Information regarding Blainville's beaked whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding Blainville's beaked whale mating habitat, location, and season was not found in the literature.

Migration

Information regarding Blainville's beaked whale migration was not found in the literature.

Home Range

Information regarding Blainville's beaked whale home range was not found in the literature.

Stock Abundance

The best abundance estimate for undifferentiated *Mesoplodon spp.* beaked whales in the western North Atlantic is 10,107 individuals (CV=0.27), based on 2016 surveys (Garrison 2020; Palka 2020). Previously, undifferentiated *Mesoplodon spp.* beaked whales in the western North Atlantic were estimated at 7,092 individuals (CV=0.54), based on 2011 surveys (Hayes et al. 2020).

Stock Abundance Trend

A trend analysis has not been conducted for this stock.

Cumulative Stressors

During the period 2013–2017, four Blainville's beaked whales were reported stranded along the U.S. Atlantic coast between Florida and Massachusetts (Hayes et al. 2020). Beaked whale strandings throughout their worldwide range have been associated with naval activities (Frantzis 1998; D'Amico et al. 2009; Filadelfo et al. 2009; Hayes et al. 2020).

Distribution and Sightings

Density model results for Blainville's beaked whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017) and Mannocci et al. (2017). Palka et al. (2021a, 2021b) present density model results for unidentified beaked whales.

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

MacLeod, C.D. 2018. Beaked Whales, Overview. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 80–83. doi: 10.1016/B978-0-12-804327-1.00062-5

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Mesoplodon densirostris*. The IUCN Red List of Threatened Species 2008: e.T13244A3426474. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T13244A3426474.en.

References

Aguilar, A., L. Jover, and J. Nadal. 1982. A note on the organochlorine contamination in a Blainville's beaked whale, *Mesoplodon densirostris* (de Blainvillle, 1817) from the Mediterranean Sea. Publicaciones Del Departmento De Zoologia, Universitat de Barcelona 7:85–90.

Baird, R.W., D.J. McSweeney, A.D. Ligon, and D.L. Webster. 2004. Tagging feasibility and diving of Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's beaked whales (*Mesoplodon densirostris*) in Hawai'i. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Order No. AB133F-03-SE-0986. 15 p.

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

Claridge, D. 2003. Examining distribution and habitat preferences of deep-diving cetaceans, including beaked whales, in Northwest Providence Channel, the Bahamas using geographic information system (GIS) mapping techniques. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals14-19 December 2003. Greensboro, North Carolina. p. 33.

Claridge, D.E. 2006. Fine-scale distribution and habitat selection of beaked whales. Aberdeen University. Dissertation. 119 p.

D'Amico, A., R.C. Gisiner, D.R. Ketten, J.A. Hammock, C. Johnson, P.L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. Aquatic Mammals 35(4):452–472. doi: 10.1578/am.35.4.2009.452

Ferguson, M.C. 2005. Cetacean population density in the eastern Pacific Ocean: Analyzing patterns with predictive spatial models. University of California, San Diego. 203 p.

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Filadelfo, R., J. Mintz, E. Michlovich, A. D'Amico, P.L. Tyack, and D.R. Ketten. 2009. Correlating military sonar use with beaked whale mass strandings: What do the historical data show? Aquatic Mammals 35(4):435–444. doi: 10.1578/am.35.4.2009.435

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Gannier, A. 2000. Distribution of cetaceans off the Society Islands (French Polynesia) as obtained from dedicated surveys. Aquatic Mammals 26(2):111–126.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Macleod, C.D. 2000. Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. Mammal Review 30(1):1–8. doi: 10.1046/j.1365-2907.2000.00057.x

MacLeod, C.D. and A. D'Amico. 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. Journal of Cetacean Research and Management 7(3):211–221.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

MacLeod, C.D. and A.F. Zuur. 2005. Habitat utilization by Blainville's beaked whales off Great Abaco, northern Bahamas, in relation to seabed topography. Marine Biology 147(1):1–11. doi: 10.1007/s00227-004-1546-9

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment

Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pitman, R.L. 2002. Mesoplodont whales *Mesoplodon* spp. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals. Academic Press, San Diego, CA. pp. 738–742.

Ritter, F. and B. Brederlau. 1999. Behavioural observations of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). Aquatic Mammals 25(2):55–61.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Ross, G.J.B. 1979. The smaller cetaceans of the south east coast of southern Africa. University of Port Elizabeth. Thesis. 415 p.

Santos, M.B., V. Martin, M. Arbelo, A. Fernandez, and G.J. Pierce. 2007. Insights into the diet of beaked whales from the atypical mass stranding in the Canary Islands in September 2002. Journal of the Marine Biological Association of the United Kingdom 87(1):243–251. doi: 10.1017/S0025315407054380

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Ward, J.A., G.H. Mitchell, A.M. Farak, and E.P. Keane. 2005. Beaked whale habitat characterization and prediction. NUWC-NPT Technical Report 11,548. Newport, RI.

Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Blue whale − *Balaenoptera musculus*

Western North Atlantic Stock

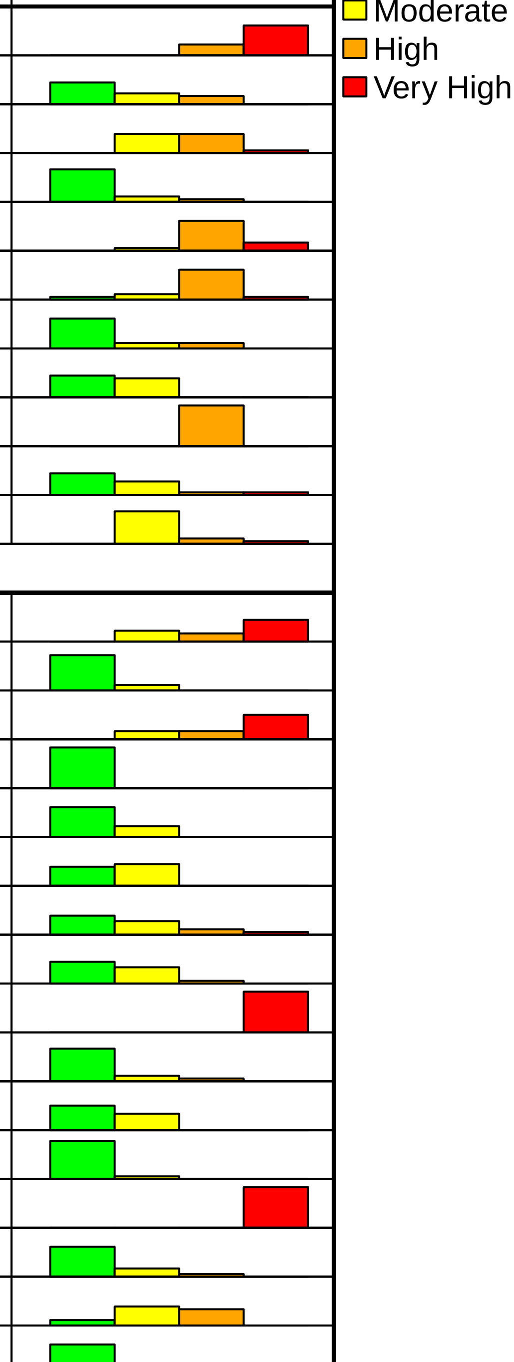
Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 81% of scores ≥ 2

	Balaenoptera musculus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	3.7	3.0	
	Habitat Specificity	1.7	2.7	
	Site Fidelity	2.6	1.8	
	Lifetime Reproductive Potential	1.3	1.7	
	Generation Length	3.1	1.7	
	Reproductive Plasticity	2.8	1.7	
	Migration	1.4	2.0	
	Home Range	1.5	2.5	
	Stock Abundance	3.0	2.0	
	Stock Abundance Trend	1.7	1.7	
	Cumulative Stressors	2.3	2.3	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.3	2.5	
	Sea Surface Temperature (Change in variability)	1.1	2.5	
	Air Temperature (Change in mean)	3.4	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.3	2.5	
	Precipitation (Change in variability)	1.5	2.5	
	Sea Surface Salinity (Change in mean)	1.8	2.5	
	Sea Surface Salinity (Change in variability)	1.5	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.3	2.5	
	Sea ice coverage (Change in mean)	1.4	2.5	
	Sea ice coverage (Change in variability)	1.1	2.5	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.3	2.5	
	Circulation	2.3	2.2	
	Sea level rise	1.3	2.5	
	Exposure Score	High		
Overall Vulnerability Rank		High		



Blue whale (Western North Atlantic Stock)

Balaenoptera musculus

CVA Results Summary

Overall Climate Vulnerability Rank: High (57% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Air Temperature (Standard anomaly) (3.40), and Sea Surface Temperature (Standard anomaly) (3.27).

Biological Sensitivity: High. Three sensitivity attributes scored greater than 3.0: Prey/Diet Specificity (3.73), Generation Time (3.13), and Species Abundance (3.00).

Distributional Response: Very High

Abundance Response: High

Phenology Response: High

Data Quality: 81 % of the data quality scores were 2 or greater 55 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The blue whale western North Atlantic stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic (Hayes et al. 2020). Photo-identification studies suggest that blue whales from the Gulf of St. Lawrence, Newfoundland, Nova Scotia, New England, and Greenland belong to the same stock, which is separate from blue whales sighted in the eastern North Atlantic (CETAP 1982; Wenzel et al. 1988; Sears and Calambokidis 2002; Sears and Larsen 2002; Hayes et al. 2020).

Prey/Diet Specificity

Blue whales in the North Atlantic consume almost exclusively krill (Hjort and Ruud 1929; Jonsgård 1955; Sergeant 1966; Sears et al. 1987; Christensen et al. 1992b). Blue whales may incidentally consume other prey species, such as fish and copepods (Kawamura 1980).

Habitat Specificity

Blue whales in the Atlantic are primarily found in deeper, offshore waters and are rare in shallower, shelf waters (Yochem and Leatherwood 1985; Wenzel et al. 1988). However, they associate with nearshore regions with strong tidal and current mixing in the Gulf of St. Lawrence (Sears et al. 1990). Blue whales forage along edges of continental shelves and upwelling regions (Reilly and Thayer 1990; Schoenherr 1991). In the Gulf of St. Lawrence, blue whales were found in association with high salinity, cold surface temperature waters in areas with slow currents (Doniol-Valcroze 2008).

Site Fidelity

Blue whales travel frequently and do not tend to remain in the same area for more than a week or two, although nearly half of the Gulf of St. Lawrence population was resighted in subsequent years (Sears et al. 1990).

Lifetime Reproductive Potential

Taylor et al. (2007) reported a blue whale interbirth interval of 2.5 years while Yochem and Leatherwood (1985) reported an interbirth interval of 2 years.

Female blue whales reach sexual maturity around 11 years of age (range 5 to 15 years; Mizroch et al. 1984; Yochem and Leatherwood 1985; Taylor et al. 2007). Age at last reproduction is estimated to be 65 years (Taylor et al. 2007).

Generation Length

Taylor et al. (2007) reported generation length of 21.7 at r=0.05 and 30.8 at r=0.0 based on values reported by Lockyer (1984) and Mizroch et al. (1984).

Reproductive Plasticity

Calving occurs primarily during winter months (Yochem and Leatherwood 1985).

Migration

Blue whales occur in the Gulf of St. Lawrence in spring, summer, and fall and off southern Newfoundland in winter (Sears et al. 1990; Hayes et al. 2020).

Home Range

Blue whales have been detected and tracked acoustically in much of the North Atlantic, indicating the potential for long-distance movements (Clark 1995).

Stock Abundance

The abundance of blue whales in the Northwest Atlantic has not been established (Sears et al. 1987; Hammond et al. 1990; Sears et al. 1990; Sears and Calambokidis 2002; Fisheries and Oceans Canada 2009). A total of 402 blue whales were photo-identified in the St. Lawrence estuary and northwestern Gulf of St. Lawrence from 1980 to the summer of 2008, with 20 to 105 whales identified in this region each year (Ramp and Sears 2013). Mitchell (1974) estimated that the blue whale population in the western North Atlantic may number only in the low hundreds. In waters around Iceland, Pike et al. (2019) estimated 3000 blue whales (95% CI = 1377–6534) in 2015, though whales in those waters are believed to be from a different population than those in the western North Atlantic (Wenzel et al. 1988; Sears and Calambokidis 2002; Sears and Larsen 2002; Hayes et al. 2020).

Stock Abundance Trend

A trend analysis has not been completed for this population. Elsewhere in the North Atlantic, the population off Iceland increased at 4.9% per year from 1969 to 1988 (Sigurjonsson and Gunnlaugsson 1990). Population estimates from the 1970s placed the blue whale population in the western North Atlantic in the low hundreds (Mitchell 1974). Pike et al. (2019) noted the increase in population in Icelandic waters continued through 2015.

Cumulative Stressors

Threats for North Atlantic blue whales include ship strikes, pollution, and entanglement in fishing gear although there are no recent confirmed records of mortality or serious injury to blue whales in the U.S. Atlantic EEZ (Hayes et al. 2020). Ice-related strandings and entrapments are known to occur off the coast of Newfoundland (Sears and Calambokidis 2002). Contaminants (e.g., PCBs, organochlorines) and increasing anthropogenic noise in the oceans also represent threats to blue whales in the western North Atlantic (Metcalfe et al. 2004; Sears and Perrin 2018).

Distribution and Sightings

Density model results for blue whales in the western North Atlantic are presented by Roberts et al. (2015, 2016). Palka et al. (2021a, 2021b) present blue whale sightings along survey track lines.

Further Reading

Cooke, J.G. 2018. *Balaenoptera musculus* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T2477A156923585. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2477A156923585.en

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

National Marine Fisheries Service (NMFS). 2020. Recovery Plan for the Blue Whale (*Balaenoptera musculus*): first revision. Silver Spring, MD. 118 p.

National Marine Fisheries Service (NMFS). 2020. Blue Whale (*Balaenoptera musculus*) 5-Year Review: Summary and Evaluation. Silver Spring, MD. 15 p.

Sears, R. and W.F. Perrin. 2018. Blue Whale: *Balaenoptera musculus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 110-114. doi: 10.1016/B978-0-12-804327-1.00070-4

References

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Christensen, I., T. Haug, and N. Øien. 1992. A review of feeding and reproduction in large baleen whales (Mysticeti) and sperm whales *Physeter macrocephalus* in Norwegian and adjacent waters. Fauna Norvegica Series A 13:39–48.

Clark, C.W. 1995. Annex M. Matters arising out of the discussion of blue whales: Annex M1. Application of US Navy underwater hydrophone arrays for scientific research on whales. Reports of the International Whaling Commission 45:210–212.

Doniol-Valcroze, T. 2008. Habitat selection and niche characteristics of rorqual whales in the northern Gulf of St. Lawrence (Canada). McGill University. Dissertation. 146 p.

Fisheries and Oceans Canada (DFO). 2009. Recovery Strategy for the blue whale (*Balaenoptera musculus*), Northwest Atlantic population, in Canada [PROPOSED]. Ottawa. 62 p.

Hammond, P.S., R. Sears, and M. Bérubé. 1990. A note on problems in estimating the number of blue whales in the Gulf of St Lawrence from photo-identification data. Reports of the International Whaling Commission (Special Issue) 12:141–142.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hjort, J. and J.T. Ruud. 1929. Whaling and fishing in the North Atlantic. Commission Internationale pour l'Exploration Scientifique de la Mer Rapports et Proces-Verbaux des Reunions 56:551.

Jonsgård, Å. 1955. The stocks of blue whales (*Balaenoptera musculus*) in the northern Atlantic Ocean and adjacent arctic waters. Norsk Hvalfangsttid 44:505–519.

Kawamura, A. 1980. A review of food of balaenopterid whales. Scientific Reports of Whales Research Institute 32:155–197.

Lockyer, C. 1984. Review of baleen whale (Mysticeti) reproduction and implications for management. Reports of the International Whaling Commission (Special Issue) 6:27–50.

Metcalfe, C., B. Koenig, T. Metcalfe, G. Paterson, and R. Sears. 2004. Intra- and inter-species differences in persistent organic contaminants in the blubber of blue whales and humpback whales from the Gulf of St. Lawrence, Canada. Marine Environmental Research 57(4):245–260. doi: 10.1016/j.marenvres.2003.08.003

Mitchell, E. 1974. Present status of Northwest Atlantic fin and other whale stocks. In: W. E. Schevill (Ed.), The whale problem: A status report. Harvard University Press, Cambridge, MA. pp. 108–169.

Mizroch, S.A., D.W. Rice, and J.M. Breiwick. 1984. The blue whale, *Balaenoptera-musculus*. Marine Fisheries Review 46(4):15–19.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix II species distribution maps of sightings not used in density-habitat models. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pike, D., T. Gunnlaugsson, B. Mikkelsen, S.D. Halldórsson, and G. Víkingsson. 2019. Estimates of the abundance of cetaceans in the central North Atlantic based on the NASS Icelandic and Faroese shipboard surveys conducted in 2015. NAMMCO Scientific Publications 11. doi: 10.7557/3.4941

Ramp, C., M. Berube, W. Hagen, and R. Sears. 2006. Survival of adult blue whales *Balaenoptera musculus* in the Gulf of St. Lawrence, Canada. Marine Ecology Progress Series 319:287–295. doi: 10.3354/meps319287

Reilly, S.B. and V.G. Thayer. 1990. Blue whale (*Balaenoptera-musculus*) distribution in the Eastern Tropical Pacific. Marine Mammal Science 6(4):265–277. doi: 10.1111/j.1748-7692.1990.tb00357.x

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for blue whale (*Balaenoptera musculus*) for the U.S. East Coast version 1.3, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 66 p.

Schoenherr, J.R. 1991. Blue whales feeding on high-concentrations of euphausiids around Monterey Submarine-Canyon. Canadian Journal of Zoology 69(3):583–594. doi: 10.1139/z91-088

Sears, R. and J. Calambokidis. 2002. COSEWIC Assessment and update status report on the blue whale Balaenoptera musculus, Atlantic population and Pacific poulation, in Canada. Committee on the Status of Endangered Wildlife in Canada: Ottawa, Canada. 38 p.

Sears, R. and F. Larsen. 2002. Long range movements of a blue whale (*Balaenoptera musculus*) between the Gulf of St. Lawrence and West Greenland. Marine Mammal Science 18(1):281–285. doi: 10.1111/j.1748-7692.2002.tb01034.x

Sears, R. and W.F. Perrin. 2018. Blue whale: *Balaenoptera musculus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 110–114. doi: 10.1016/B978-0-12-804327-1.00070-4

Sears, R., F. Wenzel, and J.M. Williamson. 1987. The blue whale: a catalog of individuals from the western North Atlantic (Gulf of St. Lawrence). Mingan Island Cetacean Study: St. Lambert, Quebec, Canada. 27 p.

Sears, R., J.M. Williamson, F.W. Wenzel, M. Bérubé, D. Gendron, and P. Jones. 1990. Photographic identification of the blue whale (*Balaenoptera musculus*) in the Gulf of St. Lawrence, Canada. Reports of the International Whaling Commission (Special Issue) 12:335–342.

Sergeant, D.E. 1966. Populations of large whale species in the western North Atlantic with special reference to the fin whale. Fisheries Research Board of Canada, Arctic Biological Station. Circular No. 9. 130 p.

Sigurjonsson, J. and T. Gunnlaugsson. 1990. Recent trends in abundance of blue (*Balaenoptera musculus*) and humpback whales (*Megaptera novaeangliae*) off west and southwest Iceland, with a note on occurrence of other cetacean species. Reports of the International Whaling Commission (Special Issue) 40:537–551.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Wenzel, F., D.K. Mattila, and P.J. Clapham. 1988. *Balaenoptera-musculus* in the Gulf of Maine. Marine Mammal Science 4(2):172–175. doi: 10.1111/j.1748-7692.1988.tb00198.x

Yochem, P.K. and S. Leatherwood. 1985. Blue whale *Balaenoptera musculus* (Linnaeus, 1758). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 3: The sirenians and baleen whales. Academic Press, San Diego, CA. pp. 193–240.

Clymene dolphin − *Stenella clymene*

Northern Gulf of Mexico Stock

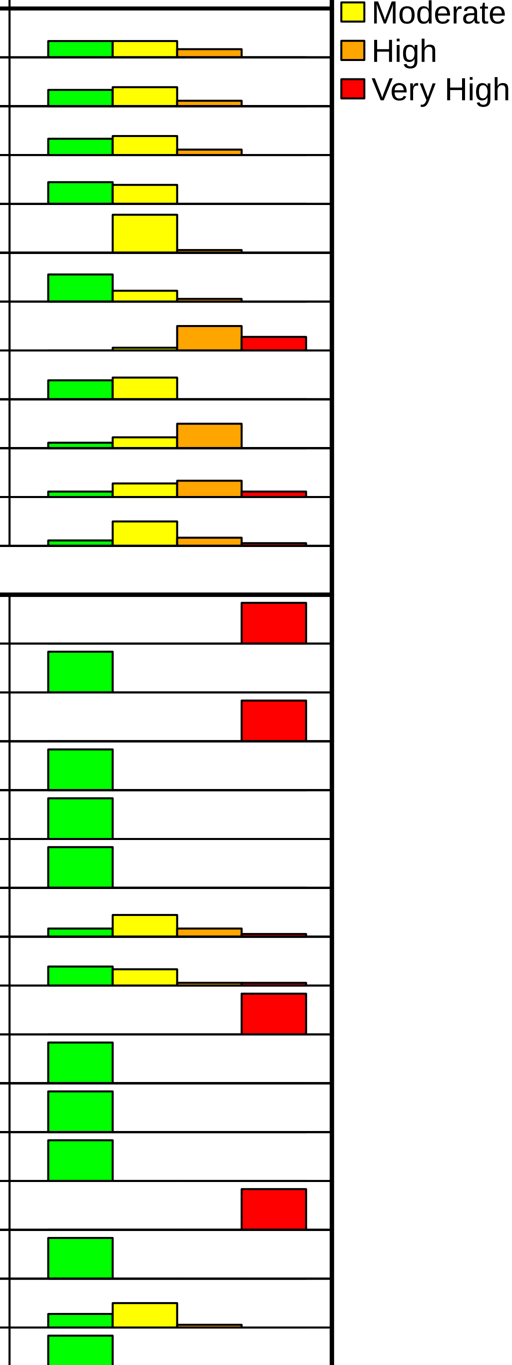
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

	Stenella clymene	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.0	
	Habitat Specificity	1.7	2.0	
	Site Fidelity	1.7	0.7	
	Lifetime Reproductive Potential	1.5	2.0	
	Generation Length	2.1	2.0	
	Reproductive Plasticity	1.4	0.7	
	Migration	3.3	1.7	
	Home Range	1.5	2.0	
	Stock Abundance	2.5	3.0	
	Stock Abundance Trend	2.5	0.7	
	Cumulative Stressors	2.2	0.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.1	2.7	
	Sea Surface Salinity (Change in variability)	1.7	2.7	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	1.7	2.3	
	Sea level rise	1.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Clymene dolphin (Northern Gulf of Mexico Stock)

Stenella clymene

CVA Results Summary

Overall Climate Vulnerability Rank: High (74% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (3.27) and Species Abundance Trend (2.53).

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 81 % of the data quality scores were 2 or greater. 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Clymene dolphin Northern Gulf of Mexico Stock includes individuals found in the waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico (Hayes et al. 2021). However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Based on stomach content analysis of two individuals and one observation of feeding free-ranging dolphins, Clymene dolphins feed on small pelagic fish and squid (Perrin et al. 1981; Fertl et al. 1997).

Habitat Specificity

Clymene dolphins in the northern Gulf of Mexico are found in deeper waters off the continental shelf and primarily west of the Mississippi River (Mullin et al. 1994; Maze-Foley and Mullin 2006). Clymene dolphins are mostly sighted in deep waters well beyond the edge of the continental shelf (Fertl et al. 2003). They often associate with the lower slope and deep water areas in regions of cyclonic or confluence circulation (Davis et al. 2002).

Site Fidelity

Information regarding Clymene dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported Clymene dolphin interbirth interval of 3.0 years based on values reported by Kasuya (1985) and Calzada et al. (1996). Taylor et al. (2007) reported Clymene dolphin age at first reproduction of 7 years and estimated age at last reproduction of 29 years. Jefferson et al. (1995) noted that pregnant females aged 15 and 16 years stranded in the northern Gulf of Mexico.

Generation Length

Taylor et al. (2007) reported generation length of 14 years at r = 0.02 and 14.7 years at r = 0.0 using information from spinner dolphins (*Stenella longirostris*) as a proxy.

Reproductive Plasticity

Information regarding Clymene dolphin mating location, habitat, and season was not found in the literature.

Migration

Clymene dolphins were seen in the winter, spring and summer during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000) and no seasonality in occurrence is known for this species (DoN 2007).

Home Range

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997), Clymene dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson et al. 2008).

Stock Abundance

The abundance of northern Gulf of Mexico Clymene dolphins is estimated to be 513 individuals (CV=1.03), based on 2017 and 2018 summer surveys in which stock abundance was estimated at 1,026 (CV=1.03) for summer 2017, based on a single sighted group, and estimated at 0 for summer 2018, based on zero sightings by primary team observers (Garrison et al. 2020). A secondary team observer reported one sighting in summer 2018, but secondary team sightings are not used directly for these abundance estimates. Three groups were sighted during a winter 2018 survey (Rappucci et al. 2019), but this survey has not been utilized for abundance estimation as yet.

Previously, the population was estimated at 129 individuals (CV=1.00) from a summer 2009 oceanic survey (Waring et al. 2012) and 6,575 individuals (CV=0.36) from 2003–2004 surveys (Mullin 2007). The 2009 and 2003–2004 estimates were revised based on the 2017 survey methodology resulting in abundance estimates of 10,900 (CV=0.42) from the 2003 survey, 13,257 (CV=0.81) from the 2004 survey, and 1,319 (CV=0.78) from the 2009 survey (Garrison et al. 2020).

Mullin and Fulling (2004) estimated 17,355 individuals (CV=0.65) in April-June 1996-2001. Hansen et al. (1995) estimated 5,571 individuals (CV=0.37) in April-June 1991-1994. Roberts et al. (2015, 2016) estimated 11,000 individuals (CV=0.16) for all months during the period 1992-2009 using a density model.

Stock Abundance Trend

Five point estimates of Clymene dolphin abundance have been made based on data from surveys covering 2003–2018, however imprecise estimates and long intervals between surveys result in poor statistical power to detect a trend (Garrison et al. 2020; Hayes et al. 2021). The DWH NRDA Trustees estimated that 2% of the Clymene dolphin stock was killed and 3% of females sustained reproductive failure following the Deepwater Horizon event (DWH NRDA 2016).

Cumulative Stressors

The Clymene dolphin Gulf of Mexico stock may interact with longline fisheries. During the period 2014–2019, no fishing-related mortality or serious injury of Clymene dolphins was reported (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b, 2021; Maze Foley and Garrison 2021). During the period 2014–2018, 16 Clymene dolphins were reported stranded along the Gulf of Mexico coast (Hayes et al. 2021).

The Clymene dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016; Aichinger Dias et al. 2017; Takeshita et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for Clymene dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Jefferson, T.A. 2018. Clymene Dolphin: *Stenella clymene*. In: Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. eds. Encyclopedia of marine mammals. Academic Press. Pages 197-200

Jefferson, T.A. and G. Braulik. 2018. *Stenella clymene*. The IUCN Red List of Threatened Species 2018: e.T20730A50373865. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20730A50373865.en

References

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Calzada, N., A. Aguilar, T.B. Sorenson, and C. Lockyer. 1996. Reproductive biology of female striped dolphin (*Stenella coeruleoalba*) from the western Mediterranean. The Zoological Society of London 240:581–591.

Davis, R.W., J.G. Ortega-Ortiz, C.A. Ribic, W.E. Evans, D.C. Biggs, P.H. Ressler, R.B. Cady, R.R. Leben, K.D. Mullin, and B. Wursig. 2002. Cetacean habitat in the northern oceanic Gulf of Mexico. Deep-Sea Research Part I-Oceanographic Research Papers 49(1):121–142. doi: 10.1016/S0967-0637(01)00035-8

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Fertl, D., T.A. Jefferson, I.B. Moreno, A.N. Zerbini, and K.D. Mullin. 2003. Distribution of the Clymene dolphin *Stenella clymene*. Mammal Review 33(3-4):253–271. doi: 10.1046/j.1365-2907.2003.00033.x

Fertl, D., A.J. Schiro, and D. Peake. 1997. Coordinated feeding by Clymene dolphins (*Stenella clymene*) in the Gulf of Mexico. Aquatic Mammals 23(2):111–112.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Garrison, L.P. and L.W. Stokes. 2021. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2019. doi: 10.25923/asb3-6q44

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hansen, L.J., K.D. Mullin, and C.L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. MIA-94/95-25. 9 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A., D.K. Odell, and K.T. Prunier. 1995. Notes on the biology of the Clymene dolphin (*Stenella clymene*) in the northern Gulf-of-Mexico. Marine Mammal Science 11(4):564–573. doi: 10.1111/j.1748-7692.1995.tb00679.x

Jefferson, T.A. and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review 27(1):27–50. doi: 10.1111/j.1365-2907.1997.tb00371.x

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.

Kasuya, T. 1985. Effect of exploitation of on reproductive parameters of the spotted and striped dolphins off the Pacific coast of Japan. Scientific Reports of the Whales Research Institute, Tokyo 36:107–138.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mullin, K.D. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 26 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996-2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

Mullin, K.D., W. Hoggard, C.L. Roden, R.R. Lohoefener, C.M. Rogers, and B. Taggart. 1994. Cetaceans on the upper continental-slope in the North-Central Gulf-of-Mexico. Fishery Bulletin 92(4):773–786.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, and P.J.H. Vanbree. 1981. *Stenella-clymene*, a rediscovered tropical dolphin of the Atlantic. Journal of Mammalogy 62(3):583–598. doi: 10.2307/1380405

Rappucci, G., A. Martinez, J. Litz, L. Aichinger Dias, M. Soldevilla, K. Ternus, L.P. Garrison, and K.D. Mullin. 2019. GoMMAPPS Winter 2018 Research Cruise Report GU18-01. doi: 10.25923/8b6m-y457

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for Clymene dolphin (*Stenella clymene*) for the U.S. Gulf of Mexico version 2.3, 2015-09-27, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 69 p.

Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. The Deepwater Horizon oil spill marine mammal injury assessment. Endangered Species Research 33:95–106. doi: 10.3354/esr00808

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Apalachee Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 74% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.0	
	Habitat Specificity	3.4	1.8	
	Site Fidelity	3.8	1.8	
	Lifetime Reproductive Potential	1.4	2.2	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.4	2.2	
	Migration	3.8	1.8	
	Home Range	3.4	1.8	
	Stock Abundance	3.0	2.0	
	Stock Abundance Trend	2.3	1.0	
	Cumulative Stressors	3.3	1.5	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.0	2.5	
	Sea Surface Salinity (Change in mean)	2.2	2.5	
	Sea Surface Salinity (Change in variability)	1.4	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.0	2.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.0	2.5	
	Circulation	3.8	1.2	
	Sea level rise	3.0	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Apalachee Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.75).

Biological Sensitivity: High. Six sensitivity attributes scored greater than or equal to 3.0: Site Fidelity (3.80), Migration (3.75), Habitat Specificity (3.45), Home Range (3.45), Cumulative Stressors (3.30), and Species Abundance (3.00).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 74% of the data quality scores were 2 or greater, 45% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins found in Apalachee Bay in the northeast Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, in inshore systems along the Florida Panhandle, Toms (2019) found fine-scale genetic population structure among five stocks and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021; Hayes et al. 2022).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

The most recent abundance estimate of 491 individuals (CV=0.39) comes from 1993 (Blaylock and Hoggard 1994; Hayes et al. 2022). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning. Dolphins along the panhandle region of Florida have been frequent targets of harassment (Vail 2016).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies have shown persistent organic pollutants (POPs) in tissues of common bottlenose dolphins from the Florida Panhandle (Wilson et al. 2012; Balmer et al. 2019) and other Florida Gulf Coast waters (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vail, C.S. 2016. An overview of increasing incidents of bottlenose dolphin harassment in the Gulf of Mexico and possible solutions. Frontiers in Marine Science 3:110. doi: 10.3389/fmars.2016.00110

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., J.R. Kucklick, B.C. Balmer, R.S. Wells, J.P. Chanton, and D.P. Nowacek. 2012. Spatial distribution of bottlenose dolphins (*Tursiops truncatus*) inferred from stable isotopes and priority organic pollutants. Science of the Total Environment 425:223–230. doi: 10.1016/j.scitotenv.2012.02.030

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Barataria Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.7	
	Habitat Specificity	3.8	3.0	
	Site Fidelity	3.8	3.0	
	Lifetime Reproductive Potential	1.7	2.0	
	Generation Length	2.9	2.3	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.9	3.0	
	Home Range	3.5	3.0	
	Stock Abundance	2.3	3.0	
	Stock Abundance Trend	3.3	1.7	
	Cumulative Stressors	3.5	3.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	1.3	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	4.0	2.3	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Barataria Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.0:Air Temperature (Standard anomaly) (4.00), Circulation (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Very High. Six sensitivity attributes scored greater than 3.0: Migration (3.93), Habitat Specificity (3.80), Site Fidelity (3.80), Cumulative Stressors (3.53), Home Range (3.47), and Species Abundance Trend (3.33)

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Caminada Bay, Barataria Bay east to Bastian Bay, Bay Coquette, and Gulf coastal waters extending 1 km from the shoreline (Blaylock et al. 1994; Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). Within Barataria Bay, common bottlenose dolphins are frequently found in areas of higher salinity (>~11ppt) and tend to avoid areas of lower salinity (<~5ppt; Hornsby et al. 2017) and foraging habitat has been characterized by depth, distance from shore, and salinity (Miller and Baltz 2010).

Site Fidelity

Strong multi-year, year-round site fidelity has been demonstrated for this stock (Wells et al. 2017).

Other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010, 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico include transient, seasonally migratory, and stable resident communities (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Louisiana/Mississippi (Hubard et al. 2004; Wells et al. 2017; Takeshita et al. 2021), Texas (Bräger 1993; Bräger et al. 1994; Fertl 1994; Irwin and Würsig 2004; Lynn and Würsig 2002; Maze and Würsig 1999; Shane 1990; Shane 2004; Weller 1998), and Florida (Balmer et al. 2008; Bassos-Hull et al. 2013; Irvine and Wells 1972; Irvine et al. 1981; Scott et al. 1990; Tyson et al. 2011; Urian et al. 2009; Wells 1986a; Wells 1991; Wells 2003; Wells et al. 1987; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997). Stable isotope data suggest little movement of this population between the estuary and the nearshore environment (Cloyed et al. 2021c). Satellite tag data suggest few long-range movements outside of the bay (Lane et al. 2015).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Cloyed et al. 2021a, 2021b).

Stock Abundance

The best available abundance estimate for this stock is 2,071 individuals (95% CI: 1,832–2,309; CV=0.06) based on vessel-based capture-recapture photo-ID surveys conducted from March and April 2019 (Garrison et al. 2020; Hayes et al. 2022). Previously, this stock abundance was estimated at 2,306 individuals (95% CI: 2,014–2,603; CV=0.09) based on vessel-based capture-recapture photo-ID surveys conducted from June 2010 to May 2014 (McDonald et al. 2017).

Stock Abundance Trend

The data are insufficient to determine population trends for most of the Gulf of Mexico bay, sound, and estuary common bottlenose dolphin stocks (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Barataria Bay were exposed to some of the highest levels of oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from Barataria Bay have shown persistent organic pollutant (POP) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was also declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Sighting maps for this stock are presented by Mullin et al. (2018).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution

patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Cloyed, C.S., B.C. Balmer, L.H. Schwacke, R. Takeshita, A. Hohn, R.S. Wells, T.K. Rowles, J.T. Saliki, C.R. Smith, M.C. Tumlin, E.S. Zolman, D.A. Fauquier, and R.H. Carmichael. 2021a. Linking morbillivirus exposure to individual habitat use of common bottlenose dolphins (*Tursiops truncatus*) between geographically different sites. Journal of Animal Ecology 90(5):1191–1204. doi: 10.1111/1365-2656.13446

Cloyed, C.S., B.C. Balmer, L.H. Schwacke, R.S. Wells, E.J. Berens McCabe, A.A. Barleycorn, J.B. Allen, T.K. Rowles, C.R. Smith, R. Takeshita, F.I. Townsend, M.C. Tumlin, E.S. Zolman, and R.H. Carmichael. 2021b. Interaction between dietary and habitat niche breadth influences cetacean vulnerability to environmental disturbance. Ecosphere 12(9):e03759. doi: 10.1002/ecs2.3759

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021c. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hornsby, F.E., T.L. McDonald, B.C. Balmer, T.R. Speakman, K.D. Mullin, P.E. Rosel, R.S. Wells, A.C. Telander, P.W. Marcy, and L.H. Schwacke. 2017. Using salinity to identify common bottlenose dolphin habitat in Barataria Bay, Louisiana, USA. Endangered Species Research 33:181–192. doi: 10.3354/esr00807

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, C.E. and D.M. Baltz. 2010. Environmental characterization of seasonal trends and foraging habitat of bottlenose dolphins (*Tursiops truncatus*) in northern Gulf of Mexico bays. Fishery Bulletin 108(1):79–86.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., K. Barry, T. McDonald, J. Morey, B. Quigley, E. Ronje, L. Schwacke, S. Carrie, T. Speakman, and J. Thompson. 2018. Assessment of the overlap of Terrebonne–Timbalier Bay and Bartaria Bay common bottlenose dolphin (*Tursiops truncatus*) stocks based on photo-identification of individual dolphins. National Oceanic and Atmospheric Administration, National Marine

Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. NOAA Technical Memorandum NMFS-SEFSC-729. 29 p. doi: 10.25923/8g4y-dg29

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater

Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778
Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292
Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x
Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145
Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.
Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.
Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Calcasieu Lake Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	2.6	1.7	
	Site Fidelity	3.5	2.0	
	Lifetime Reproductive Potential	1.7	2.3	
	Generation Length	2.8	2.3	
	Reproductive Plasticity	1.3	2.0	
	Migration	3.9	1.7	
	Home Range	3.4	1.3	
	Stock Abundance	3.7	1.7	
	Stock Abundance Trend	2.3	1.3	
	Cumulative Stressors	3.2	2.3	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	2.0	2.7	
	Sea Surface Salinity (Change in variability)	1.0	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.8	2.3	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Calcasieu Lake Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5:

Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Circulation (3.8).

Biological Sensitivity: High. Five sensitivity attributes scored greater than 3.0: Migration (3.87), Species Abundance (3.67), Site Fidelity (3.47), Home Range (3.40), and Cumulative Stressors (3.20).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 81 % of the data quality scores were 2 or greater, 55 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Calcasieu Lake, in Louisiana (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018; Bowen-Stevens et al. 2021). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). Similar to Sabine Lake, the Calcasieu Lake estuary has been extensively modified with deep engineered channels to accommodate large vessels, which likely resulted in highly stratified salinity in the channels (Ward 1980).

Site Fidelity

No specific site fidelity information was found for this stock. However, other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Connor et al. 2000; Leatherwood 1977; Wells 2003; Wells and Scott 1999).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Urian et al. 1996; Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas , and (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Wells et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells et al. 2017), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002).

Stock Abundance

Aerial surveys by Scott et al. (1989) estimated 0-6 individuals (CV=0.34) for this stock. These estimates likely represent an underestimation due to reduced detection probability compared to other platforms (e.g., see comparison of abundance estimates from aerial and small boat surveys for Sabine Lake, Ronje et al. 2020).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Calcasieu Lake may have been exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event

(UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from nearby Barataria Bay have shown persistent organic pollutant (POP) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also affected by a 2007 UME in which 66 common bottlenose dolphins stranded in northeast Texas and west Louisiana due to an undetermined cause (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Ronje, E., H. Whitehead, K. Barry, S. Piwetz, J. Struve, V. Lecours, L. Garrison, R.S. Wells, and K.D. Mullin. 2020. Abundance and occurrence of common bottlenose dolphins (*Tursiops truncatus*) in three estuaries of the northwestern Gulf of Mexico. Gulf and Caribbean Research 31:18–34. doi: 10.18785/gcr.3101.09

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, G.P., D.M. Burn, L.J. Hansen, and R.E. Owen. 1989. Estimates of bottlenose dolphin abundance in the Gulf of Mexico from regional aerial surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center: Miami, FL. Southeast Fisheries Center Contribution CRD-88/89-07. 77 p.

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells, and E.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. Journal of Mammalogy 77(2):394–403. doi: 10.2307/1382814

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Ward, G.H. 1980. Hydrography and circulation processes of Gulf estuaries. In: Hamilton, P. and K.B. Macdonald (Eds.), Estuarine and Wetland Processes, Marine Science Book Series. Vol. 11. Springer Science+Business Media, New York, NY. p. 183—215. doi: 10.1007/978—1—4757—5177—2

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Caloosahatchee River Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.0	
	Habitat Specificity	3.5	1.7	
	Site Fidelity	3.9	2.3	
	Lifetime Reproductive Potential	1.9	2.0	
	Generation Length	3.1	2.0	
	Reproductive Plasticity	1.1	2.0	
	Migration	3.9	2.0	
	Home Range	3.7	2.3	
	Stock Abundance	3.4	1.3	
	Stock Abundance Trend	2.1	1.0	
	Cumulative Stressors	3.2	1.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.7	
	Sea Surface Temperature (Change in variability)	1.1	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.1	2.7	
	Precipitation (Change in mean)	1.1	2.7	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	2.1	2.7	
	Sea Surface Salinity (Change in variability)	1.2	2.7	
	Ocean pH (Change in mean)	3.9	2.7	
	Ocean pH (Change in variability)	1.1	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	2.7	
	Dissolved oxygen (Change in variability)	1.1	2.7	
	Circulation	3.9	2.0	
	Sea level rise	3.9	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Caloosahatchee River Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.0: Circulation (3.93), Dissolved oxygen (Standard anomaly) (3.93), Sea level rise (3.93), Sea Surface Temperature (Standard anomaly) (3.93), Air Temperature (Standard anomaly) (3.87), and Ocean pH (Standard anomaly) (3.87)

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.93), Site Fidelity (3.93), and Home Range (3.73).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 85% of the data quality scores were 2 or greater, 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in the Caloosahatchee River along the Gulf of Mexico coast of Florida (Hayes et al. 2019).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Multi-year site fidelity in at least the mouth of the Caloosahatchee River has been demonstrated from photographic identification surveys of the region (Wells et al. 1997; Bassos-Hull et al. 2013). Other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies from the Texas coast suggest female common bottlenose dolphins can live up to 41 years (Fernandez and Hohn 1998). Studies from the Mississippi coast suggest female common bottlenose dolphins can live up to 30 years (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002).

Stock Abundance

A best estimate of the abundance for this stock is unavailable (Hayes et al. 2019). The most recent survey, conducted by Scott et al. (1989) between 1983 and 1986, sighted 0 dolphins within the Caloosahatchee River.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2019).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Adimey et al. 2014; McHugh et al. 2021), vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutant (POP) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018).

Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Adimey, N.M., C.A. Hudak, J.R. Powell, K. Bassos-Hull, A. Foley, N.A. Farmer, L. White, and K. Minch. 2014. Fishery gear interactions from stranded bottlenose dolphins, Florida manatees and sea turtles in Florida, U.S.A. Marine Pollution Bulletin 81(1):103–115. doi: 10.1016/j.marpolbul.2014.02.008

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, K.A., A.A. Barleycorn, J.B. Allen, K. Bassos-Hull, G. Lovewell, D. Boyd, A. Panike, C. Cush, D. Fauquier, B. Mase, R.C. Lacy, M.R. Greenfield, D.I. Rubenstein, A. Weaver, A. Stone, L. Oliver, K. Morse, and R.S. Wells. 2021. Staying alive: Long-term success of bottlenose dolphin

interventions in southwest Florida. Frontiers in Marine Science 7:624729. doi: 10.3389/fmars.2020.624729
McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Scott, G.P., D.M. Burn, L.J. Hansen, and R.E. Owen. 1989. Estimates of bottlenose dolphin abundance in the Gulf of Mexico from regional aerial surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Center: Miami, FL. Southeast Fisheries Center Contribution CRD-88/89-07. 77 p.
Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.
Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7
Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165
Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin – *Tursiops truncatus*

GoMx BSE/Choctawhatchee Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.0	
	Habitat Specificity	3.5	2.0	
	Site Fidelity	4.0	2.5	
	Lifetime Reproductive Potential	1.3	2.0	
	Generation Length	2.8	2.0	
	Reproductive Plasticity	1.4	2.0	
	Migration	3.9	2.2	
	Home Range	3.5	2.2	
	Stock Abundance	3.0	2.5	
	Stock Abundance Trend	2.1	1.2	
	Cumulative Stressors	3.2	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.0	3.0	
	Sea Surface Salinity (Change in variability)	2.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	4.0	1.2	
	Sea level rise	3.6	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Common bottlenose dolphin (GoMx BSE/Choctawhatchee Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), Circulation (3.95), and Sea level rise (3.65)

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Site Fidelity (3.95), Migration (3.90), Habitat Specificity (3.55), and Home Range (3.55)

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Choctawhatchee Bay in the northeast Gulf of Mexico along the Florida coast. This stock is bounded by Point Washington and Jolly Bay in the east and Fort Walton Beach in the west (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009)

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Wells et al. 2017).

Stock Abundance

Based on July-August 2007 surveys, the best available abundance estimate of the resident Choctawhatchee Bay Stock is 179 (CV=0.04) (Conn et al. 2011; Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Choctawhatchee Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of

Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from the waters along the Florida panhandle have shown persistent organic pollutant (POP) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in waters along the Florida panhandle (McCormack et al. 2020a, 2020b, 2022).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center,: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Conn, P.B., A.M. Gorgone, A.R. Jugovich, B.L. Byrd, and L.J. Hansen. 2011. Accounting for transients when estimating abundance of bottlenose dolphins in Choctawhatchee Bay, Florida. Journal of Wildlife Management 75(3):569–579. doi: 10.1002/jwmg.94

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria

Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.5	1.7	
	Habitat Specificity	3.5	1.3	
	Site Fidelity	3.3	1.3	
	Lifetime Reproductive Potential	2.1	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.3	2.0	
	Migration	3.6	2.0	
	Home Range	3.5	2.0	
	Stock Abundance	2.5	1.3	
	Stock Abundance Trend	1.9	0.7	
	Cumulative Stressors	2.9	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.0	
	Sea Surface Temperature (Change in variability)	1.1	2.0	
	Air Temperature (Change in mean)	3.9	2.0	
	Air Temperature (Change in variability)	1.1	2.0	
	Precipitation (Change in mean)	1.1	2.0	
	Precipitation (Change in variability)	1.1	2.0	
	Sea Surface Salinity (Change in mean)	2.7	2.0	
	Sea Surface Salinity (Change in variability)	1.3	2.0	
	Ocean pH (Change in mean)	3.9	2.0	
	Ocean pH (Change in variability)	1.1	2.0	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	3.9	2.0	
	Dissolved oxygen (Change in variability)	1.1	2.0	
	Circulation	1.2	2.0	
	Sea level rise	3.9	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Sea level rise (3.93), Air Temperature (Standard anomaly) (3.87), Dissolved oxygen (Standard anomaly) (3.87), Ocean pH (Standard anomaly) (3.87), and Sea Surface Temperature (Standard anomaly) (3.87)

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.60), Habitat Specificity (3.53), and Home Range (3.53)

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 81% of the data quality scores were 2 or greater. 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Chokoloskee Bay, Ten Thousand Islands, and Gullivan Bay in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Wells et al. 2017).

Stock Abundance

An abundance estimate is not available for this stock (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutant (POP) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; Damseaux et al. 2017; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in this stock (Damseaux et al. 2017) and elsewhere in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was at the southern end of the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Damseaux, F., J.J. Kiszka, M.R. Heithaus, G. Scholl, G. Eppe, J.P. Thome, J. Lewis, W. Hao, M.C. Fontaine, and K. Das. 2017. Spatial variation in the accumulation of POPs and mercury in bottlenose dolphins of the Lower Florida Keys and the coastal Everglades (South Florida). Environmental Pollution 220(Pt A):577–587. doi: 10.1016/j.envpol.2016.10.005

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern

Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose

dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.8	2.0	
	Site Fidelity	3.4	2.5	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.2	
	Home Range	3.5	2.5	
	Stock Abundance	2.8	2.0	
	Stock Abundance Trend	1.9	1.5	
	Cumulative Stressors	3.8	2.8	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.85), Cumulative Stressors (3.75), and Home Range (3.55).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96%of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Common bottlenose dolphins in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas have shown site fidelity (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004). Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce throughout their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas(LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Wells et al. 2017).

Stock Abundance

Blaylock and Hoggard (1994) reported a best estimate of 55 individuals (CV = 0.82) for this stock (Hayes et al. 2022). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Fire et al. 2011, 2020), recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K.

Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*)

sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Estero Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	2.0	
	Habitat Specificity	3.5	2.0	
	Site Fidelity	3.9	2.3	
	Lifetime Reproductive Potential	2.2	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.1	2.0	
	Migration	3.9	2.0	
	Home Range	3.8	2.3	
	Stock Abundance	2.9	1.7	
	Stock Abundance Trend	2.1	1.3	
	Cumulative Stressors	3.5	1.7	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.3	
	Sea Surface Temperature (Change in variability)	1.1	2.3	
	Air Temperature (Change in mean)	2.9	2.3	
	Air Temperature (Change in variability)	1.1	2.3	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.1	2.3	
	Sea Surface Salinity (Change in mean)	2.1	2.3	
	Sea Surface Salinity (Change in variability)	1.1	2.3	
	Ocean pH (Change in mean)	3.9	2.3	
	Ocean pH (Change in variability)	1.1	2.3	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	3.2	2.3	
	Dissolved oxygen (Change in variability)	1.1	2.3	
	Circulation	3.5	2.7	
	Sea level rise	3.0	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Estero Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.93), Sea Surface Temperature (Standard anomaly) (3.87), and Circulation (3.53).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.87), Site Fidelity (3.87), and Home Range (3.80).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 89% of the data quality scores were 2 or greater, 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Estero Bay in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g. sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Adimey et al. 2014; McHugh et al. 2021), vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutant (POP) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Adimey, N.M., C.A. Hudak, J.R. Powell, K. Bassos-Hull, A. Foley, N.A. Farmer, L. White, and K. Minch. 2014. Fishery gear interactions from stranded bottlenose dolphins, Florida manatees and sea turtles in Florida, U.S.A. Marine Pollution Bulletin 81(1):103–115. doi: 10.1016/j.marpolbul.2014.02.008

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, K.A., A.A. Barleycorn, J.B. Allen, K. Bassos-Hull, G. Lovewell, D. Boyd, A. Panike, C. Cush, D. Fauquier, B. Mase, R.C. Lacy, M.R. Greenfield, D.I. Rubenstein, A. Weaver, A. Stone, L. Oliver, K. Morse, and R.S. Wells. 2021. Staying alive: Long-term success of bottlenose dolphin interventions in southwest Florida. Frontiers in Marine Science 7:624729. doi: 10.3389/fmars.2020.624729

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin – *Tursiops truncatus* GoMx

BSE - Southwest Marathon Key to Marquesas Keys

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	2.2	
	Habitat Specificity	3.2	1.8	
	Site Fidelity	3.5	2.2	
	Lifetime Reproductive Potential	1.6	2.0	
	Generation Length	2.8	2.0	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.0	
	Home Range	3.3	2.0	
	Stock Abundance	3.4	1.5	
	Stock Abundance Trend	2.4	0.8	
	Cumulative Stressors	2.8	1.8	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	3.2	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.0	2.5	
	Sea Surface Salinity (Change in mean)	4.0	2.5	
	Sea Surface Salinity (Change in variability)	1.0	2.5	
	Ocean pH (Change in mean)	3.8	2.5	
	Ocean pH (Change in variability)	1.0	2.5	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	3.8	2.5	
	Dissolved oxygen (Change in variability)	1.0	2.5	
	Circulation	2.8	2.0	
	Sea level rise	3.4	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Florida Keys - Southwest Marathon Key to Marquesas Keys Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Sea Surface Temperature (Standard anomaly) (4.00), Sea Surface Salinity (Standard anomaly) (3.95), Dissolved oxygen (Standard anomaly) (3.80), and Ocean pH (Standard anomaly) (3.80).

Biological Sensitivity: High. Five sensitivity attributes scored greater than 3.0: Migration (3.85), Site Fidelity (3.50), Species Abundance (3.35), Home Range (3.30), and Habitat Specificity (3.25).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 85% of the data quality scores were 2 or greater, 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in the Florida Keys from southwest Marathon Key to Marquesas Keys in the eastern Gulf of Mexico (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017). On seagrass meadows off Key West, bottlenose dolphins create mud plumes to forage on fish, such as mullets (Lewis and Schroeder 2003).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Takeshita et al. 2021; Wells et al. 2017); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009)

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutant (POP) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; Damseaux et al. 2017; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in this stock (Damseaux et al. 2017) and elsewhere in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to

natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Damseaux, F., J.J. Kiszka, M.R. Heithaus, G. Scholl, G. Eppe, J.P. Thome, J. Lewis, W. Hao, M.C. Fontaine, and K. Das. 2017. Spatial variation in the accumulation of POPs and mercury in bottlenose dolphins of the Lower Florida Keys and the coastal Everglades (South Florida). Environmental Pollution 220(Pt A):577–587. doi: 10.1016/j.envpol.2016.10.005

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern

Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lewis, J.S. and W.W. Schroeder. 2003. Mud plume feeding, a unique foraging behavior of the bottlenose dolphin in the Florida Keys. Gulf of Mexico Science 21(1):92–97. doi: 10.18785/goms.2101.09

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Galveston Bay, East Bay, Trinity Bay

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.8	2.2	
	Site Fidelity	3.4	2.8	
	Lifetime Reproductive Potential	1.6	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.8	
	Home Range	3.5	2.8	
	Stock Abundance	2.8	2.2	
	Stock Abundance Trend	1.8	1.8	
	Cumulative Stressors	3.9	2.8	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Galveston Bay, East Bay, Trinity Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than or equal to 3.5: Cumulative Stressors (3.90), Migration (3.85), and Home Range (3.50).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Galveston Bay, East Bay, and Trinity Bay in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Preliminary estimates of prey consumption proportions for common bottlenose dolphins in the Galveston Bay estuary were determined through stable isotope analysis and Bayesian mixing models (McDaniel and Guillen 2020). In this study, examination of 36 remote biopsy samples obtained from free ranging dolphins in Galveston Bay between 2015-2017 indicated striped mullet (*Mugil cephalus*) and spotted seatrout (*Cynoscion nebulosus*) as primary prey sources. Additional contributions came from white shrimp (*Litopenaeus setiferus*), hardhead catfish (*Ariopsis felis*) and likely fish with similar δ13C and δ15N values not included in the study. The authors suggested prey abundance may contribute to disparities in estimated contributions of prey sources between years (McDaniel and Guillen 2020). Barros and Odell (1990) examined the stomach contents of 76 stranded common bottlenose dolphins from Gulf of Mexico shores, 22 of which were from the shoreline of northeast Texas adjacent to the Galveston Bay systems. Those 22 samples were combined with 3 additional stomach content analyses from common bottlenose dolphin strandings recovered in the states of Louisiana, Mississippi, and Alabama (1 sample each), and designated those states as Area 1 of their study. Using a combination of visual taxonomic identification (for undigested species) and species identification keys for fish otolith and cephalopod beaks, Barros and Odell (1990) reported the proportion of prey in Area 1 as fish (94.3%), cephalopods (5.2%), crustaceans (0.5%), and a single horseshoe crab. Only 32% of the stomach contents from Area 1 contained fish only, while fish/cephalopod and fish/cephalopod/shrimp were present in 36% and 32% respectively, of Area 1 stomach contents (Barros and Odell 1990). Overall, sciaenid fishes were the primary fish prey. However, the great diversity of species (over 300 different fish species found in eight stomachs from Area 1) and similarity of species to commercial fisheries bycatch suggested common bottlenose dolphins off Texas were supplementing their diet by depredating shrimp trawler bycatch or by taking fish directly out of the nets (presumably) during trawling operations (Barros and Odell 1990). Observations of common bottlenose dolphins feeding using both methods from Texas and Louisiana have been documented (Gunter 1938; Shane 1977; Gruber 1981; Henningsen and Würsig 1991; Fertl 1994a; Moreno 2005; Ronje et al. 2018).

While much research indicates sciaenid fishes are the primary prey fishes for common bottlenose dolphins in the Gulf of Mexico (Berens McCabe et al. 2010; Dunshea et al. 2013; Bowen-Stevens et al. 2021), other researchers (Gunter 1942; Shane 1990; Miller 1992) have suggested striped mullet (*Mugil cephalus*) may be a significant part of the bottlenose dolphin diet in Texas waters. Barros and Wells (1998) reviewed the importance of mullet in the diet of common bottlenose dolphins in Florida waters and suggested the species is important, yet ranks under soniferous fishes in their dietary profile.

Habitat Specificity

Common bottlenose dolphins in the Galveston Bay system often concentrate in Bolivar Roads, an energetic tidal pass between Galveston Island and the Bolivar Peninsula (Moreno and Mathews 2018; Bräger et al. 1994; Jones III 1988; Maze and Würsig 1999; Ronje et al. 2020). Relatively high common bottlenose dolphin group density has also been observed in the Galveston Ship Channel (Fertl 1994a; Moreno and Mathews 2018; Piwetz 2019; Ronje et al. 2020). These bay sub-areas are likely mixing zones for transient dolphins from the Western Coastal stock (Hayes et al. 2022), as well as resident Galveston Bay dolphins, all utilizing the deep, prey-rich engineered channels where estuary and Gulf waters meet (Maze and Würsig 1999; Ronje et al. 2020). Seasonal distribution patterns are evident throughout portions of Texas in bays, inlets and nearshore waters. Seasonal changes in Galveston Bay population density may reflect a combination of intra-bay, inter-bay, or coastal movements. Studies of lower Galveston Bay near Bolivar Roads have documented seasonal increases in dolphin activity in spring and late summer through fall, with decreases in winter months (Fertl 1994b; Jones III 1988). Ronje et al. (2020) conducted spatially comprehensive winter and summer photo-ID mark-recapture surveys of the Galveston Bay system and estimated a greater abundance of dolphins were present in summer. Similar seasonal relative abundance increases in upper Galveston Bay have been documented during “warm” months (May - October, water temperature typically > 23°C) with fewer dolphins sighted in the upper Galveston Bay during "cold" months (November - April, water temperature typically < 23°C; Fazioli et al. 2015; Mintzer and Fazioli 2021). Previous studies have not identified strong seasonal fluctuations in abundance in the adjacent West Bay stock (Maze and Würsig 1999); but a higher density of West Bay resident dolphins was observed in the Gulf waters near San Luis Pass during cold months, and in the bay during warm months (Irwin and Würsig 2004; Henderson and Würsig 2007). More recent studies estimated slightly higher abundance in the West Bay stock area delineated by the NMFS during winter (Litz et al. 2019; Ronje et al. 2020). Similarly, in the coastal bend region of Texas near the passes, an increase in abundance during winter months and corresponding decrease during the summer has been noted in several studies (Shane 1980; McHugh 1989; Gruber 1981). Seasonal changes in density throughout Texas estuaries have been attributed to a combination of north-south migration along the coast influenced by water temperature and more localized shifts in distribution influenced by prey movements in and out of the estuary during different times of the year (Weller 1998).

Systematic and spatially comprehensive surveys have been conducted in Trinity Bay and East Bay as well as opportunistic surveys; however, dolphin groups were generally observed only on the western margins of those areas (GDRP 2021 unpublished data; Ronje et al. 2020). The overall distribution of bottlenose dolphins in the Galveston Bay system appears to be positively correlated on a north-south axis, consistent with the general gradient of salinity and distance to coast (Moreno and Mathews 2018). Mintzer and Fazioli (2021) found that both salinity and temperature predicted dolphin movements in and out of upper Galveston Bay, with an exodus of dolphins occurring with low salinity levels, regardless of the time of year and water temperature.

Site Fidelity

Photographic identification studies of areas in lower Galveston Bay and nearshore Gulf waters surrounding and including the Bolivar Roads inlet and the Galveston ship channel, indicate long-term site fidelity for a core group of bottlenose dolphins in lower Galveston Bay and the Galveston Ship Channel, yet provide evidence this region of Galveston Bay may predominantly consist of an open bottlenose dolphin population due to the high number of identified individuals (>1,000) but relatively low number of presumed year-round residents (approximately 200; Henningsen and Würsig 1991; Bräger et al. 1994; Fertl 1994b). Multi-year studies in Galveston Bay, excluding Bolivar Roads and the Galveston Ship Channel, indicate that a likely resident Galveston Bay population occurs throughout the upper and lower bay, utilizing deep channel habitats (primarily the Houston Ship Channel) in addition to open bay and nearshore habitats, with seasonal fluctuations in distribution (Fazioli et al. 2017; Fazioli and Mintzer 2020; Mintzer and Fazioli 2021; Mintzer et al. 2022). Photo-identification analyses were utilized to calculate site fidelity metrics for 442 distinct dolphins identified in upper Galveston Bay. These results were incorporated into a cluster analysis, indicating that 192 individuals (43%), demonstrated high site fidelity to upper Galveston Bay, either year-round or with a recurring seasonal pattern of residency (Mintzer et al. 2022); Remaining individuals were classified as transients (n=141, 32%) with only one sighting, or short-term users (n=109, 25%) likely to demonstrate site fidelity to Galveston Bay but lacking a specific preference for the upper portion, however, additional research is underway to evaluate how these individuals utilize other parts of the Bay (Fazioli et al. 2017; Mintzer and Fazioli 2021; Mintzer et al. 2022). Few spatially comprehensive studies have been conducted for the

Galveston Bay system and more research needs to be conducted to better determine the proportion and spatial range of enumerated individuals exhibiting site fidelity for this stock (Ronje et al. 2020).

Other Gulf of Mexico bay, sound, and estuary stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay and Espiritu Santo Bay in Texas (Lynn and Würsig 2002), San Luis Pass in Texas (Maze and Würsig 1999; Irwin and Würsig 2004), Barataria Bay in Louisiana (Miller 2003; Takeshita et al. 2021; Wells et al. 2017), Mississippi Sound (Hubard et al. 2004; Mackey 2010), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Sarasota Bay (Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) report generation length of 20.6-21.1 years.

Reproductive Plasticity

Calving may occur year round, but strong seasonal peaks are evident. Neonatal stranding rates indicate the calving peak for Northern Texas is in March (Urian et al. 1996; Fernandez and Hohn 1998; Piwetz et al. 2022).

Migration

Photo-ID studies indicate some coastal and inter-bay dolphin movements occur among adjacent stock areas (Henningsen and Würsig 1991; Maze and Würsig 1999; Ronje et al. 2020). Maze and Würsig (1999) identified three individuals that were observed in both the Galveston Bay and adjacent West Bay stock areas, with one of those individuals remaining in West Bay for up to 9 months after its initial sighting in

Galveston Bay. Ronje et al. (2020) photo-identified 40 individuals in the Galveston Bay stock area that were also observed in adjacent stock and nearshore coastal waters (West Bay n=15, Sabine Lake n=25). Given the high proportion of distinct individuals not re-sighted in Galveston Bay during previous studies (Henningsen and Würsig 1991; Bräger 1993; Ronje et al. 2020), rates of emigration and immigration may be significant.

Home Range

Previous studies of Galveston Bay common bottlenose dolphins found low recapture rates of photo-identified individuals in Gulf of Mexico waters, and distinct dorsal fin recapture rates were higher inside the bay than in the Gulf (e.g., Henningsen and Würsig 1991; Beier 2001). However, non-consecutive seasonal site fidelity has been documented for certain individuals outside of the bay boundaries for Galveston Bay (Ronje et al. 2020). This may suggest the bay boundaries and potentially nearshore coastal waters are included in a home range consistent with topographic features; however, more information needs to be collected to delineate the home range of Galveston Bay resident dolphins.

Stock Abundance

Ronje et al. (2020) estimated abundance in Galveston Bay at 841.9 individuals (95% CI = 693.5–990.4) in the winter and 1,131.5 individuals (95% CI = 846.3–1,416.7) in the summer based on 2016 surveys. Previously, Blaylock and Hoggard (1994) estimated abundance of this stock at 152 individuals (CV = 0.43).

Stock Abundance Trend

The data are insufficient to determine population trends for most of the Gulf of Mexico bay, sound, and estuary common bottlenose dolphin stocks (Hayes et al. 2022).

Cumulative Stressors

The Galveston Bay system presents a number of potential threats to bay inhabitants. Phillips and Rosel (2014) reviewed the cumulative stressors influencing the Galveston Bay system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic. Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), unusually high freshwater inflow (Fazioli and Mintzer 2020), habitat loss, and climate change (Phillips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). This stock was also within the range of the 2007 UME in which 66 common bottlenose dolphins stranded in northeast Texas and west Louisiana due to an undetermined cause (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Sighting maps for this stock for January and July 2016 are presented in Ronje et al. (2020). Additional sighting data for August 2013 – November 2022 are available from the Galveston Bay Dolphin Research Program (GDRP) and sighting maps focused on western upper Galveston Bay, 2016-2019, are presented in Mintzer and Fazioli (2021) and Mintzer et al. (2022).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Barros, N.B. and R.S. Wells. 1998. Prey and feeding patterns of resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Journal of Mammalogy 79(3):1045–1059. doi: 10.2307/1383114

Beier, A.G. 2001. Occurrence, distribution, and movement patterns of outer coastline bottlenose dolphins off Galveston Island, Texas. Texas A&M University. Thesis. 108 p.

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean

Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Dunshea, G., N.B. Barros, E.J. Berens McCabe, N.J. Gales, M.A. Hindell, S.N. Jarman, and R.S. Wells. 2013. Stranded dolphin stomach contents represent the free-ranging population's diet. Biology Letters 9(3):20121036–20121036. doi: 10.1098/rsbl.2012.1036

Fazioli, K. and V. Mintzer. 2020. Short-term effects of Hurricane Harvey on bottlenose dolphins (*Tursiops truncatus*) in upper Galveston Bay, TX. Estuaries and Coasts 43(5):1013–1031. doi: 10.1007/s12237-020-00751-y

Fazioli, K., V. Mintzer, and G. Guillen. 2015. Bottlenose dolphin activity in a highly industrialized region of Galveston Bay, Texas. Society for Marine Mammalogy, 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, CA,

Fazioli, K.L., V. Mintzer, and G. Guillen. 2017. Site fidelity of bottlenose dolphins (*Tursiops truncatus*) in a highly-industrialized estuary. 22nd Biennial Conference on the Biology of Marine Mammals, Halifax, Nova Scotia, Canada,

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994a. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fertl, D. 1994b. Occurrence, movements, and behavior of bottlenose dolphins (*Tursiops truncatus*) in association with the shrimp fishery in Galveston Bay, Texas. Texas A&M University at Galveston. Thesis. 116 p.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Gruber, J.A. 1981. Ecology of the Atlantic bottlenosed dolphin (*Tursiops truncatus*) in the Pass Cavallo area of Matagorda Bay, Texas. Texas A&M University. Thesis. 182 p.

Gunter, G. 1938. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. Ecological Monographs 8:314–346.

Gunter, G. 1942. Contributions to the natural history of the bottle-nose dolphin *Tursiops truncatus* (Montague) on the Texas coast. Journal of Mammalogy 23:267–276.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Henningsen, T. and B. Würsig. 1991. Bottle-nosed dolphins in Galveston Bay, Texas: Numbers and activities. Proceedings of the Fifth Annual Conference of the European Cetacean Society, Sandefjord, Norway, 21–23 February 1991. pp. 36–38.

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Jones, S.C., III. 1988. Survey of the Atlantic bottlenose dolphin (*Tursiops truncatus*) population near Galveston, Texas. Texas A&M University. Thesis. 57 p.

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Litz, J.A., E.I. Ronje, H.R. Whitehead, and L.P. Garrison. 2019. Updated abundance estimates for common bottlenose dolphins (*Tursiops truncatus*) inhabiting West Bay, Texas. Aquatic Conservation: Marine and Freshwater Ecosystems 29(11):1959–1970. doi: 10.1002/aqc.3195

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McDaniel, S. and G.J. Guillen. 2020. Foraging ecology of bottlenose dolphins (*Tursiops truncatus*) in Galveston Bay [Poster]. Galveston Bay Estuary Program, State of the Bay Symposium, Galveston, TX,

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, W.G. 1992. An investigation of bottlenose dolphin *Tursiops truncatus* deaths in East Matagorda Bay, Texas, January 1990. Fishery Bulletin 90:791–797.

Mintzer, V.J. and K.L. Fazioli. 2021. Salinity and water temperature as predictors of bottlenose dolphin (*Tursiops truncatus*) encounter rates in upper Galveston Bay, Texas. Frontiers in Marine Science 8:754686. doi: 10.3389/fmars.2021.754686

Mintzer, V.J., A. Quackenbush, and K.L. Fazioli. 2022. Site fidelity of common bottlenose dolphins (*Tursiops truncatus*) in a highly industrialized area of the upper Galveston Bay estuary. Marine Mammal Science. doi: 10.1111/mms.12984

Moreno, M.P.T. 2005. Environmental predictors of bottlenose dolphin distribution and core feeding densities in Galveston Bay, Texas. Texas A&M University at Galveston. Dissertation. 88 p.

Moreno, P. and M. Mathews. 2018. Identifying foraging hotspots of bottlenose dolphins in a highly dynamic system: A method to enhance conservation in estuaries. Aquatic Mammals 44(6):694–710. doi: 10.1578/am.44.6.2018.694

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Piwetz, S. 2019. Common bottlenose dolphin (*Tursiops truncatus*) behavior in an active narrow seaport. PLoS ONE 14(2):e0211971. doi: 10.1371/journal.pone.0211971

Piwetz, S., R. E.I., and H.R. Whitehead. 2022. Forty-year historical analysis of marine mammal strandings in Texas, from 1980 – 2019. Journal of Cetacean Research and Management 23(1):27–47. doi: 10.47536/jcrm.v23i1.345

Ronje, E., H. Whitehead, K. Barry, S. Piwetz, J. Struve, V. Lecours, L. Garrison, R.S. Wells, and K.D. Mullin. 2020. Abundance and occurrence of common bottlenose dolphins (*Tursiops truncatus*) in three estuaries of the northwestern Gulf of Mexico. Gulf and Caribbean Research 31:18–34. doi: 10.18785/gcr.3101.09

Ronje, E.I., H.R. Whitehead, S. Piwetz, and K.D. Mullin. 2018. Field summary for common bottlenose dolphin surveys on the Texas, Gulf of Mexico Coast, 2014–2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. NOAA Southeast Fisheries Science Center PRBD-2018-02. 31 p.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S. 1977. The population biology of the Atlantic bottlenose dolphin, *Tursiops truncatus*, in the Aransas Pass area of Texas. Texas A&M University. Thesis.

Shane, S.H. 1980. Occurrence, movements, and distribution of bottlenose dolphin, *Tursiops truncatus*, in southern Texas. Fishery Bulletin 78(3):593–601.

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells, and E.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. Journal of Mammalogy 77(2):394–403. doi: 10.2307/1382814

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and

Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.
Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin – *Tursiops truncatus*

GoMx BSE/Laguna Madre Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.0	
	Habitat Specificity	3.0	2.0	
	Site Fidelity	3.6	2.0	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.9	2.0	
	Home Range	3.6	1.8	
	Stock Abundance	3.2	2.0	
	Stock Abundance Trend	2.0	1.2	
	Cumulative Stressors	3.1	2.5	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.0	2.5	
	Sea Surface Salinity (Change in mean)	2.1	2.5	
	Sea Surface Salinity (Change in variability)	1.0	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.0	2.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	3.2	2.5	
	Dissolved oxygen (Change in variability)	1.0	2.5	
	Circulation	3.1	2.2	
	Sea level rise	4.0	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Laguna Madre Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.90), Site Fidelity (3.65), and Home Range (3.60).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in the Laguna Madre in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Individual bottlenose dolphins identified in Laguna Madre photo-identification surveys show some degree of site fidelity, however, effort is low and spatially concentrated and further research is needed in order to determine the number of individuals exhibiting year-round site fidelity for this stock. One case study (Texas Marine Mammal Stranding Network 2019, *unpublished data*) reported a dolphin calf that became injured in 2008, disentangled in 2009, and is regularly sighted in the lower Laguna Madre as recently as 2019, now with her own calf. Similar case studies exist for individual dolphins that have become stranded, released, and tagged in the Laguna Madre between 2003 and 2019. Other Gulf of Mexico bay, sound, and estuary stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay and Espiritu Santo Bay in Texas (Lynn and Würsig 2002), San Luis Pass in Texas (Maze and Würsig 1999; Irwin and Würsig 2004), Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021), Mississippi Sound (Hubard et al. 2004; Mackey 2010), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Sarasota Bay (Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017). Few studies have focused on the Laguna Madre and little is known about the site-fidelity of dolphins using the Laguna Madre. The results of several structured seasonal photo-ID surveys (Texas Marine Mammal Stranding Network 2018-19, *unpublished data*) and opportunistic observations during a dolphin disentanglement effort (Ronje et al. 2018) in the southern Laguna Madre indicate dolphin groups use the lower Laguna Madre area, primarily deeper channels and passes including the Brownsville Ship Channel, the Gulf Intracoastal Waterway, and the Brazos Santiago Pass. Dolphins travel through the Gulf inlet (Brazos-Santiago Pass) during flood tides and follow shrimp trawlers into waters well into the Brownsville Ship Channel to the Brownsville Fishing Harbor. Anecdotal reports suggest common bottlenose dolphins may travel between the Brazos-Santiago Pass and Port Mansfield, approximately 60 km north (Ronje et al. 2018). Additional photo-ID surveys reaching farther north into the Laguna Madre are needed to better understand dolphin movements in this area.

Stock Abundance

Blaylock and Boggard (1994) estimated abundance of this stock at 80 individuals (CV = 1.57). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Philips and Rosel (2014) reviewed the cumulative stressors influencing the Laguna Madre system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic. Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), habitat loss, and climate change (Philips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Sighting maps for this stock from July 2016 are presented in Ronje et al. (2018). Additional sighting data from December 2018 and August 2019 is available from the Texas Marine Mammal Stranding Network (TMMSN).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Ronje, E.I., H.R. Whitehead, S. Piwetz, and K.D. Mullin. 2018. Field summary for common bottlenose dolphin surveys on the Texas, Gulf of Mexico Coast, 2014–2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. NOAA Southeast Fisheries Science Center PRBD-2018-02. 31 p.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.8	2.2	
	Site Fidelity	3.4	2.5	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.2	
	Home Range	3.5	2.5	
	Stock Abundance	3.1	2.0	
	Stock Abundance Trend	2.0	1.8	
	Cumulative Stressors	2.8	2.8	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: High. Four sensitivity attributes scored greater than 3.0: Migration (3.85), Home Range (3.55), Site Fidelity (3.45), and Species Abundance (3.10).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Matagorda Bay, Tres Palacios Bay, Lavaca Bay, and smaller bays associated with Matagorda Bay in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Lynn and Würsig (2002) attached radio transmitters to dolphins near Port O'Connor, TX and recorded telemetry data that indicated dolphins have strong site fidelity to Matagorda Bay and Espiritu Santo Bay. Other Gulf of Mexico bay, sound, and estuary (BSE) stocks also show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Connor et al. 2000; Leatherwood 1977; Wells 2003; Wells and Scott 1999).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Urian et al. 1996; Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010, 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Takeshita et al. 2021).

Stock Abundance

Blaylock and Hoggard (1994) estimated this stock’s abundance at 61 individuals (CV=0.45). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Phillips and Rosel (2014) reviewed the cumulative stressors influencing the Matagorda Bay system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic.

Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), habitat loss, and climate change (Phillips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and

Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.
Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113
Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x
Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564
Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.
Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.
Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.
Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191
Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16
Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06
Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x
Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299
Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.
Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.
Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02
LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells, and E.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. Journal of Mammalogy 77(2):394–403. doi: 10.2307/1382814

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Mississippi River Delta Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.7	
	Habitat Specificity	3.7	2.0	
	Site Fidelity	3.7	2.0	
	Lifetime Reproductive Potential	1.3	2.0	
	Generation Length	2.5	2.3	
	Reproductive Plasticity	2.2	2.3	
	Migration	3.9	2.0	
	Home Range	3.4	2.0	
	Stock Abundance	3.0	2.7	
	Stock Abundance Trend	2.4	1.0	
	Cumulative Stressors	2.9	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	1.0	2.7	
	Sea Surface Salinity (Change in variability)	1.0	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.7	2.7	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/Mississippi River Delta Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.67).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.87), Habitat Specificity (3.67), and Site Fidelity (3.67).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in the Mississippi River Delta in the northern Gulf of Mexico along the Louisiana coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

Hayes et al. (2022) reported this stock's abundance estimate at 1,446 individuals (CV = 0.19) based on 2017 and 2018 surveys (Garrison et al. 2021). Hayes et al. (2019) reported this stock's abundance estimate at 332 individuals (CV = 0.93).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the Mississippi River Delta were likely exposed to high levels of oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from nearby Barataria Bay have shown persistent organic pollutant (POP) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Mississippi Sound, Lake Borgne, Bay Boudreau Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.2	
	Habitat Specificity	3.4	2.5	
	Site Fidelity	3.8	2.8	
	Lifetime Reproductive Potential	1.2	2.0	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.9	2.2	
	Migration	3.8	3.0	
	Home Range	3.2	3.0	
	Stock Abundance	2.2	3.0	
	Stock Abundance Trend	2.8	1.8	
	Cumulative Stressors	3.2	2.8	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	1.8	3.0	
	Sea Surface Salinity (Change in variability)	1.6	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.8	2.5	
	Sea level rise	3.5	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/Mississippi Sound, Lake Borgne, Bay Boudreau Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), Circulation (3.80), and Sea level rise (3.50).

Biological Sensitivity: High. Five sensitivity attributes scored greater than 3.0: Migration (3.80), Site Fidelity (3.75), Habitat Specificity (3.35), Cumulative Stressors (3.20), and Home Range (3.20).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Mississippi Sound, Lake Borgne, and Bay Boudreau in the northern Gulf of Mexico along the Louisiana, Mississippi, and Alabama coasts. It includes the adjacent Gulf coastal waters extending 1 km from the barrier islands and passes that bound the bays (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Studies in Mississippi Sound have suggested dolphins show a preference for specific habitats, such as mainland coasts, channels, or barrier islands, and environmental conditions, such as temperature and salinity (Hubard et al. 2004; Pitchford et al. 2016a, 2016b; Mullin et al. 2017). A study using satellite-linked telemetry suggested two different patterns of ranging (one around the barrier islands, another in inshore waters with seasonal use of the mid-portion of Mississippi Sound), representing different habitat use (Mullin et al. 2017). Mississippi Sound is an open embayment with large passes between the barrier islands, including two dredged shipping channels (Hayes et al. 2022).

Site Fidelity

In general, photo-ID studies within Mississippi Sound have resulted in low re-sighting rates of dolphins, and many animals sighted only one time (Hubard et al. 2004; Mackey 2010). However, long-term site fidelity has been shown by resightings of animals originally freeze-branded in 1982–1983 that were still present during studies in the 1990s and early 2000s (Hubard et al. 2004; Mackey 2010). Hubard et al. (2004) suggested some animals displayed spatial and/or temporal site fidelity patterns. Year-round residents, seasonal residents, and transients were all reported by Mackey (2010).

Other common bottlenose dolphin Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some area (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

During photo-ID studies conducted during 2004–2007 within Mississippi Sound, Mackey (2010) identified 687 dolphins, of which the majority, 498 (73.5%) were classified as transients. A smaller number, 70 (10%), were classified as year-round residents, and 109 (16%) were classified as seasonal residents. Bay, sound, and estuary stocks appear to be genetically distinct from other BSE populations adjacent coastal populations, continental shelf, and oceanic populations (Sellas et al. 2005; Vollmer 2011).

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019) and Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), in addition to Louisiana/Mississippi (Hubard et al. 2004; Mackey 2010; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021a, 2021b). A study using satellite-linked telemetry suggested two different patterns of ranging within Mississippi Sound: animals that ranged exclusively around the barrier islands, and those that ranged in inshore waters with seasonal use of the mid-portion of the sound (Mullin et al. 2017).

Stock Abundance

Garrison et al. (2021) estimated the abundance of this stock at 1,265 (CV=0.35) from winter 2018 aerial survey data. Previously, Mullin et al. (2017) estimated the abundance of this stock at 3,046 (95% CI: 2,702–3,293; CV=0.06) from January 2012 vessel-based capture-recapture photo-ID surveys.

Stock Abundance Trend

This stock was estimated to experience a 62% decline in population size due to the Deepwater Horizon oil spill (DWH MMIQT 2015; Schwacke et al. 2017). Using photo-identification data from 2011–June 2015, Samuelson et al. (2021) estimated the monthly population growth rate at 1.005 (95% CI: 0.998–1.013).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Mississippi Sound were exposed to high levels of oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from Mississippi Sound have shown persistent organic pollutant (POP) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 1996 Mississippi UME that was suspected to have been caused by brevetoxin (Litz et al. 2014).

Distribution and Sightings

Sighting maps and spatial density models for this stock are presented by Pitchford et al. (2016a, 2016b).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Cloyed, C.S., B.C. Balmer, L.H. Schwacke, R.S. Wells, E.J. Berens McCabe, A.A. Barleycorn, J.B. Allen, T.K. Rowles, C.R. Smith, R. Takeshita, F.I. Townsend, M.C. Tumlin, E.S. Zolman, and R.H. Carmichael. 2021a. Interaction between dietary and habitat niche breadth influences cetacean vulnerability to environmental disturbance. Ecosphere 12(9):e03759. doi: 10.1002/ecs2.3759

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021b. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Marine Mammai Injury Quantification Team (DWH MMIQT). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. 64 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pitchford, J.L., V.A. Howard, J.K. Shelley, B.J.S. Serafin, A.T. Coleman, and M. Solangi. 2016. Predictive spatial modelling of seasonal bottlenose dolphin (*Tursiops truncatus*) distributions in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 26(2):289–306. doi: 10.1002/aqc.2547

Pitchford, J.L., E.E. Pulis, K. Evans, J.K. Shelley, B.J.S. Serafin, and M. Solangi. 2016. Seasonal density estimates of *Tursiops truncatus* (bottlenose dolphin) in the Mississippi Sound from 2011 to 2013. Southeastern Naturalist 15(2):188–206. doi: 10.1656/058.015.0201

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Samuelson, M.M., M. Fujiwara, E.E. Pulis, J. Pitchford, V.A. Howard, and M. Solangi. 2021. Comprehensive evaluation of survival and population growth for common bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound, USA, following the Deepwater Horizon oil spill. Southeastern Naturalist 20(1):178–191. doi: 10.1656/058.020.0121

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin

(*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248
Vollmer, N.L. 2011. Population structure of common bottlenose dolphins in coastal and offshore waters of the Gulf of Mexico revealed by genetic and environmental analysis. University of Louisiana at Lafayette. Dissertation. 409 p.
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.
Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.
Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.
Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Mobile Bay, Bonsecour Bay Stock

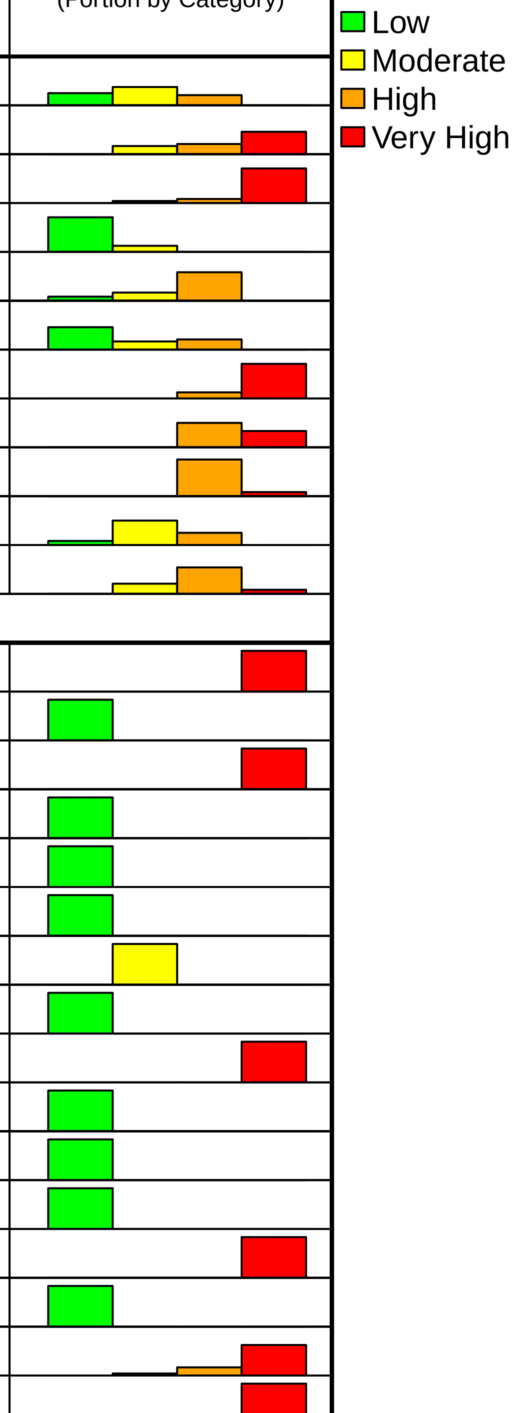
Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.2	
	Habitat Specificity	3.4	2.0	
	Site Fidelity	3.8	2.0	
	Lifetime Reproductive Potential	1.1	2.2	
	Generation Length	2.6	2.2	
	Reproductive Plasticity	1.7	1.8	
	Migration	3.8	2.2	
	Home Range	3.4	2.2	
	Stock Abundance	3.1	2.2	
	Stock Abundance Trend	2.2	1.2	
	Cumulative Stressors	2.8	2.0	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.7	2.2	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		



Common bottlenose dolphin (GoMx BSE/Mobile Bay, Bonsecour Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Circulation (3.7).

Biological Sensitivity: High. Five sensitivity attributes scored greater than 3.0: Migration (3.85), Site Fidelity (3.80), Home Range (3.40), Habitat Specificity (3.35), and Species Abundance (3.10).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Mobile Bay and Bonsecour Bay in the northern Gulf of Mexico along the Alabama coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021a, 2021b).

Stock Abundance

Blaylock and Hoggard (1994) estimated this stock's abundance at 122 individuals (CV= 0.34). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Mobile Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of

Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from the northern Gulf of Mexico have shown persistent organic pollutant (POP) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Cloyed, C.S., B.C. Balmer, L.H. Schwacke, R.S. Wells, E.J. Berens McCabe, A.A. Barleycorn, J.B. Allen, T.K. Rowles, C.R. Smith, R. Takeshita, F.I. Townsend, M.C. Tumlin, E.S. Zolman, and R.H. Carmichael. 2021a. Interaction between dietary and habitat niche breadth influences cetacean vulnerability to environmental disturbance. Ecosphere 12(9):e03759. doi: 10.1002/ecs2.3759

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021b. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*)

sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Nueces Bay, Corpus Christi Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.8	2.0	
	Site Fidelity	3.4	2.2	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.2	
	Home Range	3.5	2.5	
	Stock Abundance	3.0	1.8	
	Stock Abundance Trend	2.0	1.5	
	Cumulative Stressors	3.5	2.8	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	3.2	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.2	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/Nueces Bay, Corpus Christi Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), and Sea Surface Temperature (Standard anomaly) (3.85).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.85), Cumulative Stressors (3.55), and Home Range (3.50).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Nueces Bay and Corpus Christi Bay in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay and Espiritu Santo Bay in Texas (Lynn and Würsig 2002), San Luis Pass in Texas (Maze and Würsig 1999; Irwin and Würsig 2004), Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021), Mississippi Sound (Hubard et al. 2004; Mackey 2010), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), Tampa Bay (Wells et al. 1996b; Urian et al. 2009), and Charlotte Harbor and Pine Island Sound (Wells et al. 1996a; Wells et al. 1997; Bassos-Hull et al. 2013).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Connor et al. 2000; Leatherwood 1977; Wells 2003; Wells and Scott 1999).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Urian et al. 1996; Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; Mullin et al. 2017; Wells et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells et al. 2017), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002).

Stock Abundance

Blaylock and Hoggard (1994) estimated this stock’s abundance at 58 individuals (CV = 0.61). More recent estimates are unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Phillips and Rosel (2014) reviewed the cumulative stressors influencing the Nueces Bay and Corpus Christi Bay system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic. Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), habitat loss, and climate change (Phillips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In:

Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells, and E.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. Journal of Mammalogy 77(2):394–403. doi: 10.2307/1382814

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Pensacola Bay, East Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	3.7	2.3	
	Site Fidelity	3.9	2.3	
	Lifetime Reproductive Potential	1.2	2.0	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.4	2.0	
	Migration	3.7	2.3	
	Home Range	3.5	2.3	
	Stock Abundance	3.1	2.7	
	Stock Abundance Trend	2.2	1.7	
	Cumulative Stressors	3.6	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	2.0	2.7	
	Sea Surface Salinity (Change in variability)	1.3	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.9	1.7	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/Pensacola Bay, East Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: Very High. Five sensitivity attributes scored greater than 3.5: Site Fidelity (3.87), Migration (3.73), Habitat Specificity (3.67), Cumulative Stressors (3.60), and Home Range (3.53).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Pensacola Bay and East Bay in the northern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Toms (2019) reported that 70% of dolphins sighted during a capture-mark-recapture photo-ID study carried out over a 2.5 year period (June 2013 - January 2016) were seen more than once in the study area. In that study, 43% of all dolphins identified were seen in just one season and 30% of these were seen only once. 26% of dolphins sighted were seen across two seasons, 20% across three seasons, and 12% were seen in all four seasons.

Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf

sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

Blaylock and Hoggard (1994) estimated this stock’s abundance at 33 individuals (CV = 0.80). More recently, Toms (2019) completed a photo-ID mark-recapture analysis and estimated this stock’s abundance to be between 222 (95% CI: 173–286; Spring 2015) and 309 (95% CI: 211–453; Winter 2013/2014) individuals; 43% of individuals were considered to be transients.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Pensacola Bay and East Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from the northern Gulf of Mexico have shown persistent organic pollutants (POPs) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida waters (McCormack et al. 2020a, 2020b, 2022).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution

patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806
McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087
Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f
Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Perdido Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	3.7	2.2	
	Site Fidelity	3.9	2.2	
	Lifetime Reproductive Potential	1.2	2.0	
	Generation Length	2.8	2.0	
	Reproductive Plasticity	1.4	2.0	
	Migration	3.8	2.2	
	Home Range	3.5	2.0	
	Stock Abundance	3.1	2.0	
	Stock Abundance Trend	2.2	1.5	
	Cumulative Stressors	3.5	2.2	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	4.0	1.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Perdido Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.95).

Biological Sensitivity: Very High. Five sensitivity attributes scored greater than or equal to 3.5: Site Fidelity (3.90), Migration (3.80), Habitat Specificity (3.70), Cumulative Stressors (3.55), and Home Range (3.50).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Perdido Bay in the northern Gulf of Mexico along the Alabama and Florida coasts (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson 2004).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Perdido Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from the northern Gulf of Mexico have shown persistent organic pollutants (POPs) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in waters along the Florida panhandle (McCormack et al. 2020a, 2020b, 2022).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*)

sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.3	
	Habitat Specificity	3.7	2.3	
	Site Fidelity	3.9	3.0	
	Lifetime Reproductive Potential	1.9	2.3	
	Generation Length	2.8	2.3	
	Reproductive Plasticity	1.4	2.3	
	Migration	3.9	2.7	
	Home Range	3.8	3.0	
	Stock Abundance	2.9	2.7	
	Stock Abundance Trend	2.1	1.3	
	Cumulative Stressors	3.7	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.7	
	Sea Surface Temperature (Change in variability)	1.1	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.1	2.7	
	Precipitation (Change in mean)	1.1	2.7	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	1.7	2.7	
	Sea Surface Salinity (Change in variability)	1.5	2.7	
	Ocean pH (Change in mean)	3.9	2.7	
	Ocean pH (Change in variability)	1.1	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	2.7	
	Dissolved oxygen (Change in variability)	1.1	2.7	
	Circulation	3.9	3.0	
	Sea level rise	3.9	2.7	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (3.93), Dissolved oxygen (Standard anomaly) (3.93), Ocean pH (Standard anomaly) (3.93), Sea level rise (3.93), Sea Surface Temperature (Standard anomaly) (3.93), and Circulation (3.87).

Biological Sensitivity: Very High. Five sensitivity attributes scored greater than 3.5: Migration (3.93), Site Fidelity (3.93), Home Range (3.80), Cumulative Stressors (3.67), and Habitat Specificity (3.67).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Pine Island Sound, Charlotte Harbor, Gasparilla Sound, and Lemon Bay in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Strong multi-year, year-round site fidelity has been demonstrated for bottlenose dolphins in this region (Wells et al. 1996a; Wells et al. 1997; Bassos-Hull et al. 2013). Other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021).

Stock Abundance

Bassos-Hull et al. (2013) estimated this stock's abundance at 826 individuals (CV = 0.09).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Adimey et al. 2014; McHugh et al. 2021), vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutants (POPs) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Adimey, N.M., C.A. Hudak, J.R. Powell, K. Bassos-Hull, A. Foley, N.A. Farmer, L. White, and K. Minch. 2014. Fishery gear interactions from stranded bottlenose dolphins, Florida manatees and sea turtles in Florida, U.S.A. Marine Pollution Bulletin 81(1):103–115. doi: 10.1016/j.marpolbul.2014.02.008

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806
McHugh, K.A., A.A. Barleycorn, J.B. Allen, K. Bassos-Hull, G. Lovewell, D. Boyd, A. Panike, C. Cush, D. Fauquier, B. Mase, R.C. Lacy, M.R. Greenfield, D.I. Rubenstein, A. Weaver, A. Stone, L. Oliver, K. Morse, and R.S. Wells. 2021. Staying alive: Long-term success of bottlenose dolphin interventions in southwest Florida. Frontiers in Marine Science 7:624729. doi: 10.3389/fmars.2020.624729
McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.
Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7
Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165
Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Sabine Lake Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.5	2.0	
	Site Fidelity	3.4	2.5	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.8	2.5	
	Home Range	3.5	2.5	
	Stock Abundance	3.8	2.0	
	Stock Abundance Trend	2.0	1.5	
	Cumulative Stressors	3.2	2.5	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Sabine Lake Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than or equal to 3.5: Migration (3.85), Species Abundance (3.75), and Home Range (3.50).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Sabine Lake in the northwest Gulf of Mexico along the Texas and Louisiana coasts (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The primary source of freshwater into Sabine Lake is the Neches and Sabine rivers, and their water flow is regulated by upstream hydroelectric dams that contribute to seasonal fluctuations in the surface salinity of the Sabine Lake area. The Sabine Lake estuary has been extensively modified with deep engineered channels to accommodate large vessels en route to Port Arthur and Beaumont, TX.

The engineered channels removed previous restrictions to Gulf tidal influx, and as a result the salinity in the channels is highly stratified (Ward 1980).

Site Fidelity

Preliminary data from photo-ID mark-recapture surveys suggests there may be common bottlenose dolphins with site-fidelity to Sabine Lake (Ronje et al. 2020a). Dolphins were also found to use the Gulf waters near the end of and adjacent to the Sabine Pass Channel, particularly during the winter season (Ronje et al. 2020b), possibly because Sabine Lake salinity is typically lowest in winter (Orlando et al. 1993). Few surveys have been conducted in Sabine Lake and more research needs to be conducted to better describe the site fidelity of common bottlenose dolphins to the Sabine Lake area. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay in Florida (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Ronje et al. (2020b) photo-identified 25 apparently transient individuals that were observed in both the Sabine Lake and Galveston Bay stock areas, a distance of approximately 90 km to the Gulf pass of each bay. Some individuals observed in Sabine Lake were also observed well into the Galveston Bay estuary, including upper Bay and the western side of Trinity Bay (Ronje et al. 2020b). It is not known if those individuals are transients or were seasonally migrating.

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017). Photo-identified individuals observed in both winter and summer seasons in Sabine Lake were found to range at the extreme north and south margins of the Sabine Lake estuary (including the Neches and Sabine Rivers at the north end), and anecdotal reports suggest dolphins range as far west as Beaumont, TX (Ronje et al. 2020b) but more data on individual site-fidelity needs to be collected to better assess the home range of resident individuals.

Stock Abundance

Ronje et al. (2020b) used photo-ID mark-recapture encounter histories to estimate abundance of this stock. By including all distinctive individuals observed in the bay or Gulf pass to the bay in ≥ 1 season plus individuals observed in coastal waters during both summer and winter seasons (but not observed in other survey areas), Ronje et al. (2020b) estimated the common bottlenose dolphin population of Sabine Lake to be 121.6 individuals (95% CI=73.0–170.3) in the winter and 162.2 individuals (95% CI=114.3–210.2) in the summer.

Stock Abundance Trend

Data are insufficient to complete a trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Phillips and Rosel (2014) reviewed the cumulative stressors influencing the Sabine Lake system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic. Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), habitat loss, and climate change (Phillips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). This stock was also within the range of the 2007 UME in which 66 common bottlenose dolphins stranded in northeast Texas and west Louisiana due to an undetermined cause (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Sighting maps for this stock are presented in Ronje et al. (2020b).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. doi: 10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Orlando, S.P.J., L.P. Rozas, G.H. Ward, and C.J. Klein. 1993. Salinity characteristics of Gulf of Mexico estuaries. NOAA's National Estuarine Inventory Series. National Oceanic and Atmospheric Administration, Office of Ocean Resources Conservation and Assessment: Silver Spring, MD. 209 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Ronje, E., S. Piwetz, H. Whitehead, and K.D. Mullin. 2020. Intraspecific aggression towards common bottlenose dolphin calves, Northern Gulf of Mexico. Gulf and Caribbean Research 31:SC6–SC12. doi: 10.18785/gcr.3101.07

Ronje, E., H. Whitehead, K. Barry, S. Piwetz, J. Struve, V. Lecours, L. Garrison, R.S. Wells, and K.D. Mullin. 2020. Abundance and occurrence of common bottlenose dolphins (*Tursiops truncatus*) in three estuaries of the northwestern Gulf of Mexico. Gulf and Caribbean Research 31:18–34. doi: 10.18785/gcr.3101.09

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Ward, G.H. 1980. Hydrography and circulation processes of Gulf estuaries. In: Hamilton, P. and K.B. Macdonald (Eds.), Estuarine and Wetland Processes, Marine Science Book Series. Vol. 11. Springer Science+Business Media, New York, NY. p. 183—215. doi: 10.1007/978—1—4757—5177—2

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus* GoMx

BSE/Sarasota Bay, Little Sarasota Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 100% of scores≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	3.0	
	Habitat Specificity	3.9	3.0	
	Site Fidelity	4.0	3.0	
	Lifetime Reproductive Potential	1.5	3.0	
	Generation Length	3.0	3.0	
	Reproductive Plasticity	1.3	3.0	
	Migration	4.0	3.0	
	Home Range	3.5	3.0	
	Stock Abundance	3.0	3.0	
	Stock Abundance Trend	2.0	2.7	
	Cumulative Stressors	3.7	3.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	1.4	3.0	
	Sea Surface Salinity (Change in variability)	2.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.9	2.3	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Sarasota Bay, Little Sarasota Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Migration (4.00), Site Fidelity (4.00), Habitat Specificity (3.87), and Cumulative Stressors (3.67).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 100% of the data quality scores were 2 or greater, 100 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Sarasota Bay and Little Sarasota Bay along the Gulf of Mexico coast of Florida (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021) and individuals of this stock have been found to have a flexible diet consisting primarily of fish (Cloyed et al. 2021a). In Sarasota Bay, FL, Rossman et al. (2015a, 2015b) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Strong site fidelity was first defined for common bottlenose dolphins based on research initiated on this stock in 1970 (Irvine and Wells 1972; Irvine et al. 1981; Wells 2014). The dolphins of this stock are year-round, multi-decadal, multi-generational residents of the inshore waters from southern Tampa Bay to Venice Inlet (Wells 2014).

Other Gulf of Mexico bay, sound, and estuary (BSE) stocks also show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay and Espiritu Santo Bay in Texas (Lynn and Würsig 2002), San Luis Pass in Texas (Maze and Würsig 1999; Irwin and Würsig 2004), Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021), Mississippi Sound (Hubard et al. 2004; Mackey 2010), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), Tampa Bay (Wells et al. 1996b; Urian et al. 2009), and Charlotte Harbor and Pine Island Sound (Wells et al. 1996a; Wells et al. 1997; Bassos-Hull et al. 2013).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6-21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Urian et al. 1996; Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary (BSE) stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Balmer et al. 2008; Bassos-Hull et al. 2013; Irvine and Wells 1972; Irvine et al. 1981; Scott et al. 1990; Tyson et al. 2011; Urian et al. 2009; Wells 1986; Wells 1991; Wells 2003; Wells et al. 1987; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997), Texas (Bräger 1993; Bräger et al. 1994; Fertl 1994; Irwin and Würsig 2004; Lynn and Würsig 2002; Maze and Würsig 1999; Shane 1990; Shane 2004; Weller 1998), and Louisiana/Mississippi (Hubard et al. 2004; Wells et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Cloyed et al. 2021b).

Stock Abundance

Tyson and Wells (2016) estimated this stock's abundance at 158 individuals (CV = 0.27).

Stock Abundance Trend

The bottlenose dolphins of Sarasota Bay have increased in abundance since an initial estimate of 102 dolphins (95% CI = 90–117) in 1976 (Irvine et al. 1981), and a subsequent estimate of 98 (95% CI = 89–108) in 1983 (Wells 1986), to the 2015 estimate of 158 dolphins (Tyson and Wells 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation (Wilkinson et al. 2017), harmful algal blooms (Fire et al. 2007, 2008a, 2008b, 2021; McHugh et al. 2011; Twiner et al. 2011), recreational and commercial fishing gear (Powell and Wells 2011), vessel traffic, pollution, habitat alteration, and provisioning (Christiansen et al. 2016). Common bottlenose dolphins in the Sarasota Bay, Little Sarasota Bay Stock interact with the stone crab trap/pot fisheries (86 FR 3028, January 14, 2021).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from Sarasota Bay have shown persistent organic pollutants (POPs) in blubber and blood samples (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Sarasota Bay and Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022). Other compounds such as perfluoroalkyl phosphinic acids (PFPIAs), perfluoroalkyl carboxylates (PFCAs), perfluoroalkanesulfonates (PFSAs), and phthalates have been found in individuals of this stock (Houde et al. 2005, 2006; De Silva et al. 2016; Hart et al. 2018; Dziobak et al. 2021).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin and the 1991 Sarasota UME suspected to have been caused by biotoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Christiansen, F., K.A. McHugh, L. Bejder, E.M. Siegal, D. Lusseau, E.B. McCabe, G. Lovewell, and R.S. Wells. 2016. Food provisioning increases the risk of injury in a long-lived marine top predator. Royal Society Open Science 3(12):160560. doi: 10.1098/rsos.160560

Cloyed, C.S., B.C. Balmer, L.H. Schwacke, R.S. Wells, E.J. Berens McCabe, A.A. Barleycorn, J.B. Allen, T.K. Rowles, C.R. Smith, R. Takeshita, F.I. Townsend, M.C. Tumlin, E.S. Zolman, and R.H. Carmichael. 2021a. Interaction between dietary and habitat niche breadth influences cetacean vulnerability to environmental disturbance. Ecosphere 12(9):e03759. doi: 10.1002/ecs2.3759

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021b. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

De Silva, A.O., C. Spencer, K.C. Ho, M. Al Tarhuni, C. Go, M. Houde, S.R. de Solla, R.A. Lavoie, L.E. King, D.C. Muir, P.A. Fair, R.S. Wells, and G.D. Bossart. 2016. Perfluoroalkylphosphinic acids in northern pike (*Esox lucius*), double-crested cormorants (*Phalacrocorax auritus*), and bottlenose dolphins (*Tursiops truncatus*) in relation to other perfluoroalkyl acids. Environmental Science & Technology 50(20):10903–10913. doi: 10.1021/acs.est.6b03515

Dziobak, M.K., R.S. Wells, E.C. Pisarski, E.F. Wirth, and L.B. Hart. 2021. Demographic Assessment of Mono(2-ethylhexyl) Phthalate (MEHP) and Monoethyl Phthalate (MEP) Concentrations in Common Bottlenose Dolphins (*Tursiops truncatus*) From Sarasota Bay, FL, USA. Geohealth 5(5):e2020GH000348. doi: 10.1029/2020GH000348

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fire, S.E., D. Fauquier, L.J. Flewelling, M. Henry, J. Naar, R. Pierce, and R.S. Wells. 2007. Brevetoxin exposure in bottlenose dolphins (*Tursiops truncatus*) associated with *Karenia brevis* blooms in Sarasota Bay, Florida. Marine Biology 152(4):827–834. doi: 10.1007/s00227-007-0733-x

Fire, S.E., L.J. Flewelling, J. Naar, M.J. Twiner, M.S. Henry, R.H. Pierce, D.P. Gannon, Z.H. Wang, L. Davidson, and R.S. Wells. 2008a. Prevalence of brevetoxins in prey fish of bottlenose dolphins in Sarasota Bay, Florida. Marine Ecology Progress Series 368:283–294. doi: 10.3354/meps07643

Fire, S.E., L.J. Flewelling, Z.H. Wang, J. Naar, M.S. Henry, R.H. Pierce, and R.S. Wells. 2008b. Florida red tide and brevetoxins: Association and exposure in live resident bottlenose dolphins (*Tursiops truncatus*) in the eastern Gulf of Mexico, USA. Marine Mammal Science 24(4):831–844. doi: 10.1111/j.1748-7692.2008.00221.x

Fire, S.E., G.A. Miller, E.R. Sabater, and R.S. Wells. 2021. Utility of red tide (*Karenia brevis*) monitoring data as a predictive tool to estimate brevetoxin accumulation in live, free-ranging marine mammals. Frontiers in Marine Science 8:611310. doi: 10.3389/fmars.2021.611310

Hart, L.B., B. Beckingham, R.S. Wells, M. Alten Flagg, K. Wischusen, A. Moors, J. Kucklick, E. Pisarski, and E. Wirth. 2018. Urinary phthalate metabolites in common bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL, USA. Geohealth 2(10):313–326. doi: 10.1029/2018GH000146

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Houde, M., T.A. Bujas, J. Small, R.S. Wells, P.A. Fair, G.D. Bossart, K.R. Solomon, and D.C. Muir. 2006. Biomagnification of perfluoroalkyl compounds in the bottlenose dolphin (*Tursiops truncatus*) food web. Environmental Science & Technology 40(13):4138–4144. doi: 10.1021/es060233b

Houde, M., R.S. Wells, P.A. Fair, G.D. Bossart, A.A. Hohn, T.K. Rowles, J.C. Sweeney, K.R. Solomon, and D.C.G. Muir. 2005. Polyfluoroalkyl compounds in free-ranging bottlenose dolphins (*Tursiops truncatus*) from the Gulf of Mexico and the Atlantic Ocean. Environmental Science & Technology 39(17):6591–6598. doi: 10.1021/es0506556

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McHugh, K.A., J.B. Allen, A.A. Barleycorn, and R.S. Wells. 2011. Severe *Karenia brevis* red tides influence juvenile bottlenose dolphin (*Tursiops truncatus*) behavior in Sarasota Bay, Florida. Marine Mammal Science 27(3):622–643. doi: 10.1111/j.1748-7692.2010.00428.x

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Powell, J.R. and R.S. Wells. 2011. Recreational fishing depredation and associated behaviors involving common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Mammal Science 27(1):111–129. doi: 10.1111/j.1748-7692.2010.00401.x

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., E. Berens McCabe, N.B. Barros, H. Gandhi, P.H. Ostrom, C.A. Stricker, and R.S. Wells. 2015. Foraging habits in a generalist predator: Sex and age influence habitat selection and resource use among bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 31(1):155–168. doi: 10.1111/mms.12143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity

exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Twiner, M.J., S. Fire, L. Schwacke, L. Davidson, Z. Wang, S. Morton, S. Roth, B. Balmer, T.K. Rowles, and R.S. Wells. 2011. Concurrent exposure of bottlenose dolphins (*Tursiops truncatus*) to multiple algal toxins in Sarasota Bay, Florida, USA. PLoS ONE 6(3):e17394. doi: 10.1371/journal.pone.0017394
Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292
Tyson, R.B. and R.S. Wells. 2016. Sarasota Bay/Little Sarasota Bay bottlenose dolphin abundance estimates: 2015. Prepared for National Marine Fisheries Service northern Gulf of Mexico bay, sound and estuary bottlenose dolphin stock Blocks B20 and B35, combined. Southeast Fisheries Science Center Reference Document PRBD-2016-02. 22 p. doi: 10.7289/V5/RD-PRBD-2016-02
Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells, and E.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. Journal of Mammalogy 77(2):394–403. doi: 10.2307/1382814
Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.
Wells, R.S. 1986. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops aduncus*. Indo-Pacific bottlenose. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals, Third Edition. Academic Press, London, UK. pp. 125–130.

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilkinson, K.A., R.S. Wells, W.E. Pine, and R.R. Borkhataria. 2017. Shark bite scar frequency in resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Mammal Science 33(2):678–686. doi: 10.1111/mms.12385

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/St. Andrew Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	3.7	2.0	
	Site Fidelity	3.8	2.3	
	Lifetime Reproductive Potential	1.2	2.0	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.4	2.0	
	Migration	3.7	2.3	
	Home Range	3.4	2.0	
	Stock Abundance	3.1	2.3	
	Stock Abundance Trend	2.2	1.7	
	Cumulative Stressors	3.6	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.0	3.0	
	Sea Surface Salinity (Change in variability)	1.8	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.9	1.7	
	Sea level rise	3.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/St. Andrew Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Site Fidelity (3.80), Migration (3.73), Habitat Specificity (3.67), and Cumulative Stressors (3.60).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in St. Andrew Bay in the northeast Gulf of Mexico along the Florida coast (Hayes et al. 2020).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Studies from St. Andrew Bay suggest common bottlenose dolphins in this stock show site fidelity (Bouveroux et al. 2014; Balmer et al. 2019a).

Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks also show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019a; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019a), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021). Balmer et al. (2019a) found few dolphins sighted in both St. Andrew Bay and along coastal waters, suggesting there may be minimal overlap between the St. Andrew Bay stock and the Northern Coastal stock.

Stock Abundance

Balmer et al. (2019) completed a photo-ID mark-recapture analysis between 2015 and 2016 and estimated this stock's abundance to be lowest in April 2016 (199 individuals; 95% CI 173–246), and highest in October 2016 (315 individuals; 95% CI 274–378). Previously, Blaylock and Hoggard (1994) estimated this stock's abundance at 124 individuals (CV = 0.57). Bouveroux et al. (2014) used robust design photo-ID mark-recapture models between March 2004 - July 2007 and found that seasonal abundance estimates ranged from 89 (CI 95%= 71–161) to 183 (CI 95%= 169–208) dolphins, even though 263 distinctive dolphins were identified during the study.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2020).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Twiner et al. 2012), recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies have shown persistent organic pollutants (POPs) in tissues of common bottlenose dolphins from St. Andrew Bay (Wilson et al. 2012; Balmer et al. 2019b) and other Florida Gulf Coast waters (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

Common bottlenose dolphins in St. Andrew Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B., G. Ylitalo, S. Watwood, B. Quigley, J. Bolton, K. Mullin, P. Rosel, T. Rowles, T. Speakman, L. Wilcox, E. Zolman, and L. Schwacke. 2019. Comparison of persistent organic pollutants (POPs) between small cetaceans in coastal and estuarine waters of the northern Gulf of Mexico. Marine Pollution Bulletin 145:239–247. doi: 10.1016/j.marpolbul.2019.05.017

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Blaylock, R.A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-356. 10 p.

Bouveroux, T., R.B. Tyson, and D.P. Nowacek. 2014. Abundance and site fidelity of bottlenose dolphins in coastal waters near Panama City, Florida. Journal of Cetacean Research and Management 14:37–42. doi: 10.47536/jcrm.v14i1.521

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/St. Joseph Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	3.5	2.0	
	Site Fidelity	3.9	3.0	
	Lifetime Reproductive Potential	1.3	2.0	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.3	2.0	
	Migration	3.8	3.0	
	Home Range	3.6	2.7	
	Stock Abundance	3.0	3.0	
	Stock Abundance Trend	2.1	1.7	
	Cumulative Stressors	3.3	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.0	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.9	1.3	
	Sea level rise	3.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/St. Joseph Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Site Fidelity (3.93), Migration (3.80), and Home Range (3.60).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in St. Joseph Bay, Crooked Island Sound and coastal waters out to 2 km from shore along St. Joseph Peninsula and Crooked Island in the northeast Gulf of Mexico along the Florida coast (Hayes et al. 2020).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Studies from St. Joseph Bay suggest common bottlenose dolphins in this stock show site fidelity (Balmer et al. 2008; Balmer et al. 2018).

Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks also show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); and Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021).

Stock Abundance

Balmer et al. (2018) estimated the abundance of this stock at 142 individuals (95% CI: 92–190; CV=0.17), based on a February 2011 vessel-based capture-recapture photo-ID survey.

Stock Abundance Trend

There is no evidence of a trend in this stock's abundance based on estimates from February/March 2005, February 2006, and February 2011 (Balmer et al. 2018; Hayes et al. 2020).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Schwacke et al. 2010; Twiner et al. 2012), recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies have shown persistent organic pollutants (POPs) in tissues of common bottlenose dolphins from St. Joseph Bay (Yordy et al. 2010a; Wilson et al. 2012; Balmer et al. 2015) and other Florida Gulf Coast waters (Yordy et al. 2010b, 2010c; Kucklick et al. 2011; Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

Common bottlenose dolphins in St. Joseph Bay were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern

Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Schwacke, L.H., M.J. Twiner, S. De Guise, B.C. Balmer, R.S. Wells, F.I. Townsend, D.C. Rotstein, R.A. Varela, L.J. Hansen, E.S. Zolman, T.R. Spradlin, M. Levin, H. Leibrecht, Z. Wang, and T.K. Rowles. 2010. Eosinophilia and biotoxin exposure in bottlenose dolphins (*Tursiops truncatus*) from a coastal area impacted by repeated mortality events. Environmental Research 110(6):548–555. doi: 10.1016/j.envres.2010.05.003

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries

Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235
Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2
Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279
Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152
Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/St. Joseph Sound, Clearwater Harbor Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.2	
	Habitat Specificity	3.7	2.2	
	Site Fidelity	3.8	2.0	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.4	2.2	
	Migration	3.8	2.2	
	Home Range	3.5	2.2	
	Stock Abundance	3.1	1.5	
	Stock Abundance Trend	2.2	1.5	
	Cumulative Stressors	3.5	2.2	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.0	2.5	
	Sea Surface Salinity (Change in mean)	1.0	2.5	
	Sea Surface Salinity (Change in variability)	2.0	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.0	2.5	
	Sea ice coverage (Change in mean)	1.0	2.3	
	Sea ice coverage (Change in variability)	1.0	2.3	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.0	2.5	
	Circulation	3.9	2.2	
	Sea level rise	4.0	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/St. Joseph Sound, Clearwater Harbor Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Circulation (3.9).

Biological Sensitivity: Very High. Five sensitivity attributes scored greater than 3.5: Migration (3.85), Site Fidelity (3.85), Habitat Specificity (3.70), Cumulative Stressors (3.55), and Home Range (3.55).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in St. Joseph Sound and Clearwater Harbor in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2019).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); and Mississippi Sound in Mississippi/Louisiana (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2019).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2019).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (McHugh et al. 2021), vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from Florida Gulf Coast waters have shown persistent organic pollutants (POPs) in blubber and blood samples (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. doi: doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806
McHugh, K.A., A.A. Barleycorn, J.B. Allen, K. Bassos-Hull, G. Lovewell, D. Boyd, A. Panike, C. Cush, D. Fauquier, B. Mase, R.C. Lacy, M.R. Greenfield, D.I. Rubenstein, A. Weaver, A. Stone, L. Oliver, K. Morse, and R.S. Wells. 2021. Staying alive: Long-term success of bottlenose dolphin interventions in southwest Florida. Frontiers in Marine Science 7:624729. doi: 10.3389/fmars.2020.624729
McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.
Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.
Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/St. Vincent Sound, Apalachicola Bay, St. George Sound Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	3.6	2.2	
	Site Fidelity	3.8	2.5	
	Lifetime Reproductive Potential	1.2	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.6	2.2	
	Migration	3.6	2.2	
	Home Range	3.4	2.2	
	Stock Abundance	3.0	2.2	
	Stock Abundance Trend	2.2	1.2	
	Cumulative Stressors	3.6	2.2	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.2	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	1.8	
	Sea level rise	3.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/St. Vincent Sound, Apalachicola Bay, St. George Sound Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Site Fidelity (3.75), Habitat Specificity (3.65), Migration (3.65), and Cumulative Stressors (3.60).

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in St. Vincent Sound, Apalachicola Bay, and St. George Sound in the northeast Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Studies from St. Vincent Sound and Apalachicola Bay suggest common bottlenose dolphins in this stock show site fidelity (Tyson et al. 2011).

Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks also show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019a), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017); and Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017; Takeshita et al. 2021).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson 2004).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019a; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019a), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017). Stable isotope data suggests individuals in St. George Sound maintain a restricted home range (Wilson et al. 2013).

Stock Abundance

Tyson et al. (2011) found that two parapatric dolphin communities exist in the waters stretching from St. Vincent Sound to Alligator Harbor, with the eastern community (inhabiting St. George Sound and Alligator Harbor) supporting a more transient population than the western community (inhabiting St. Vincent Sound and Apalachicola Bay). Independent estimates of abundance were calculated using the Chapman modification of the Lincoln-Petersen method for June 2007 and for January and February 2008 for the eastern area (242 individuals [141−343], 395 individuals [273−516]) and for the western survey area (197 individuals [130−264], 111 individuals [71−150]), respectively. However, given these communities are still considered a single stock, their abundance estimate is considered the sum of the June 2007 estimates (439 individuals; CV=0.14; Tyson et al. 2011; Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Twiner et al. 2012), recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies have shown persistent organic pollutants (POPs) in tissues of common bottlenose dolphins from the Florida Panhandle (Wilson et al. 2012; Balmer et al. 2019b) and other Florida Gulf Coast waters (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

Common bottlenose dolphins in this stock were possibly exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

UMEs have been declared for common bottlenose dolphins in waters of the Florida panhandle with biotoxins (e.g., brevetoxin from *Karenia brevis*) the suspected or confirmed cause (Twiner et al. 2012; Litz et al. 2014). Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B., G. Ylitalo, S. Watwood, B. Quigley, J. Bolton, K. Mullin, P. Rosel, T. Rowles, T. Speakman, L. Wilcox, E. Zolman, and L. Schwacke. 2019. Comparison of persistent organic pollutants (POPs) between small cetaceans in coastal and estuarine waters of the northern Gulf of Mexico. Marine Pollution Bulletin 145:239–247. doi: 10.1016/j.marpolbul.2019.05.017

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean

Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Twiner, M.J., L.J. Flewelling, S.E. Fire, S.R. Bowen-Stevens, J.K. Gaydos, C.K. Johnson, J.H. Landsberg, T.A. Leighfield, B. Mase-Guthrie, L. Schwacke, F.M. Van Dolah, Z. Wang, and T.K. Rowles. 2012. Comparative analysis of three brevetoxin-associated bottlenose dolphin (*Tursiops truncatus*) mortality events in the Florida Panhandle region (USA). PLoS ONE 7(8):e42974. doi: 10.1371/journal.pone.0042974

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., J.A. Nelson, B.C. Balmer, D.P. Nowacek, and J.P. Chanton. 2013. Stable isotope variation in the northern Gulf of Mexico constrains bottlenose dolphin (*Tursiops truncatus*) foraging ranges. Marine Biology 160(11):2967–2980. doi: 10.1007/s00227-013-2287-4

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose

dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152
Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Tampa Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	2.3	
	Habitat Specificity	3.7	3.0	
	Site Fidelity	3.9	3.0	
	Lifetime Reproductive Potential	1.6	2.3	
	Generation Length	2.9	2.7	
	Reproductive Plasticity	1.5	2.3	
	Migration	3.9	3.0	
	Home Range	3.7	3.0	
	Stock Abundance	3.0	1.7	
	Stock Abundance Trend	2.1	1.3	
	Cumulative Stressors	3.7	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	1.0	3.0	
	Sea Surface Salinity (Change in variability)	2.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.9	2.7	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Tampa Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: Very High. Five sensitivity attributes scored greater than or equal to 3.5: Migration (3.93), Site Fidelity (3.93), Habitat Specificity (3.73), Cumulative Stressors (3.67), and Home Range (3.67)

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Tampa Bay in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Bottlenose dolphins in Tampa Bay have been shown to demonstrate strong site fidelity (Wells et al. 1996; Urian et al. 2009). Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), and St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017); and Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017; Takeshita et al. 2021).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017; Cloyed et al. 2021).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (McHugh et al. 2021), vessel traffic (MacQueeney et al. 2022), pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from nearby Sarasota Bay have shown persistent organic pollutants (POPs) in blubber and blood samples (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in

Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to

natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Cloyed, C.S., R.M. Wilson, B.C. Balmer, A.A. Hohn, L.H. Schwacke, E.S. Zolman, M.C. Tumlin, R.S. Wells, A.A. Barleycorn, J.B. Allen, and R.H. Carmichael. 2021. Specialization of a mobile, apex predator affects trophic coupling among adjacent habitats. Scientific Reports 11(1):19611. doi: 10.1038/s41598-021-99017-1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

MacQueeney, M., M.A.M. Collier, P. Simard, and S. Gowans. 2021. Characterizing human interactions with bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay. Human Dimensions of Wildlife 27(4):397–406. doi: 10.1080/10871209.2021.1950241

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, K.A., A.A. Barleycorn, J.B. Allen, K. Bassos-Hull, G. Lovewell, D. Boyd, A. Panike, C. Cush, D. Fauquier, B. Mase, R.C. Lacy, M.R. Greenfield, D.I. Rubenstein, A. Weaver, A. Stone, L. Oliver, K. Morse, and R.S. Wells. 2021. Staying alive: Long-term success of bottlenose dolphin interventions in southwest Florida. Frontiers in Marine Science 7:624729. doi: 10.3389/fmars.2020.624729

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Terrebonne Bay, Timbalier Bay Stock

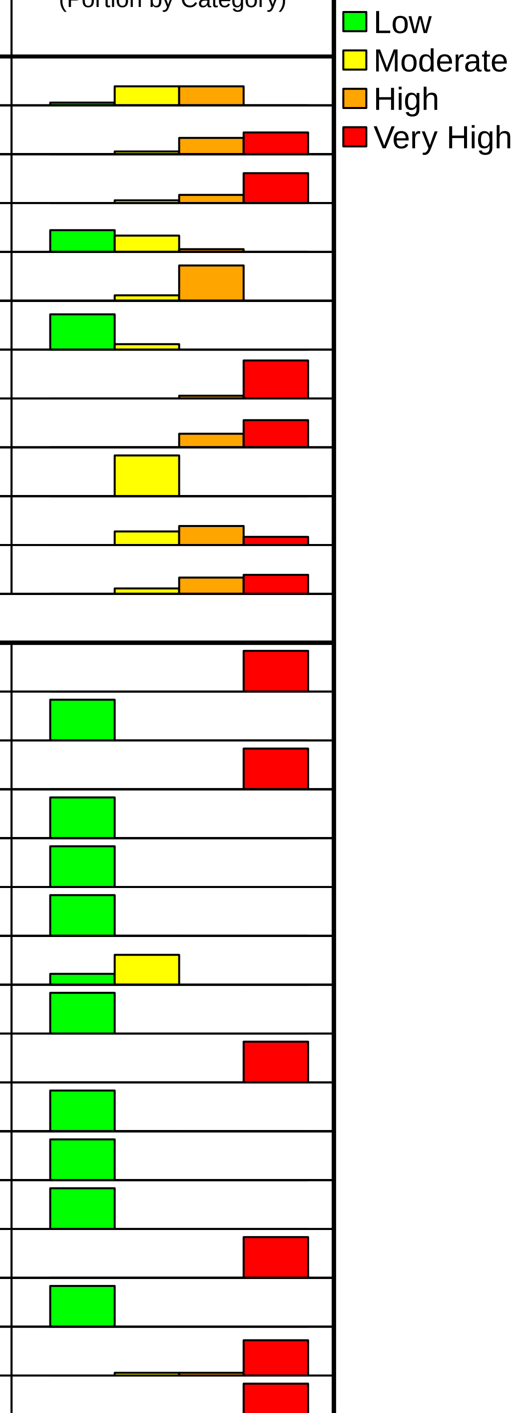
Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.3	
	Habitat Specificity	3.5	1.7	
	Site Fidelity	3.7	2.0	
	Lifetime Reproductive Potential	1.5	1.7	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.1	2.0	
	Migration	3.9	2.0	
	Home Range	3.7	2.0	
	Stock Abundance	2.0	2.7	
	Stock Abundance Trend	2.9	1.0	
	Cumulative Stressors	3.3	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	1.7	2.7	
	Sea Surface Salinity (Change in variability)	1.0	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.8	2.0	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		



Common bottlenose dolphin (GoMx BSE/Terrebonne Bay, Timbalier Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.80).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.93), Home Range (3.67), and Site Fidelity (3.67).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 89% of the data quality scores were 2 or greater, 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in estuarine waters from Bay Junop to Bayou LaFourche, including Bay Junop, Caillou Lake, Lake Pelto, Terrebonne Bay, Lake Barre, Lake Felicity, Timbalier Bay, and Lake Raccourci, and adjacent waters out to 1 km from the barrier islands in the northern Gulf of Mexico along the Louisiana coast (Hayes et al. 2019).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf

sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

Litz et al. (2018) estimated this stock’s abundance at 3,870 (CV=0.15; 95% CI: 2934–5210), based on June 2016 vessel-based capture-recapture photo-ID surveys.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2019).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in this stock were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021;

Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from nearby Barataria Bay have shown persistent organic pollutants (POPs) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Sighting maps for this stock are presented by Mullin et al. (2018).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J., C. Sinclair, and L.P. Garrison. 2018. Terrebonne-Timbalier Bay, Louisiana, common bottlenose dolphin abundance estimate 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. SEFSC Report PRBD-2018-03. 9 p.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., K. Barry, T. McDonald, J. Morey, B. Quigley, E. Ronje, L. Schwacke, S. Carrie, T. Speakman, and J. Thompson. 2018. Assessment of the overlap of Terrebonne–Timbalier Bay and Bartaria Bay common bottlenose dolphin (*Tursiops truncatus*) stocks based on photo-identification of individual dolphins. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. NOAA Technical Memorandum NMFS-SEFSC-729. 29 p. doi: 10.25923/8g4y-dg29

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	3.8	2.0	
	Site Fidelity	3.7	2.0	
	Lifetime Reproductive Potential	1.4	2.0	
	Generation Length	2.9	2.3	
	Reproductive Plasticity	1.3	2.0	
	Migration	3.9	2.0	
	Home Range	3.5	2.0	
	Stock Abundance	3.7	1.7	
	Stock Abundance Trend	2.3	1.0	
	Cumulative Stressors	2.7	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	1.2	2.7	
	Sea Surface Salinity (Change in variability)	1.0	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.8	1.7	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Circulation (3.8).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Migration (3.87), Habitat Specificity (3.80), Site Fidelity (3.73), and Species Abundance (3.67).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 89% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Vermilion Bay, West Cote Blanche Bay, and Atchafalaya Bay in the northern Gulf of Mexico along the Louisiana coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are able to adapt to a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in this stock were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from nearby Barataria Bay have shown persistent organic pollutants (POPs) in blubber and blood samples, though at concentrations lower than other southeastern U.S. sites (Kucklick et al. 2011; Balmer et al. 2015; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Louisiana waters, but in lower concentrations than common bottlenose dolphins found in Florida waters (McCormack et al. 2020a, 2020b, 2022).

Dolphin morbillivirus has been detected in populations of the northern Gulf of Mexico, but has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. doi: 10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Waccasassa Bay, Withlacoochee Bay, Crystal Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 78% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	3.6	2.0	
	Site Fidelity	3.7	1.7	
	Lifetime Reproductive Potential	1.3	2.3	
	Generation Length	2.9	2.3	
	Reproductive Plasticity	1.5	2.3	
	Migration	3.7	1.7	
	Home Range	3.4	1.7	
	Stock Abundance	3.1	1.7	
	Stock Abundance Trend	2.3	1.3	
	Cumulative Stressors	3.8	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.3	
	Sea Surface Temperature (Change in variability)	1.0	2.3	
	Air Temperature (Change in mean)	4.0	2.3	
	Air Temperature (Change in variability)	1.0	2.3	
	Precipitation (Change in mean)	1.0	2.3	
	Precipitation (Change in variability)	1.0	2.3	
	Sea Surface Salinity (Change in mean)	1.5	2.3	
	Sea Surface Salinity (Change in variability)	1.8	2.3	
	Ocean pH (Change in mean)	4.0	2.3	
	Ocean pH (Change in variability)	1.0	2.3	
	Sea ice coverage (Change in mean)	1.0	2.3	
	Sea ice coverage (Change in variability)	1.0	2.3	
	Dissolved oxygen (Change in mean)	4.0	2.3	
	Dissolved oxygen (Change in variability)	1.0	2.3	
	Circulation	3.7	1.7	
	Sea level rise	4.0	2.3	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Waccasassa Bay, Withlacoochee Bay, Crystal Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.73).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Cumulative Stressors (3.80), Site Fidelity (3.73), Migration (3.67), and Habitat Specificity (3.60).

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 78% of the data quality scores were 2 or greater, 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Waccasassa Bay, Withlacoochee Bay, and Crystal Bay in the northeast Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); and Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson et al. 2007).

Migration

The bay, sound, and estuary stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from Florida Gulf Coast waters have shown persistent organic pollutants (POPs) in blubber and blood samples (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014). This stock was also within the range of the 2005–2006 UME in central west Florida caused by brevetoxin (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern

Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity

exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292
Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.
Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.
Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.
Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries

Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235
Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2
Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279
Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152
Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/West Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	2.8	2.2	
	Site Fidelity	3.6	2.8	
	Lifetime Reproductive Potential	1.5	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.2	2.2	
	Migration	3.8	2.5	
	Home Range	3.5	2.5	
	Stock Abundance	4.0	2.8	
	Stock Abundance Trend	2.0	1.8	
	Cumulative Stressors	2.5	2.8	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.0	2.8	
	Sea Surface Salinity (Change in variability)	1.2	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.9	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (GoMx BSE/West Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.85).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than 3.5: Species Abundance (3.95), Migration (3.80), Site Fidelity (3.65), and Home Range (3.55).

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in West Bay in the western Gulf of Mexico along the Texas coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for noise-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, FL, Rossman et al. (2015) found common bottlenose dolphins to show diet specialization despite the broader group showing diet generalist.

Prey studies focusing on common bottlenose dolphins (*Tursiops truncatus*) in the West Bay estuary were not found specifically pertaining to those waters. However, Barros and Odell (1990) examined the stomach contents of 76 stranded bottlenose dolphins from Gulf of Mexico shores, 22 of which were from the shoreline of northeast Texas adjacent to the Galveston Bay system just to the north of West Bay. Those 22 samples were combined with 3 additional stomach content analyses from common bottlenose dolphin strandings recovered in the states of Louisiana, Mississippi, and Alabama (1 sample each), and designated those states as Area 1 of their study. Using a combination of visual taxonomic identification (for undigested species) and species identification keys for fish otolith and cephalopod beaks, Barros and Odell (1990) reported the proportion of prey in Area 1 as fish (94.3%), cephalopods (5.2%), crustaceans (0.5%), and a single horseshoe crab. Only 32% of the stomach contents from Area 1 contained fish only, while fish/cephalopod and fish/cephalopod/shrimp were present in 36% and 32% respectively, of Area 1 stomach contents (Barros and Odell 1990). Overall, sciaenid fishes were the primary fish prey. However, the great diversity of species (over 300 different fish species found in eight stomachs from Area 1) and similarity of species to commercial fisheries bycatch suggests bottlenose dolphins off Texas were supplementing their diet by depredating shrimp trawler bycatch or by taking fish directly out of the nets (presumably) during trawling operations (Barros and Odell 1990). Observations of common bottlenose dolphins feeding using both methods from Texas and Louisiana have been well documented (Gunter 1938; Shane 1977; Gruber 1981; Henningsen and Würsig 1991; Fertl 1994b; Moreno 2005).

While much research indicates sciaenid fishes are the primary prey fishes for bottlenose dolphins in the Gulf of Mexico (Berens McCabe et al. 2010; Dunshea et al. 2013), other researchers (Gunter 1942; Shane 1990; Miller 1992) have suggested striped mullet (*Mugil cephalus*) may be a significant part of the bottlenose dolphin diet in Texas waters. Barros and Wells (1998) reviewed the importance of mullet in the diet of common bottlenose dolphins in Florida waters and suggested the species is important, yet ranks under soniferous fishes in their dietary profile.

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Maze and Würsig (1999) assessed photo-ID data collected from West Bay in years ranging from 1990 to 1996, and found~20% of the individuals observed in 1995–1996 were also present in 1990. Irwin and Würsig (2004) further analyzed photo-ID data collected in West Bay from 1990–2001, and found evidence for strong site fidelity for West Bay individuals. Common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994a; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Photo-ID studies indicate coastal and inter-bay dolphin movements occur among adjacent stock areas on the north Texas coast (Henningsen and Würsig 1991; Maze and Würsig 1999; Ronje et al. 2020). Maze and Würsig (1999) identified 3 individuals that were observed in both the Galveston Bay and adjacent West Bay stock areas, with one of those individuals remaining in West Bay for up to 9 months after its initial sighting in Galveston Bay. Ronje et al. (2020) photo-identified 15 individuals in the West Bay stock area that were also observed in the adjacent Galveston Bay stock area. More information needs to be collected to determine if any migratory patterns exist, but transient individuals are thought to frequent the San Luis Pass at the southeastern end of West Bay.

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017). Maze and Würsig (1999), Irwin and Würsig (2004), and Henderson and Würsig (2007) noted higher resident density in the Gulf during cold months and in West Bay during warm months. San Luis Pass (a natural sandy pass connecting West Bay to the Gulf of Mexico) is a relatively small part of West Bay, yet typically contains the highest dolphin density for the West Bay stock (Maze and Würsig 1999).

Stock Abundance

Litz et al. (2019) used photo-identification mark-recapture data to estimate West Bay abundance at 50.63 [unconditional SE 2.23] in the winter and 44.36 [unconditional SE 1.18] in the summer. Ronje et al. (2020) estimated the abundance of bottlenose dolphins in West Bay at 37.9 individuals (95% CI = 28.7–47.1) in the winter and 36.5 individuals (95% CI = 32.7–40.3) in the summer.

Stock Abundance Trend

The estimate of 36.5-37.9 individuals (Ronje et al. 2020) compares similarly with the Irwin and Würsig (2004) estimated abundance of 32 individuals (CV = 0.15) using data from the time period 1997–2001, suggesting the population is relatively stable. Previously, Maze and Würsig (1999) identified 71 individuals, 37 of which used both bay and GOM coastal waters, during the time period 1995–1996.

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Phillips and Rosel (2014) reviewed the cumulative stressors influencing the West Bay system. Potential health threats range from contagious disease (e.g., *Brucella*), harmful algal blooms (HABs; Fire et al. 2011, 2020), and anthropogenic activities: mining, crude oil exploration, transport, and refinement, commercial fisheries, agricultural runoff in the form of pesticide and fertilizer, heavy metals and other chemical contaminants, marine debris, shipping and dredging, noise, tourism and boat traffic. Natural events may also pose threats: hypoxia resulting from HABs, adverse weather (e.g., hurricane storm surge), habitat loss, and climate change (Phillips and Rosel 2014).

Unusual Mortality Events (UMEs) have been declared for common bottlenose dolphins in waters of Texas with morbillivirus the confirmed cause in 1994, a suspected cause in 1992 along with environmental conditions, and an undetermined cause in 2008 (Litz et al. 2014). This stock was also within the range of the 2007 UME in which 66 common bottlenose dolphins stranded in northeast Texas and west Louisiana due to an undetermined cause (Litz et al. 2014). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014)

Distribution and Sightings

Sighting maps for this stock from December 2014 and June 2015 are presented in Ronje et al. (2020).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S, A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Barros, N.B. and R.S. Wells. 1998. Prey and feeding patterns of resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Journal of Mammalogy 79(3):1045–1059. doi: 10.2307/1383114

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to

natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Dunshea, G., N.B. Barros, E.J. Berens McCabe, N.J. Gales, M.A. Hindell, S.N. Jarman, and R.S. Wells. 2013. Stranded dolphin stomach contents represent the free-ranging population's diet. Biology Letters 9(3):20121036–20121036. doi: 10.1098/rsbl.2012.1036

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994a. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Fertl, D. 1994b. Occurrence, movements, and behavior of bottlenose dolphins (*Tursiops truncatus*) in association with the shrimp fishery in Galveston Bay, Texas. Texas A&M University at Galveston. Thesis. 116 p.

Fire, S.E., T.A. Leighfield, G.A. Miller, S. Piwetz, E.R. Sabater, and H. Whitehead. 2020. Association between red tide exposure and detection of corresponding neurotoxins in bottlenose dolphins from Texas waters during 2007-2017. Marine Environmental Research 162:105191. doi: 10.1016/j.marenvres.2020.105191

Fire, S.E., Z. Wang, M. Byrd, H.R. Whitehead, J. Paternoster, and S.L. Morton. 2011. Co-occurrence of multiple classes of harmful algal toxins in bottlenose dolphins (*Tursiops truncatus*) stranding during an unusual mortality event in Texas, USA. Harmful Algae 10(3):330–336. doi: 10.1016/j.hal.2010.12.001

Gruber, J.A. 1981. Ecology of the Atlantic bottlenosed dolphin (*Tursiops truncatus*) in the Pass Cavallo area of Matagorda Bay, Texas. Texas A&M University. Thesis. 182 p.

Gunter, G. 1938. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. Ecological Monographs 8:314–346.

Gunter, G. 1942. Contributions to the natural history of the bottle-nose dolphin *Tursiops truncatus* (Montague) on the Texas coast. Journal of Mammalogy 23:267–276.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Henningsen, T. and B. Würsig. 1991. Bottle-nosed dolphins in Galveston Bay, Texas: Numbers and activities. Proceedings of the Fifth Annual Conference of the European Cetacean Society, Sandefjord, Norway, 21–23 February 1991. pp. 36–38.

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Litz, J.A., E.I. Ronje, H.R. Whitehead, and L.P. Garrison. 2019. Updated abundance estimates for common bottlenose dolphins (*Tursiops truncatus*) inhabiting West Bay, Texas. Aquatic Conservation: Marine and Freshwater Ecosystems 29(11):1959–1970. doi: 10.1002/aqc.3195

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in

Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806
McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Miller, W.G. 1992. An investigation of bottlenose dolphin *Tursiops truncatus* deaths in East Matagorda Bay, Texas, January 1990. Fishery Bulletin 90:791–797.
Moreno, M.P.T. 2005. Environmental predictors of bottlenose dolphin distribution and core feeding densities in Galveston Bay, Texas. Texas A&M University at Galveston. Dissertation. 88 p.
Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8
Ronje, E., H. Whitehead, K. Barry, S. Piwetz, J. Struve, V. Lecours, L. Garrison, R.S. Wells, and K.D. Mullin. 2020. Abundance and occurrence of common bottlenose dolphins (*Tursiops truncatus*) in three estuaries of the northwestern Gulf of Mexico. Gulf and Caribbean Research 31:18–34. doi: 10.18785/gcr.3101.09
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S. 1977. The population biology of the Atlantic bottlenose dolphin, *Tursiops truncatus*, in the Aransas Pass area of Texas. Texas A&M University. Thesis.

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Common bottlenose dolphin − *Tursiops truncatus*

GoMx BSE/Whitewater Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 78% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.5	1.3	
	Habitat Specificity	3.3	1.7	
	Site Fidelity	3.1	1.7	
	Lifetime Reproductive Potential	2.1	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.3	2.0	
	Migration	3.8	2.0	
	Home Range	3.8	2.3	
	Stock Abundance	2.6	1.3	
	Stock Abundance Trend	1.9	1.0	
	Cumulative Stressors	2.8	1.3	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.3	
	Sea Surface Temperature (Change in variability)	2.1	2.3	
	Air Temperature (Change in mean)	2.9	2.3	
	Air Temperature (Change in variability)	1.1	2.3	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.1	2.3	
	Sea Surface Salinity (Change in mean)	3.2	2.3	
	Sea Surface Salinity (Change in variability)	1.1	2.3	
	Ocean pH (Change in mean)	3.7	2.3	
	Ocean pH (Change in variability)	1.1	2.3	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.7	2.3	
	Dissolved oxygen (Change in variability)	1.1	2.3	
	Circulation	3.8	2.7	
	Sea level rise	3.9	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (GoMx BSE/Whitewater Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Sea Surface Temperature (Standard anomaly) (3.93), Sea level rise (3.87), Circulation (3.80), Dissolved oxygen (Standard anomaly) (3.73), and Ocean pH (Standard anomaly) (3.73).

Biological Sensitivity: High. Four sensitivity attributes scored greater than 3.0: Home Range (3.80), Migration (3.80), Habitat Specificity (3.33), and Site Fidelity (3.13).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 78% of the data quality scores were 2 or greater, 45% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Whitewater Bay in the eastern Gulf of Mexico along the Florida coast (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017; Matich et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

Limited information is available on site fidelity for this stock. However, from August 2010 to June 2012, a total of 92 individuals were identified in Whitewater Bay (Sarabia et al. 2018), but recapture rates were not documented. In other regions, common bottlenose dolphins in other Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986a; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996b; Urian et al. 2009); Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); and Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

The BSE stocks in the Gulf of Mexico are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of a BSE stock area are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2022). Molecular genetic data support that some BSE stocks are genetically distinct from one another, and furthermore are differentiated from adjacent coastal populations (e.g., Sellas et al. 2005; Rosel et al. 2017). For example, Toms (2019) found fine-scale genetic population structure among five inshore systems in the Florida Panhandle and variable migration rates among populations.

Year-round residency has been reported for common bottlenose dolphins (Hayes et al. 2022), such as in Florida (Irvine and Wells 1972; Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells et al. 1987; Scott et al. 1990; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Wells et al. 1997; Wells 2003; Balmer et al. 2008; Urian et al. 2009; Tyson et al. 2011; Bassos-Hull et al. 2013; B. Balmer et al. 2018; Balmer et al. 2019; Toms 2019), Texas (Shane 1990; Bräger 1993; Bräger et al. 1994; Fertl 1994; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004; Shane 2004), and Louisiana/Mississippi (Hubard et al. 2004; McDonald et al. 2017; Mullin et al. 2017; Takeshita et al. 2021).

Home Range

The home ranges of individuals within the Gulf of Mexico BSE stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Irvine et al. 1981; Wells 1986a; Wells 1986b; Wells 1991; Wells et al. 1996a; Wells et al. 1996b; Balmer et al. 2008; Wells 2014; Balmer et al. 2019), although some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002; Urian et al. 2009; Mullin et al. 2017; Wells et al. 2017).

Stock Abundance

An abundance estimate for this stock is unavailable (Hayes et al. 2022).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of bottlenose dolphin tissues from southwest Florida have shown persistent organic pollutants (POPs) in blubber and blood samples (Balmer et al. 2015; Damseaux et al. 2017; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in this stock (Damseaux et al. 2017) and elsewhere in Florida Gulf Coast waters (McCormack et al. 2020a, 2020b, 2022).

An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, B.C., G.M. Ylitalo, L.E. McGeorge, K.A. Baugh, D. Boyd, K.D. Mullin, P.E. Rosel, C. Sinclair, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Persistent organic pollutants (POPs) in blubber of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico coast, USA. Science of the Total Environment 527-528:306–312. doi: 10.1016/j.scitotenv.2015.05.016

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to

natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Marine Mammal Science 9:434–438. doi: 10.1111/j.1748-7692.1993.tb00477.x

Bräger, S., B. Würsig, A. Acevedo, and T. Henningsen. 1994. Association patterns of bottle-nosed dolphins (*Tursiops-truncatus*) in Galveston Bay, Texas. Journal of Mammalogy 75(2):431–437. doi: 10.2307/1382564

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Damseaux, F., J.J. Kiszka, M.R. Heithaus, G. Scholl, G. Eppe, J.P. Thome, J. Lewis, W. Hao, M.C. Fontaine, and K. Das. 2017. Spatial variation in the accumulation of POPs and mercury in bottlenose dolphins of the Lower Florida Keys and the coastal Everglades (South Florida). Environmental Pollution 220(Pt A):577–587. doi: 10.1016/j.envpol.2016.10.005

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irvine, A.B., M.D. Scott, R.S. Wells, and J.H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. Fishery Bulletin 79(4):671–688.

Irvine, B. and R.S. Wells. 1972. Results of attempts to tag Atlantic bottlenosed dolphins (*Tursiops truncatus*). Cetology 13:1–5.

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Matich, P., J.S. Ault, R.E. Boucek, D.R. Bryan, K.R. Gastrich, C.L. Harvey, M.R. Heithaus, J.J. Kiszka, V. Paz, J.S. Rehage, and A.E. Rosenblatt. 2017. Ecological niche partitioning within a large predator guild in a nutrient-limited estuary. Limnology and Oceanography 62(3):934–953. doi: 10.1002/lno.10477

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sarabia, R.E., M.R. Heithaus, and J.J. Kiszka. 2018. Spatial and temporal variation in abundance, group size and behaviour of bottlenose dolphins in the Florida coastal Everglades. Journal of the Marine Biological Association of the United Kingdom 98(5):1097–1107. doi: 10.1017/s002531541700090x

Scott, M.D. and S.J. Chivers. 1990. Distribution and herd structure of bottlenose dolphins in the eastern tropical Pacific Ocean. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 387–402.

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H. 2004. Residence patterns, group characteristics, and association patterns of bottlenose dolphins near Sanibel Island, Florida. Gulf of Mexico Science 22(1):1–12. doi: 10.18785/goms.2201.01

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity

exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Toms, C. 2019. Filling the gaps: Common bottlenose dolphin (*Tursiops truncatus*) population dynamics, structure, and connectivity within Florida panhandle bays, sounds, and estuaries. University of Central Florida. Dissertation. 373 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292
Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.
Wells, R.S. 1986a. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.
Wells, R.S. 1986b. Structural aspects of dolphin societies. University of California, Santa Cruz. Dissertation. 234 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.
Wells, R.S., M.K. Bassos, K.W. Urian, S.H. Shane, E.C.G. Owen, C.F. Weiss, W.J. Carr, and M.D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. National Oceanic and Atmospheric Administration, National Marine Fisheries

Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Center Contribution No. 40-WCNF601958. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

Gulf of Mexico, Continental Shelf Stock

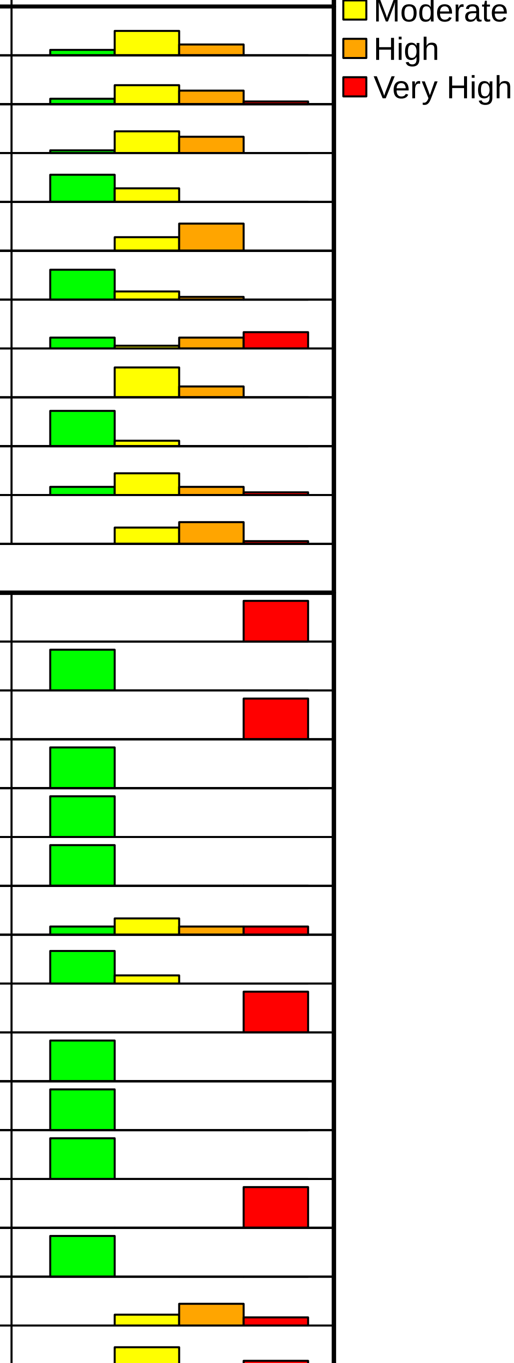
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	2.3	2.3	
	Site Fidelity	2.3	2.7	
	Lifetime Reproductive Potential	1.3	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.3	1.7	
	Migration	2.8	2.3	
	Home Range	2.3	2.3	
	Stock Abundance	1.1	3.0	
	Stock Abundance Trend	2.1	1.3	
	Cumulative Stressors	2.7	3.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.4	2.7	
	Sea Surface Salinity (Change in variability)	1.2	2.7	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	2.9	1.7	
	Sea level rise	2.7	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Common bottlenose dolphin (Gulf of Mexico, Continental Shelf Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (96% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (2.80), Cumulative Stressors (2.67), and Generation Time (2.67).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 89% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in waters from 20 to 200 m deep the northern Gulf of Mexico from the U.S.-Mexican border to the Florida Keys and adjacent Mexican and Cuban territorial waters (Hayes et al. 2022). The stock includes genetically distinct “coastal” and “offshore” ecotypes of bottlenose dolphins, but consists primarily of the coastal ecotype (Hoelzel et al. 1998; Vollmer and Rosel 2017).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2019), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Data are insufficient to characterize migration patterns (or the lack thereof) for this stock. However, genetic data do support the presence of multiple differentiated populations of common bottlenose dolphins in coastal and offshore waters with very low levels of migration among them (Vollmer and Rosel 2017). Molecular genetic data further support that coastal populations are genetically differentiated from BSE populations (Sellas et al. 2005; Rosel et al. 2017). In waters of the West Florida Shelf, acoustic and visual sighting data suggest seasonal movement from deeper waters in the winter and spring into shallower waters during the summer and fall (Simard et al. 2015).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

This stock is estimated at 63,280 individuals (CV=0.10; Garrison et al. 2021; Hayes et al. 2022) based on summer 2017 and fall 2018 aerial surveys. Previously, this stock was estimated at 51,192 individuals (CV=0.10) based on seasonal abundance estimates from spring 2011, summer 2011, fall 2011 and winter 2012 aerial surveys (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the northern Gulf of Mexico were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; Aichinger Dias et al. 2017; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b). A UME was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

The northern Gulf of Mexico continental shelf common bottlenose dolphin stock potentially interacts with four commercial fisheries (shrimp trawl commercial fishery; shark bottom longline/hook-and-line; snapper-grouper and other reef fish; and commercial passenger fishing vessel/hook-and-line; Hayes et al. 2022).

Distribution and Sightings

Density model results for common bottlenose dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R. S. and M. D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. eds. Encyclopedia of marine mammals. Academic Press. Pages 118-125

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hoelzel, A.R., C.W. Potter, and P.B. Best. 1998. Genetic differentiation between parapatric 'nearshore' and 'offshore' populations of the bottlenose dolphin. Proceedings of the Royal Society of London. Series B: Biological Sciences 265(1402):1177–1183. doi: 10.1098/rspb.1998.0416

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for bottlenose dolphin (*Tursiops truncatus*) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 84 p.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Simard, P., C.C. Wall, J.B. Allen, R.S. Wells, S. Gowans, and E.A. Forys. 2015. Dolphin distribution on the west Florida Shelf using visual surveys and passive acoustic monitoring. Aquatic Mammals 41(2):167–187. doi: 10.1578/am.41.2.2015.167

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. 2011. Population structure of common bottlenose dolphins in coastal and offshore waters of the Gulf of Mexico revealed by genetic and environmental analysis. University of Louisiana at Lafayette. Dissertation. 409 p.

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Vollmer, N.L. and P.E. Rosel. 2017. Fine-scale population structure of common bottlenose dolphins (*Tursiops truncatus*) in offshore and coastal waters of the US Gulf of Mexico. Marine Biology 164(8):160. doi: 10.1007/s00227-017-3186-x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 1986. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

Gulf of Mexico, Eastern Coastal Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

Tursiops truncatus		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.2	
	Habitat Specificity	2.5	2.5	
	Site Fidelity	3.1	2.5	
	Lifetime Reproductive Potential	1.8	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.2	1.8	
	Migration	3.5	2.5	
	Home Range	2.2	2.5	
	Stock Abundance	1.2	3.0	
	Stock Abundance Trend	2.1	1.5	
	Cumulative Stressors	2.8	2.2	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.5	3.0	
	Sea Surface Salinity (Change in variability)	1.4	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	3.0	2.8	
	Sea level rise	2.8	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Gulf of Mexico, Eastern Coastal Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (78% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (3.95), Dissolved oxygen (Standard anomaly) (3.95), Ocean pH (Standard anomaly) (3.95), and Sea Surface Temperature (Standard anomaly) (3.95).

Biological Sensitivity: High. Two sensitivity attributes scored greater than 3.0: Migration (3.55) and Site Fidelity (3.10).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in coastal waters (defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath) in an area of the eastern Gulf of Mexico that extends from 84W longitude to Key West, Florida (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; B. Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Data are insufficient to characterize migration patterns (or the lack thereof) for this stock. However, genetic data do support the presence of multiple differentiated populations of common bottlenose dolphins in coastal and offshore waters with very low levels of migration among them (Vollmer and Rosel 2017). Molecular genetic data further support that coastal populations are genetically differentiated from BSE populations (Sellas et al. 2005; Rosel et al. 2017). In waters of the West Florida Shelf, acoustic and visual sighting data suggest seasonal movement from deeper waters in the winter and spring into shallower waters during the summer and fall (Simard et al. 2015).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

The best abundance estimate available for this stock is 16,407 individuals (CV=0.17; Garrison et al. 2021; Hayes et al. 2022) based on summer 2017 and fall 2018 aerial surveys. Previously, this stock was estimated at 12,388 individuals (CV=0.13) based on seasonal abundance estimates from spring 2011, summer 2011, fall 2011 and winter 2012 aerial surveys (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The Gulf of Mexico eastern coastal common bottlenose dolphin stock potentially interacts with eight commercial fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl; Gulf of Mexico gillnet; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline/hook-and-line; Florida spiny lobster trap/pot; Gulf of Mexico blue crab trap/pot; Florida West Coast sardine purse seine; and commercial passenger fishing vessel/hook-and-line; Hayes et al. 2022).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from Florida Gulf Coast waters have shown persistent organic pollutants (POPs) in blubber and blood samples (Yordy et al. 2010a, 2010b, 2010c; Kucklick et al. 2011; J. Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; Miller et al. 2011; Correa et al. 2013; McCormack et al. 2020a, 2020b, 2022).

Five Unusual Mortality Events (UMEs) in the Gulf of Mexico have overlapped with the eastern coastal common bottlenose dolphin stock. The causes of these UMEs have included morbillivirus and brevetoxin (Litz et al. 2014).

Distribution and Sightings

Density model results for common bottlenose dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R. S. and M. D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. eds. Encyclopedia of marine mammals. Academic Press. Pages 118-125

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Balmer, J.E., G.M. Ylitalo, T.K. Rowles, K.D. Mullin, R.S. Wells, F.I. Townsend, R.W. Pearce, J.L. Bolton, E.S. Zolman, B.C. Balmer, and L.H. Schwacke. 2018. Persistent organic pollutants (POPs) in blood and blubber of common bottlenose dolphins (*Tursiops truncatus*) at three northern Gulf of Mexico sites following the Deepwater Horizon oil spill. Science of the Total Environment 621:130–137. doi: 10.1016/j.scitotenv.2017.11.209

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to

natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Correa, L., J.M. Castellini, R.S. Wells, and T. O'Hara. 2013. Distribution of mercury and selenium in blood compartments of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida. Environmental Toxicology and Chemistry 32(11):2441–2448. doi: 10.1002/etc.2327

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, D.L., V. Woshner, E.L. Styer, S. Ferguson, K.K. Knott, M.J. Gray, R.S. Wells, and T.M. O'Hara. 2011. Histologic findings in free-ranging Sarasota Bay bottlenose dolphin (*Tursiops truncatus*) skin: mercury, selenium, and seasonal factors. Journal of Wildlife Diseases 47(4):1012–1018. doi: 10.7589/0090-3558-47.4.1012

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for bottlenose dolphin (*Tursiops truncatus*) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 84 p.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Simard, P., C.C. Wall, J.B. Allen, R.S. Wells, S. Gowans, and E.A. Forys. 2015. Dolphin distribution on the west Florida Shelf using visual surveys and passive acoustic monitoring. Aquatic Mammals 41(2):167–187. doi: 10.1578/am.41.2.2015.167

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Vollmer, N.L. and P.E. Rosel. 2017. Fine-scale population structure of common bottlenose dolphins (*Tursiops truncatus*) in offshore and coastal waters of the US Gulf of Mexico. Marine Biology 164(8):160. doi: 10.1007/s00227-017-3186-x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 1986. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kucklick. 2010c. Life history as a source of variation for persistent organic pollutant (POP) patterns in a community of common bottlenose dolphins (*Tursiops truncatus*) resident to Sarasota Bay, FL. Science of the Total Environment 408(9):2163–2172. doi: 10.1016/j.scitotenv.2010.01.032

Common bottlenose dolphin − *Tursiops truncatus*

Gulf of Mexico, Northern Coastal Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.4	
	Habitat Specificity	2.6	2.6	
	Site Fidelity	2.8	2.8	
	Lifetime Reproductive Potential	1.5	2.0	
	Generation Length	3.0	2.0	
	Reproductive Plasticity	1.1	1.6	
	Migration	3.4	1.8	
	Home Range	2.3	2.2	
	Stock Abundance	2.0	3.0	
	Stock Abundance Trend	3.1	2.0	
	Cumulative Stressors	3.2	3.0	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	1.6	2.8	
	Sea Surface Salinity (Change in variability)	1.2	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.4	2.6	
	Sea level rise	3.1	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Gulf of Mexico, Northern Coastal Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: High. Four sensitivity attributes scored greater than 3.0: Migration (3.40), Cumulative Stressors (3.24), Species Abundance Trend (3.08), and Generation Time (3.04).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in coastal waters (defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath) in an area of the northern Gulf of Mexico that extends from 84W longitude to the Mississippi River Delta (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce throughout most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported a common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Data are insufficient to characterize migration patterns (or the lack thereof) for this stock. However, genetic data do support the presence of multiple differentiated populations of common bottlenose dolphins in coastal and offshore waters with very low levels of migration among them (Vollmer and Rosel 2017). Molecular genetic data further support that coastal populations are genetically differentiated from BSE populations (Sellas et al. 2005; Rosel et al. 2017).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

The best abundance estimate available for this stock is 11,543 individuals (CV=0.19; Garrison et al. 2021; Hayes et al. 2022) based on summer 2017, winter 2018, and fall 2018 aerial surveys. Previously, this stock was estimated at 7,185 individuals (CV=0.21) based on seasonal abundance estimates from spring 2011, summer 2011, fall 2011 and winter 2012 aerial surveys (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the northern Gulf of Mexico were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; Aichinger Dias et al. 2017; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The Gulf of Mexico northern coastal common bottlenose dolphin stock potentially interacts with six commercial fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl; Gulf of Mexico menhaden purse seine; Gulf of Mexico gillnet; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; Gulf of Mexico blue crab trap/pot; and commercial passenger fishing vessel/hook-and-line; Hayes et al. 2022).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from Gulf Coast waters along the Florida panhandle have shown persistent organic pollutants (POPs) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues in Florida Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; McCormack et al. 2020a, 2020b, 2022).

An additional five UMEs in the Gulf of Mexico have overlapped with the northern coastal common bottlenose dolphin stock. The causes of these UMEs have included brevetoxin and dolphin morbillivirus (Litz et al. 2014). Although morbillivirus has been detected in populations of the northern Gulf of Mexico, it has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017).

Distribution and Sightings

Density model results for common bottlenose dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging

patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265
National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for bottlenose dolphin (*Tursiops truncatus*) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 84 p.
Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f
Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777
Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7
Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165
Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x
Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778
Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity

exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292
Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x
Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145
Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Vollmer, N.L. and P.E. Rosel. 2017. Fine-scale population structure of common bottlenose dolphins (*Tursiops truncatus*) in offshore and coastal waters of the US Gulf of Mexico. Marine Biology 164(8):160. doi: 10.1007/s00227-017-3186-x
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN
Wells, R.S. 1986. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.
Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wells, R.S., K.W. Urian, A.J. Read, M.K. Bassos, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-385. 36 p.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Common bottlenose dolphin − *Tursiops truncatus*

Gulf of Mexico, Oceanic Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	1.9	2.0	
	Site Fidelity	2.1	1.7	
	Lifetime Reproductive Potential	1.3	2.3	
	Generation Length	2.8	2.3	
	Reproductive Plasticity	1.3	1.7	
	Migration	3.6	2.0	
	Home Range	2.1	1.7	
	Stock Abundance	1.9	2.7	
	Stock Abundance Trend	2.3	1.3	
	Cumulative Stressors	2.2	2.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	2.3	2.3	
	Sea Surface Salinity (Change in variability)	1.3	2.3	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	1.7	2.3	
	Sea level rise	1.3	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Gulf of Mexico, Oceanic Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (96% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (3.60) and Generation Time (2.80).

Distributional Response: Moderate

Abundance Response: Low

Phenology Response: Low

Data Quality: 85% of the data quality scores were 2 or greater, 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in oceanic waters seaward from the 200-m isobath in the U.S. Exclusive Economic Zone and adjacent offshore waters of the Gulf of Mexico (Hayes et al. 2021).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are able to adapt to a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock.

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce throughout their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Data are insufficient to characterize migration patterns (or the lack thereof) for this stock. However, genetic data do support the presence of multiple differentiated populations of common bottlenose dolphins in coastal and offshore waters with very low levels of migration among them (Vollmer and Rosel 2017). Molecular genetic data further support that coastal populations are genetically differentiated from bay, sound, and estuary (BSE) populations (Sellas et al. 2005; Rosel et al. 2017).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

The abundance of this stock is estimated to be 7,462 individuals (CV=0.31) based on 2017 and 2018 surveys (Garrison et al. 2020; Hayes et al. 2021). Previously, the stock was estimated at 5,806 individuals (CV=0.39) based on 2009 oceanic surveys (Waring et al. 2016).

Stock Abundance Trend

Five point estimates of bottlenose dolphin abundance have been made based on data from surveys in 2003 (21,350; CV=0.47), 2004 (8,864; CV=0.50), 2009 (9,640; CV=0.66), 2017 (8,756; CV=0.41), and 2018 (5,833; CV=0.46). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the northern Gulf of Mexico were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; Aichinger Dias et al. 2017; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b). An Unusual Mortality Event (UME) was declared in 1990 for the Gulf of Mexico from Florida to Texas, with more than 300 common bottlenose dolphins stranding due to an undetermined cause, although morbillivirus and cold temperatures may have contributed (Litz et al. 2014).

Distribution and Sightings

Density model results for common bottlenose dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for bottlenose dolphin (*Tursiops truncatus*) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 84 p.

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015a. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015b. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Vollmer, N.L. and P.E. Rosel. 2017. Fine-scale population structure of common bottlenose dolphins (*Tursiops truncatus*) in offshore and coastal waters of the US Gulf of Mexico. Marine Biology 164(8):160. doi: 10.1007/s00227-017-3186-x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common bottlenose dolphin − *Tursiops truncatus*

Gulf of Mexico, Western Coastal Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.5	
	Habitat Specificity	2.1	2.2	
	Site Fidelity	2.4	2.2	
	Lifetime Reproductive Potential	1.6	2.2	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.4	1.8	
	Migration	3.4	2.2	
	Home Range	2.1	2.0	
	Stock Abundance	1.4	2.5	
	Stock Abundance Trend	1.9	1.5	
	Cumulative Stressors	2.5	2.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	4.0	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	1.8	2.8	
	Sea Surface Salinity (Change in variability)	1.0	2.8	
	Ocean pH (Change in mean)	4.0	2.8	
	Ocean pH (Change in variability)	1.0	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	4.0	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.4	2.5	
	Sea level rise	3.5	2.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Gulf of Mexico, Western Coastal Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (99% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Sea level rise (3.50).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (3.45), Generation Time (2.80), and Cumulative Stressors (2.55).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in coastal waters (defined as waters between the shore, barrier islands or presumed outer bay boundaries out to the 20-m isobath) in an area of the northwestern Gulf of Mexico that extends from the Mississippi River Delta to the Texas-Mexico border (Hayes et al. 2022).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

In nearby Galveston Bay estuary, preliminary estimates of prey consumption proportions for bottlenose dolphins were determined through stable isotope analysis and Bayesian mixing models (McDaniel and Guillen 2020). In this study, examination of 36 remote biopsy samples obtained from free ranging dolphins in Galveston Bay between 2015-2017 indicate striped mullet (*Mugil cephalus*) and spotted seatrout (*Cynoscion nebulosus*) as primary prey sources. Additional contributions came from white shrimp (*Litopenaeus setiferus*), hardhead catfish (*Ariopsis felis*) and likely fish with similar δ13C and δ15N values not included in the study. The authors suggest prey abundance may contribute to disparities in estimated contributions of prey sources between years (McDaniel and Guillen 2020). Barros and Odell (1990) examined the stomach contents of 76 stranded bottlenose dolphins from Gulf of Mexico shores, 22 of which were from the shoreline of northeast Texas adjacent to the Galveston Bay systems. Those 22 samples were combined with 3 additional stomach content analyses from bottlenose dolphin strandings recovered in the states of Louisiana, Mississippi, and Alabama (1 sample each), and designated those states as Area 1 of their study. Using a combination of visual taxonomic identification (for undigested species) and species identification keys for fish otolith and cephalopod beaks, Barros and Odell (1990) reported the proportion of prey in Area 1 as fish (94.3%), cephalopods (5.2%), crustaceans (0.5%), and a single horseshoe crab. Only 32% of the stomach contents from Area 1 contained fish only, while fish/cephalopod and fish/cephalopod/shrimp were present in 36% and 32% respectively, of Area 1 stomach contents (Barros and Odell 1990). Overall, sciaenid fishes were the primary fish prey. However, the great diversity of species (over 300 different fish species found in eight stomachs from Area 1) and similarity of species to commercial fisheries bycatch suggests bottlenose dolphins off Texas were supplementing their diet by depredating shrimp trawler bycatch or by taking fish directly out of the nets (presumably) during trawling operations (Barros and Odell 1990). Observations of bottlenose dolphins feeding using both methods from Texas and Louisiana have been well documented (Gunter 1938; Shane 1977; Gruber 1981; Henningsen and Würsig 1991; Fertl 1994; Moreno 2005).

While much research indicates sciaenid fishes are the primary prey fishes for bottlenose dolphins in the Gulf of Mexico (Berens McCabe et al. 2010; Dunshea et al. 2013), other researchers (Gunter 1942; Shane 1990; Miller 1992) have suggested striped mullet (*Mugil cephalus*) may be a significant part of the bottlenose dolphin diet in Texas waters. Barros and Wells (1998) reviewed the importance of mullet in the diet of bottlenose dolphins in Florida waters and suggested the species is important, yet ranks under soniferous fishes in their dietary profile.

Habitat Specificity

Common bottlenose dolphins are able to adapt to a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock. However, common bottlenose dolphins in Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017; Takeshita et al. 2021); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce throughout their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota common bottlenose dolphins can give birth when they are as young as 6 years of age, and continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Data are insufficient to characterize migration patterns (or the lack thereof) for this stock. However, genetic data do support the presence of multiple differentiated populations of common bottlenose dolphins in coastal and offshore waters with very low levels of migration among them (Vollmer and Rosel 2017). Molecular genetic data further support that coastal populations are genetically differentiated from BSE populations (Sellas et al. 2005; Rosel et al. 2017).

Inter-bay movements of individuals thought to be part of coastal stocks have been reported for the north-central Gulf of Mexico (Balmer et al. 2016; Ronje et al. 2017) and similar movements of the Western Coastal Stock may coincide with seasonal changes in water temperature and prey density. Seasonal changes in density throughout Texas have also been attributed to a combination of north - south migration along the coast influenced by water temperature and more localized shifts in distribution influenced by prey movements in and out of the estuary during different times of the year (Weller 1998). Gruber (1981) observed an individual in Matagorda Bay previously identified in the Port Aransas area, ~95 km to the southwest. Jones (1991) reported 2 dolphins that ranged between Gulf inlets 500 - 600 km apart, and found 11 others traveled a distance < 300 km. Coastal movements have also been reported in north Texas between Galveston Bay and West Bay (Maze and Würsig 1999; Ronje et al. 2020) and between Galveston Bay and Sabine Lake (Ronje et al. 2020). Lynn and Würsig (2002) reviewed Texas dolphin movement patterns and hypothesized that while small localized communities of Texas dolphins that exhibit high site fidelity to individual bays may be highly susceptible to anthropogenic threats, these populations may have the ability to recover due to the presence of transients and migratory individuals traveling between bays. The authors stressed the unknown aspect of genetic mixing in these communities and the need for additional research. Sellas et al. (2005) concluded little interbreeding occurs between coastal and estuarine populations in their study on the Florida coast; however, more research needs to be conducted to determine the migratory habits of the Western Coastal Stock.

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

The best abundance estimate available for this stock is 20,759 individuals (CV=0.13; Garrison et al. 2021; Hayes et al. 2022) based on summer 2017 and fall 2018 aerial surveys. Previously, this stock was estimated at 20,161 individuals (CV=0.17) based on seasonal abundance estimates from spring 2011, summer 2011, fall 2011 and winter 2012 aerial surveys (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Phillips and Rosel 2014; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the northern Gulf of Mexico were exposed to oil and dispersants following the Deepwater Horizon oil spill, which may result in long term reproductive and chronic health effects (NOAA 2011; Michel et al. 2013; Helm et al. 2015; DWH NRDA 2016; Lane et al. 2015; Aichinger Dias et al. 2017; De Guise et al. 2017, 2021; Kellar et al. 2017; Smith et al. 2017; Schwacke et al. 2017). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015a, 2015b).

The Gulf of Mexico western coastal common bottlenose dolphin stock potentially interacts with five commercial fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl; Gulf of Mexico menhaden purse seine; Gulf of Mexico gillnet; Gulf of Mexico blue crab trap/pot; and commercial passenger fishing vessel/hook-and-line; Hayes et al. 2022).

The nearshore and estuarine habitats along the Gulf of Mexico coast include waters adjacent to areas of high human population, some of which are highly industrialized, and areas of heavy agricultural impact. Studies of common bottlenose dolphin tissues from western Gulf Coast waters have shown persistent organic pollutants (POPs) in blubber and blood samples (Kucklick et al. 2011; Balmer et al. 2018). Similarly, mercury has been detected in common bottlenose dolphin tissues from western Gulf Coast waters (Bryan et al. 2007; Woshner et al. 2008; McCormack et al. 2020a, 2020b, 2022).

An additional five UMEs in the Gulf of Mexico have overlapped with the western coastal common bottlenose dolphin stock. The suspected causes of these UMEs have included environmental conditions, brevetoxin, and dolphin morbillivirus (Litz et al. 2014). Although morbillivirus morbillivirus has been detected in populations of the northern Gulf of Mexico, it has not been attributed to large scale die-offs since 1993−1994 (Lipscomb et al. 1996; Litz et al. 2014; Van Bressem et al. 2014; Fauquier et al. 2017).

Distribution and Sightings

Density model results for common bottlenose dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Balmer, B., T. McDonald, F. Hornsby, J. Adams, J. Allen, A. Barleycorn, and L. Schwacke. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the Deepwater Horizon oil spill. Journal of Cetacean Research and Management 18:1–9. doi: 10.47536/jcrm.v18i1.409

Balmer, B., C. Sinclair, T. Speakman, B. Quigley, K. Barry, C. Cush, M. Hendon, K. Mullin, E. Ronje, P. Rosel, L. Schwacke, R. Wells, and E. Zolman. 2016. Extended movements of common bottlenose dolphins (*Tursiops truncatus*) along the northern Gulf of Mexico's central coast. Gulf of Mexico Science 33(1):93–97. doi: 10.18785/goms.3301.08

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution

patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Barros, N.B. and R.S. Wells. 1998. Prey and feeding patterns of resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Journal of Mammalogy 79(3):1045–1059. doi: 10.2307/1383114

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Bryan, C.E., S.J. Christopher, B.C. Balmer, and R.S. Wells. 2007. Establishing baseline levels of trace elements in blood and skin of bottlenose dolphins in Sarasota Bay, Florida: implications for non-invasive monitoring. Science of the Total Environment 388(1-3):325–342. doi: 10.1016/j.scitotenv.2007.07.046

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Guise, S., M. Levin, E. Gebhard, L. Jasperse, L. Burdett Hart, C.R. Smith, S. Venn-Watson, F. Townsend, R. Wells, B. Balmer, E. Zolman, T. Rowles, and L. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the Deepwater Horizon oil spill. Endangered Species Research 33:291–303. doi: 10.3354/esr00814

De Guise, S., M. Levin, L. Jasperse, J. Herrman, R.S. Wells, T. Rowles, and L. Schwacke. 2021. Long-term immunological alterations in bottlenose dolphin a decade after the Deepwater Horizon oil spill in the northern Gulf of Mexico: Potential for multigenerational effects. Environmental Toxicology and Chemistry 40(5):1308–1321. doi: 10.1002/etc.4980

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Dunshea, G., N.B. Barros, E.J. Berens McCabe, N.J. Gales, M.A. Hindell, S.N. Jarman, and R.S. Wells. 2013. Stranded dolphin stomach contents represent the free-ranging population's diet. Biology Letters 9(3):20121036–20121036. doi: 10.1098/rsbl.2012.1036

Fauquier, D.A., J. Litz, S. Sanchez, K. Colegrove, L.H. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougeres, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, R.H. Carmichael, C. Clemons-Chevis, W. Hatchett, D. Shannon, S. Shippee, S. Smith, L. Staggs, M.C. Tumlin, N.L. Wingers, and T.K. Rowles. 2017. Evaluation of morbillivirus exposure in cetaceans from the northern Gulf of Mexico 2010-2014. Endangered Species Research 33:211–220. doi: 10.3354/esr00772

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fertl, D. 1994. Occurrence patterns and behavior of bottlenose dolphins (*Tursiops truncatus*) in the Galveston ship channel, Texas. Texas Journal of Science 46(4):299–318.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2021. Abundance of coastal and continental shelf stocks of common bottlenose and Atlantic spotted dolphins in the northern Gulf of Mexico: 2017–2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRD-2021-01. 25 p. doi: 10.25923/vk95-t881

Gruber, J.A. 1981. Ecology of the Atlantic bottlenosed dolphin (*Tursiops truncatus*) in the Pass Cavallo area of Matagorda Bay, Texas. Texas A&M University. Thesis. 182 p.

Gunter, G. 1938. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. Ecological Monographs 8:314–346.

Gunter, G. 1942. Contributions to the natural history of the bottle-nose dolphin *Tursiops truncatus* (Montague) on the Texas coast. Journal of Mammalogy 23:267–276.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Henningsen, T. and B. Würsig. 1991. Bottle-nosed dolphins in Galveston Bay, Texas: Numbers and activities. Proceedings of the Fifth Annual Conference of the European Cetacean Society, Sandefjord, Norway, 21–23 February 1991. pp. 36–38.

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Jones, S.C., III. 1991. Movements of bottlenose dolphins between inlets along the Texas coast. Abstracts of the 9th Biennial Conference on the Biology of Marine Mammals, Chicago, IL, 7-11 November 1991. p. 37.

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon disaster (2010-2015). Endangered Species Research 33:143–158. doi: 10.3354/esr00775

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proceedings of the Royal Society B: Biological Sciences 282(1818):20151944. doi: 10.1098/rspb.2015.1944

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lipscomb, T.P., S. Kennedy, D. Moffett, A. Krafft, B.A. Klaunberg, J.H. Lichy, G.T. Regan, G.A.J. Worthy, and J.K. Taubenberger. 1996. Morbilliviral epizootic in bottlenose dolphins of the Gulf of Mexico. Journal of Veterinary Diagnostic Investigation 8(3):283–290. doi: 10.1177/104063879600800302

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

McCormack, M.A., F. Battaglia, W.E. McFee, and J. Dutton. 2020a. Mercury concentrations in blubber and skin from stranded bottlenose dolphins (*Tursiops truncatus*) along the Florida and Louisiana coasts (Gulf of Mexico, USA) in relation to biological variables. Environmental Research 180:108886. doi: 10.1016/j.envres.2019.108886

McCormack, M.A., B.P. Jackson, and J. Dutton. 2020b. Relationship between mercury and selenium concentrations in tissues from stranded odontocetes in the northern Gulf of Mexico. Science of the Total Environment 749:141350. doi: 10.1016/j.scitotenv.2020.141350

McCormack, M.A., W.H. Nowlin, and J. Dutton. 2022. Effect of trophic position on mercury concentrations in bottlenose dolphins (*Tursiops truncatus*) from the northern Gulf of Mexico. Environmental Research 204(Pt B):112124. doi: 10.1016/j.envres.2021.112124

McDaniel, S. and G.J. Guillen. 2020. Foraging ecology of bottlenose dolphins (*Tursiops truncatus*) in Galveston Bay [Poster]. Galveston Bay Estuary Program, State of the Bay Symposium, Galveston, TX,

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and degree of shoreline oiling: Deepwater Horizon oil spill, Gulf of Mexico, USA. PLoS ONE 8(6):e65087. doi: 10.1371/journal.pone.0065087

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Miller, W.G. 1992. An investigation of bottlenose dolphin *Tursiops truncatus* deaths in East Matagorda Bay, Texas, January 1990. Fishery Bulletin 90:791–797.

Moreno, M.P.T. 2005. Environmental predictors of bottlenose dolphin distribution and core feeding densities in Galveston Bay, Texas. Texas A&M University at Galveston. Dissertation. 88 p.

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Phillips, N.M. and P.E. Rosel. 2014. A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Southeast Fisheries Science Center: Lafayette, LA. NOAA Technical Memorandum NMFS-SEFSC-665. 146 p. doi: 10.7289/V5F769H8

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for bottlenose dolphin (*Tursiops truncatus*) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 84 p.

Ronje, E., H. Whitehead, K. Barry, S. Piwetz, J. Struve, V. Lecours, L. Garrison, R.S. Wells, and K.D. Mullin. 2020. Abundance and occurrence of common bottlenose dolphins (*Tursiops truncatus*) in three estuaries of the northwestern Gulf of Mexico. Gulf and Caribbean Research 31:18–34. doi: 10.18785/gcr.3101.09

Ronje, E.I., H.R. Whitehead, S. Piwetz, K. Barry, C. Sinclair, and K.D. Mullin. 2017. Seasonal distribution and coastal movements of common bottlenose dolphins in bays and adjacent coastal waters of Texas. 22nd Biennial Conference of the Society of Marine Mammalogy, Halifax, Nova Scotia, Canada, 22–28 October 2017

Rosel, P.E., L.A. Wilcox, C. Sinclair, T.R. Speakman, M.C. Tumlin, J.A. Litz, and E.S. Zolman. 2017. Genetic assignment to stock of stranded common bottlenose dolphins in southeastern Louisiana after the Deepwater Horizon oil spill. Endangered Species Research 33:221–234. doi: 10.3354/esr00780

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the deepwater horizon oil spill. Environmental Science & Technology 48(1):93–103. doi: 10.1021/es403610f

Schwacke, L.H., L. Thomas, R.S. Wells, W.E. McFee, A.A. Hohn, K.D. Mullin, E.S. Zolman, B.M. Quigley, T.K. Rowles, and J.H. Schwacke. 2017. Quantifying injury to common bottlenose dolphins from the Deepwater Horizon oil spill using an age-, sex- and class-structured population model. Endangered Species Research 33:265–279. doi: 10.3354/esr00777

Sellas, A.B., R.S. Wells, and P.E. Rosel. 2005. Mitochondrial and nuclear DNA analyses reveal fine scale geographic structure in bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Mexico. Conservation Genetics 6(5):715–728. doi: 10.1007/s10592-005-9031-7

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S. 1977. The population biology of the Atlantic bottlenose dolphin, *Tursiops truncatus*, in the Aransas Pass area of Texas. Texas A&M University. Thesis.

Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 245–265. doi: 10.1016/B978-0-12-440280-5.50016-0

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Smith, C.R., T.K. Rowles, L.B. Hart, F.I. Townsend, R.S. Wells, E.S. Zolman, B.C. Balmer, B. Quigley, M. Ivančić, W. McKercher, M.C. Tumlin, K.D. Mullin, J.D. Adams, Q. Wu, W. McFee, T.K. Collier, and L.H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon oil spill (2013-2014), with evidence of persistent lung disease and impaired stress response. Endangered Species Research 33:127–142. doi: 10.3354/esr00778

Takeshita, R., B.C. Balmer, F. Messina, E.S. Zolman, L. Thomas, R.S. Wells, C.R. Smith, T.K. Rowles, and L.H. Schwacke. 2021. High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health. PLoS ONE 16(9):e0258031. doi: 10.1371/journal.pone.0258031

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Van Bressem, M.F., P.J. Duignan, A. Banyard, M. Barbieri, K.M. Colegrove, S. De Guise, G. Di Guardo, A. Dobson, M. Domingo, D. Fauquier, A. Fernandez, T. Goldstein, B. Grenfell, K.R. Groch, F. Gulland, B.A. Jensen, P.D. Jepson, A. Hall, T. Kuiken, S. Mazzariol, S.E. Morris, O. Nielsen, J.A. Raga, T.K. Rowles, J. Saliki, E. Sierra, N. Stephens, B. Stone, I. Tomo, J. Wang, T. Waltzek, and J.F. Wellehan. 2014. Cetacean morbillivirus: current knowledge and future directions. Viruses 6(12):5145–5181. doi: 10.3390/v6125145

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010-June 2013. PLoS ONE 10(2):e0117248. doi: 10.1371/journal.pone.0117248

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Vollmer, N.L. and P.E. Rosel. 2017. Fine-scale population structure of common bottlenose dolphins (*Tursiops truncatus*) in offshore and coastal waters of the US Gulf of Mexico. Marine Biology 164(8):160. doi: 10.1007/s00227-017-3186-x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Weller, D.W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Texas A&M University. Dissertation. 142 p.

Wells, R.S. 1986. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235
Woshner, V., K. Knott, R. Wells, C. Willetto, R. Swor, and T. O'Hara. 2008. Mercury and selenium in blood and epidermis of bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, FL: interaction and relevance to life history and hematologic parameters. Ecohealth 5(3):360–370. doi: 10.1007/s10393-008-0164-2

Common bottlenose dolphin − *Tursiops truncatus*

Biscayne Bay Stock

Overall Vulnerability Rank = Very High

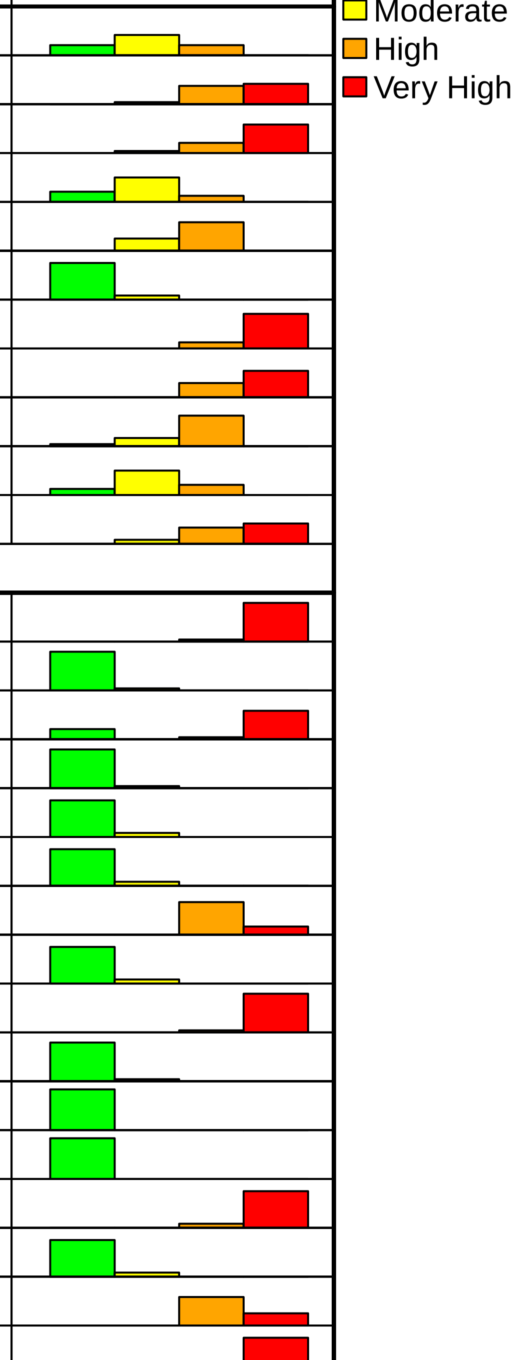
Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality
Sensitivity attributes	Prey/Diet Specificity	2.0	2.5
	Habitat Specificity	3.4	2.2
	Site Fidelity	3.6	2.2
	Lifetime Reproductive Potential	1.9	2.2
	Generation Length	2.7	2.2
	Reproductive Plasticity	1.1	2.2
	Migration	3.8	2.5
	Home Range	3.6	3.0
	Stock Abundance	2.7	2.8
	Stock Abundance Trend	2.1	2.2
	Cumulative Stressors	3.4	1.5
	Sensitivity Score	Very High	
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0
	Sea Surface Temperature (Change in variability)	1.0	3.0
	Air Temperature (Change in mean)	3.2	3.0
	Air Temperature (Change in variability)	1.0	3.0
	Precipitation (Change in mean)	1.1	3.0
	Precipitation (Change in variability)	1.1	3.0
	Sea Surface Salinity (Change in mean)	3.2	2.8
	Sea Surface Salinity (Change in variability)	1.1	3.0
	Ocean pH (Change in mean)	4.0	3.0
	Ocean pH (Change in variability)	1.0	3.0
	Sea ice coverage (Change in mean)	1.0	3.0
	Sea ice coverage (Change in variability)	1.0	3.0
	Dissolved oxygen (Change in mean)	3.9	3.0
	Dissolved oxygen (Change in variability)	1.1	3.0
	Circulation	3.3	2.5
	Sea level rise	3.9	3.0
	Exposure Score	Very High	
Overall Vulnerability Rank		Very High	

Expert Scores Plots (Portion by Category)



Common bottlenose dolphin (Biscayne Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.95), Sea Surface Temperature (Standard anomaly) (3.95), Dissolved oxygen (Standard anomaly) (3.90), and Sea level rise (3.90).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.85), Home Range (3.65), and Site Fidelity (3.65).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins in Biscayne Bay in the western North Atlantic along the coast of Miami, Florida from Haulover Inlet in the north and Card Sound bridge in the south (Waring et al. 2014).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

The NMFS Southeast Fisheries Science Center has been conducting photo-ID surveys of the common bottlenose dolphin Biscayne Bay Stock since 1990 and suggests 80% of the individuals in the stock are long-term residents (Litz 2007). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2014), such as in South Carolina (Sloan 2006; Waring et al. 2016), Georgia (Pulster and Maruya 2008; Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (Waring et al. 2014; LaBrecque et al. 2015). Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Durden et al. 2011; Waring et al. 2014; Waring et al. 2016), though some remain entirely in estuarine waters (Mazzoil et al. 2008a).

Home Range

The home range of individuals varies within the Biscayne Bay study area, which is bounded by Haulover Inlet to the north and Barnes Sound the south (Litz 2007). Some individuals are seen throughout the bay whereas others have smaller home ranges within the study area. It is suspected that some individuals may use areas outside these boundaries (Waring et al. 2014).

The home ranges of individuals within the western North Atlantic estuarine stocks generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Waring et al. 2014; LaBrecque et al. 2015). In Gulf of Mexico bay, sound, and estuary stocks, some individuals show preference for small areas within the stock boundaries (Lynn and Würsig 2002).

Stock Abundance

Odell (1979) assumed one group of 13 individuals occupied Biscayne Bay. Photo-id surveys have identified 229 unique individuals from 1990 through 2007, with 157 unique individuals identified during surveys conducted between 2003 and 2007, however it is not understood if these were resident individuals or transient individuals from other stocks (Waring et al. 2014).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2014).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning. In 2018, a dead dolphin stranded in Biscayne Bay with ingested monofilament line which likely contributed to its cause of death. Also in 2018, a dead dolphin stranded in Biscayne Bay with wounds consistent with a vessel strike (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

The Biscayne Bay common bottlenose dolphin stock may interact with crab or lobster pots fisheries or hook and line fisheries, however observer coverage is lacking (Waring et al. 2014). More recently, 2 live dolphins were reported entangled in pot gear in 2020. One was confirmed to be entangled in a commercial blue crab pot and one in an unknown pot/trap. Both were released alive (NOAA National

Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, elevated POP concentrations were observed in individuals associated with the northern, more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011).

Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions (Waring et al. 2014; also see NOAA National Marine Mammal Health and Stranding Response Database).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, P.E. Rosel, T.V.N. Cole, L. Engleby, L.P. Garrison, A. Henry, K. Mullin, C. Orphanides, R.M. Pace, D.L. Palka, M. Lyssikatos, and F.W. Wenzel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern

Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Odell, D.K. 1979. A preliminary study of the ecology and population biology of the bottlenose dolphin in Southeast Florida; Final report to the Marine Mammal Commission in fulfillment of contract MM4AC003. University of Miami: Miami, FL. 26 p.

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L. and K.A. Maruya. 2008. Geographic specificity of Aroclor 1268 in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia (USA). Science of the Total Environment 393(2-3):367–375. doi: 10.1016/j.scitotenv.2007.12.031

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Central Georgia Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.0	
	Habitat Specificity	3.8	2.0	
	Site Fidelity	3.9	2.8	
	Lifetime Reproductive Potential	1.0	2.2	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.4	2.2	
	Migration	3.9	2.8	
	Home Range	3.1	2.8	
	Stock Abundance	3.0	2.8	
	Stock Abundance Trend	2.1	1.8	
	Cumulative Stressors	2.8	2.5	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.3	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.9	3.0	
	Sea Surface Salinity (Change in mean)	2.3	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	4.0	1.7	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Central Georgia Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Circulation (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.90), Site Fidelity (3.90), and Habitat Specificity (3.75).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Central Georgia Estuarine System (CGES) Stock includes common bottlenose dolphins found in the estuarine and nearshore (≤ 1km from shore) coastal waters of the western North Atlantic along the Georgia coast from the northern extent of Ossabaw Sound in the north to the Altamaha River in the south (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the CGES stock is characterized by extensive estuarine tidal marsh systems that include the Altamaha River (Waring et al. 2016).

Site Fidelity

Common bottlenose dolphins in central and southern Georgia show strong site fidelity (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in South Carolina (Sloan 2006; Waring et al. 2016), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016).

Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Durden et al. 2011; Waring et al. 2014; Waring et al. 2016), though some remain entirely in estuarine waters (Mazzoil et al. 2008a).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Waring et al. 2016). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the SGES Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Balmer et al. (2013) estimated an average abundance of 192 individuals (CV=0.04), based on winter surveys from 2008 and 2009 from approximately half of the entire range of the CGES.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

The Central Georgia Estuarine Stock common bottlenose dolphin stock interacts with the blue crab trap/pot fishery, however levels of serious injury and mortality are unknown due to a lack of observer coverage (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2014; also see NOAA National Marine Mammal Health and Stranding Response Database). During the period 2009–2013, 24 common bottlenose dolphins stranded within the CGES, with two individuals presenting interactions with crab trap/pot gear (Waring et al.

2014; Seguel et al. 2020). The cause of death for six of the other stranded individuals was likely high concentrations of persistent organic pollutants (POPs; Seguel et al. 2020).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). Polychlorinated biphenyls (PCBs) have been found in Sapelo Island waters within the boundaries of this stock, though at lower concentrations than nearby Brunswick, GA (Wirth et al. 2014).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016).

Balmer et al. (2018) found coastal dolphins in southern Georgia had a significantly higher prevalence of positive dolphin morbillivirus (DMV) antibody titers (0.67; N = 2/3) than sound and estuary dolphins (0.13; N = 2/16), suggesting the coastal stock may have experienced greater exposure to DMV as compared to the sound and estuary stocks, which may be vulnerable to DMV infection in the future.

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x
Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278
Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.
Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630
Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1
Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232
Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665
Seguel, M., R.C. George, G. Maboni, S. Sanchez, A. Page-Karjian, E. Wirth, W. McFee, and N.L. Gottdenker. 2020. Pathologic findings and causes of death in bottlenose dolphins *Tursiops truncatus* stranded along the Georgia coast, USA (2007-2013). Diseases of Aquatic Organisms 141:25–38. doi: 10.3354/dao03509

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Wirth, E.F., P.L. Pennington, C. Cooksey, L. Schwacke, L. Balthis, J. Hyland, and M.H. Fulton. 2014. Distribution and sources of PCBs (Aroclor 1268) in the Sapelo Island National Estuarine Research Reserve. Environmental Monitoring and Assessment 186(12):8717–8726. doi: 10.1007/s10661-014-4039-4

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Charleston Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	3.0	
	Habitat Specificity	3.7	2.3	
	Site Fidelity	4.0	3.0	
	Lifetime Reproductive Potential	1.0	2.3	
	Generation Length	2.7	2.3	
	Reproductive Plasticity	1.2	2.3	
	Migration	3.9	3.0	
	Home Range	3.1	3.0	
	Stock Abundance	3.0	3.0	
	Stock Abundance Trend	2.3	2.3	
	Cumulative Stressors	3.1	2.7	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.3	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	2.0	3.0	
	Sea Surface Salinity (Change in mean)	3.1	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	4.0	1.7	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (Charleston Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Circulation (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Site Fidelity (4.00), Migration (3.93), and Habitat Specificity (3.67).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 100% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Charleston Estuarine System (CES) Stock includes common bottlenose dolphins in the estuarine and nearshore (≤ 1km from shore) coastal waters of the western North Atlantic along the South Carolina coast from Price Inlet in the north to the North Edisto River in the south. It includes waters in the Intracoastal Waterway (ICW), Charleston Harbor, the main channels and creeks of the Ashley, Cooper, Wando, Stono and North Edisto Rivers (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017). Stable isotope data suggests differences in common bottlenose dolphin forage composition among estuaries along the South Carolina coast and between estuaries and the nearshore coastal populations (Olin et al. 2012)

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the CES stock is characterized by estuarine tidal marsh systems, river channels, tidal creeks, and open water habitat (Waring et al. 2016).

Site Fidelity

Common bottlenose dolphins in the CES Stock show evidence of site fidelity (Speakman et al. 2006). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in South Carolina (Sloan 2006; Waring et al. 2016), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female common bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female common bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings.

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (Waring et al. 2016; LaBrecque et al. 2015). Taylor et al. (2016) found seasonal abundance and temporary emigration patterns in the CES, with low abundance in winter, and peak abundance in summer.

Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Durden et al. 2011; Waring et al. 2014; Waring et al. 2016), though some remain entirely in estuarine waters (Mazzoil et al. 2008a).

Home Range

The home ranges of individual common bottlenose dolphins within the CES generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Gubbins 2002a, 2002b, 2002c; Zolman 2002; Gubbins et al. 2003; Speakman et al. 2006; Laska et al. 2011).

Stock Abundance

Speakman et al. (2010) estimated this stock's abundance at 289 individuals (CV=0.03) based on seasonal (January, April, July, October) surveys during 2004–2006. However, this estimate did not cover the entire range of the stock, and may represent an undercount (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the CES stock interact with the blue crab trap/pot fishery, however levels of serious injury and mortality are unknown due to a lack of observer coverage (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2016; also see NOAA National Marine Mammal Health and Stranding Response Database).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016). A UME for bottlenose dolphins was declared in winter and spring of 2011 in South Carolina, during which common bottlenose dolphins stranded at a rate nearly three times the historical average, with evidence suggesting an unusually cold winter and decreased prey abundance contributed to the UME (Waring et al. 2016).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. Common bottlenose dolphins in the CES have been found with elevated levels of POPs (Hansen et al. 2004), polybrominated diphenyl ethers (PBDE; Fair et al. 2007; Kucklick et al. 2011; Adams et al. 2014), perfluoroalkyl compounds (PFCs; Adams et al. 2008), and per- and polyfluoroalkyl substances (PFAS; Fair et al. 2012; Fair et al. 2013; De Silva et al. 2016; Lynch et al. 2019). In South Carolina, urban areas showed greater numbers of strandings than areas with primarily agricultural input (McFee and Burdett 2007). Adams et al. (2008) found dolphins in the CES that spent most of their time in urbanized and industrial areas had significantly higher plasma PFC concentrations than dolphins that spent most of their time in less developed areas. These findings are consistent with a study from Biscayne Bay, Florida, that showed elevated POP concentrations in individuals associated with more polluted areas compared to individuals associated with less polluted areas, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007). Common bottlenose dolphins stranded along the South Carolina coast have been found with ingested microplastics (Battaglia et al. 2020). Individuals of this stock have been found with mercury in blood and skin samples, though at lower concentrations relative to individuals in the Indian River Lagoon in Florida (Schaefer et al. 2011).

Common bottlenose dolphins in the CES have tested negative for titers to both dolphin morbillivirus and porpoise morbillivirus, indicating that these dolphins have not been exposed to morbillivirus in recent years and may therefore be susceptible to future infection (Rowles et al. 2011; Bossart et al. 2010; Bossart et al. 2017).

Common bottlenose dolphins stranded in the CES and other regions of South Carolina show a high prevalence of the gram-negative facultative intracellular bacterium *Brucella ceti* found in the tissues of brain, lung, and other tissues (McFee et al. 2020). Nearly 32% of dolphins tested positive for *B. ceti* over the six year study period, coinciding with the calving period.

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Adams, J., M. Houde, D. Muir, T. Speakman, G. Bossart, and P. Fair. 2008. Land use and the spatial distribution of perfluoroalkyl compounds as measured in the plasma of bottlenose dolphins (*Tursiops truncatus*). Marine Environmental Research 66(4):430–437. doi: 10.1016/j.marenvres.2008.07.004

Adams, J., T. Speakman, E. Zolman, G. Mitchum, E. Wirth, G.D. Bossart, and P.A. Fair. 2014. The relationship between land use and emerging and legacy contaminants in an Apex predator, the bottlenose dolphin (*Tursiops truncatus*), from two adjacent estuarine watersheds. Environmental Research 135:346–353. doi: 10.1016/j.envres.2014.08.037

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Battaglia, F.M., B.A. Beckingham, and W.E. McFee. 2020. First report from North America of microplastics in the gastrointestinal tract of stranded bottlenose dolphins (*Tursiops truncatus*). Marine Pollution Bulletin 160:111677. doi: 10.1016/j.marpolbul.2020.111677

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bossart, G.D., P. Fair, A.M. Schaefer, and J.S. Reif. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. I. Infectious diseases. Diseases of Aquatic Organisms 125(2):141–153. doi: 10.3354/dao03142

Bossart, G.D., J.S. Reif, A.M. Schaefer, J. Goldstein, P.A. Fair, and J.T. Saliki. 2010. Morbillivirus infection in free-ranging Atlantic bottlenose dolphins (*Tursiops truncatus*) from the Southeastern United

States: Seroepidemiologic and pathologic evidence of subclinical infection. Veterinary Microbiology 143(2-4):160–166. doi: 10.1016/j.vetmic.2009.11.024

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

De Silva, A.O., C. Spencer, K.C. Ho, M. Al Tarhuni, C. Go, M. Houde, S.R. de Solla, R.A. Lavoie, L.E. King, D.C. Muir, P.A. Fair, R.S. Wells, and G.D. Bossart. 2016. Perfluoroalkylphosphinic acids in northern pike (*Esox lucius*), double-crested cormorants (*Phalacrocorax auritus*), and bottlenose dolphins (*Tursiops truncatus*) in relation to other perfluoroalkyl acids. Environmental Science & Technology 50(20):10903–10913. doi: 10.1021/acs.est.6b03515

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fair, P.A., M. Houde, T.C. Hulsey, G.D. Bossart, J. Adams, L. Balthis, and D.C.G. Muir. 2012. Assessment of perfluorinated compounds (PFCs) in plasma of bottlenose dolphins from two southeast US estuarine areas: relationship with age, sex and geographic locations. Marine Pollution Bulletin 64(1):66–74. doi: 10.1016/j.marpolbul.2011.10.022

Fair, P.A., T. Romano, A.M. Schaefer, J.S. Reif, G.D. Bossart, M. Houde, D. Muir, J. Adams, C. Rice, T.C. Hulsey, and M. Peden-Adams. 2013. Associations between perfluoroalkyl compounds and immune and clinical chemistry parameters in highly exposed bottlenose dolphins (*Tursiops truncatus*). Environmental Toxicology and Chemistry 32(4):736–746. doi: 10.1002/etc.2122

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C. 2002a. Use of home ranges by resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. Journal of Mammalogy 83(1):178–187. doi: 10.1644/1545-1542(2002)083<0178:Uohrbr>2.0.Co;2

Gubbins, C.M. 2002b. Association patterns of resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. Aquatic Mammals 28:24–31.

Gubbins, C.M. 2002c. The dolphins of Hilton Head: Their natural history. University of South Carolina Press, Columbia, SC. 96 p. doi: 10.2307/j.ctv1htpdsv

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Laska, D., T. Speakman, and P.A. Fair. 2011. Community overlap of bottlenose dolphins (*Tursiops truncatus*) found in coastal waters near Charleston, South Carolina. Journal of Marine Animals and Their Ecology 4(2):10–18.

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Lynch, K.M., P.A. Fair, M. Houde, D.C.G. Muir, K. Kannan, G.D. Bossart, S.M. Bartell, and M.O. Gribble. 2019. Temporal trends in per- and polyfluoroalkyl substances in bottlenose dolphins (*Tursiops truncatus*) of Indian River Lagoon, Florida and Charleston, South Carolina. Environmental Science & Technology 53(24):14194–14203. doi: 10.1021/acs.est.9b04585

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E. and L.G. Burdett. 2007. Spatial and temporal analysis of bottlenose dolphin strandings in South Carolina, 1992-2005. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-46. 12 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McFee, W.E., D. Wu, K. Colegrove, K. Terio, L. Balthis, and R. Young. 2020. Occurrence of *Brucella ceti* in stranded bottlenose dolphins *Tursiops truncatus* coincides with calving season. Diseases of Aquatic Organisms 141:185–193. doi: 10.3354/dao03526

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Olin, J.A., P.A. Fair, M.A. Recks, E. Zolman, J. Adams, and A.T. Fisk. 2012. Unique seasonal forage bases within a local population of bottlenose dolphin (*Tursiops truncatus*). Marine Mammal Science 28(1):E28–E40. doi: 10.1111/j.1748-7692.2011.00470.x

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Rowles, T.K., L.S. Schwacke, R.S. Wells, J.T. Saliki, L. Hansen, A. Hohn, F. Townsend, R.A. Sayre, and A.J. Hall. 2011. Evidence of susceptibility to morbillivirus infection in cetaceans from the United States. Marine Mammal Science 27(1):1–19. doi: 10.1111/j.1748-7692.2010.00393.x

Schaefer, A.M., H.C. Stavros, G.D. Bossart, P.A. Fair, J.D. Goldstein, and J.S. Reif. 2011. Associations between mercury and hepatic, renal, endocrine, and hematological parameters in Atlantic bottlenose dolphins (*Tursiops truncatus*) along the eastern coast of Florida and South Carolina. Arch Environ Contam Toxicol 61(4):688–695. doi: 10.1007/s00244-011-9651-5

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Speakman, T.R., S.M. Lane, L.H. Schwacke, P.A. Fair, and E.S. Zolman. 2010. Mark-recapture estimates of seasonal abundance and survivorship for bottlenose dolphins (*Tursiops truncatus*) near Charleston, South Carolina, USA. Journal of Cetacean Research and Management 11(2):153–162.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, A.R., J.H. Schacke, T.R. Speakman, S.B. Castleberry, and R.B. Chandler. 2016. Factors related to common bottlenose dolphin (*Tursiops truncatus*) seasonal migration along South Carolina and Georgia coasts, USA. Animal Migration 3(1):14–26. doi: 10.1515/ami-2016-0002

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Zolman, E.S. 2002. Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River estuary, Charleston County, South Carolina, USA. Marine Mammal Science 18(4):879–892. doi: 10.1111/j.1748-7692.2002.tb01079.x

Common bottlenose dolphin − *Tursiops truncatus*

Florida Bay Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.6	2.7	
	Habitat Specificity	3.5	2.3	
	Site Fidelity	3.8	2.7	
	Lifetime Reproductive Potential	2.0	2.3	
	Generation Length	2.7	2.3	
	Reproductive Plasticity	1.1	2.3	
	Migration	3.8	2.3	
	Home Range	3.7	2.3	
	Stock Abundance	3.0	2.3	
	Stock Abundance Trend	2.2	1.3	
	Cumulative Stressors	2.9	1.7	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	3.0	
	Sea Surface Temperature (Change in variability)	1.1	3.0	
	Air Temperature (Change in mean)	2.9	3.0	
	Air Temperature (Change in variability)	1.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	3.3	2.7	
	Sea Surface Salinity (Change in variability)	1.1	3.0	
	Ocean pH (Change in mean)	3.9	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	3.0	
	Dissolved oxygen (Change in variability)	1.1	3.0	
	Circulation	3.4	2.0	
	Sea level rise	3.9	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Florida Bay Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.93), Dissolved oxygen (Standard anomaly) (3.87), Sea level rise (3.87), and Sea Surface Temperature (Standard anomaly) (3.87).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.80), Site Fidelity (3.80), and Home Range (3.73).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93 % of the data quality scores were 2 or greater, 82 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Florida Bay Stock includes common bottlenose dolphins found in Florida Bay and within the Gulf of Mexico-side portion of the Florida Keys National Marine Sanctuary (FKNMS) southwest to Marathon, Florida (Waring et al. 2014).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017). Bottlenose dolphins in Florida Bay use three main foraging tactics, which vary across multiple habitats. However, individuals tend to specialize and only use one foraging tactic (Torres and Read 2009; Engleby and Powell 2019).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the Florida Bay Stock includes interconnected basins, grassy mud banks, mangrove islands, and shallow open water habitat, with runoff from the Everglades a primary input of freshwater (Fourqurean and Robblee 1999).

Site Fidelity

Torres (2007) found high individual site fidelity for common bottlenose dolphins in Florida Bay during summers (June-August) from 2002 to 2005. From August 2010 to June 2012, dedicated surveys were also carried out in the Florida coastal Everglades, including the northern portion of Florida Bay to investigate the occurrence, relative abundance, and behavior of bottlenose dolphins and suggested the need for additional research on site fidelity in Florida Bay due to low levels or resighting (Sarabia et al. 2018). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2014), such as in South Carolina (Sloan 2006; Waring et al. 2016), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). A mid-summer calving peak (July through August) has been reported for bottlenose dolphins off Puerto Rico (Rodríguez-Ferrer 2001). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (Waring et al. 2014; LaBrecque et al. 2015).

Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Durden et al. 2011; Waring et al. 2014; Waring et al. 2016), though some remain entirely in estuarine waters (Mazzoil et al. 2008a).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (Waring et al. 2014; LaBrecque et al. 2015). Surveys conducted by the Dolphin Ecology Project since 1999 suggest the presence of common bottlenose dolphins throughout Florida Bay (Engleby et al. 2002). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the SGES Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Torres (2007) identified 437 individuals from a summer-months photo-id catalog. Both of these studies may not differentiate between resident and non-resident individuals (Waring et al. 2014).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2014).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in Florida Bay interact with the hook and line fishery (Waring et al. 2014). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions (Waring et al. 2014; also see NOAA National Marine Mammal Health and Stranding Response Database). For example, during the period 2007–2011, five common bottlenose dolphins stranded within the boundaries of Florida Bay, with one individual presenting evidence of a propeller scar (Waring et al. 2014).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In nearby Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). However, studies have shown POP levels in Florida Bay dolphins to be among the lowest of all sampled in the southeast U.S. (Fair et al. 2003; Schwacke et al. 2004; Damseaux et al. 2017). In contrast, mercury has been detected in this stock at high concentrations relative to other stocks in the southeast United States (Damseaux et al. 2017).

The Florida Everglades that bound the northern edge of Florida Bay have been subjected to engineered flood control and water diversion that affect freshwater flow into Florida Bay and resulting changes in salinity and cascading effects on biota and habitat (Rudnick et al. 2005).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, P.E. Rosel, T.V.N. Cole, L. Engleby, L.P. Garrison, A. Henry, K. Mullin, C. Orphanides, R.M. Pace, D.L. Palka, M. Lyssikatos, and F.W. Wenzel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Damseaux, F., J.J. Kiszka, M.R. Heithaus, G. Scholl, G. Eppe, J.P. Thome, J. Lewis, W. Hao, M.C. Fontaine, and K. Das. 2017. Spatial variation in the accumulation of POPs and mercury in bottlenose dolphins of the Lower Florida Keys and the coastal Everglades (South Florida). Environmental Pollution 220(Pt A):577–587. doi: 10.1016/j.envpol.2016.10.005

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Engleby, L.K. and J.R. Powell. 2019. Detailed observations and mechanisms of mud ring feeding by common bottlenose dolphins (*Tursiops truncatus truncatus*) in Florida Bay, Florida, U.S.A. Marine Mammal Science 35(3):1162–1172. doi: 10.1111/mms.12583

Engleby, L.K., A.J. Read, D. Waples, and L. Torres. 2002. Habitat use of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay. Final Report to the Southeast Fisheries Science Center, National Marine Fisheries Service. 12 p.

Fair, P., L. Schwacke, E. Zolman, W. McFee, and L. Engleby. 2003. Assessment of contaminant concentrations in tissues of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay. Harbor Branch Oceanographic Institute Protect Wild Dolphins Grant. RFP-PWD-2001. 18 p.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fourqurean, J.W. and M.B. Robblee. 1999. Florida Bay: A history of recent ecological changes. Estuaries 22(2B):345–357. doi: 10.2307/1353203

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rodríguez-Ferrer, G. 2001. The bottlenose dolphin (*Tursiops truncatus* Montague 1821) of the southwest coast of Puerto Rico: An assessment of its status and habitat use. University of Puerto Rico. Thesis.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Rudnick, D.T., P.B. Ortner, J.A. Browder, and S.M. Davis. 2005. A conceptual ecological model of Florida Bay. Wetlands 25(4):870–883. doi: 10.1672/0277-5212(2005)025[0870:acemof]2.0.co;2

Sarabia, R.E., M.R. Heithaus, and J.J. Kiszka. 2018. Spatial and temporal variation in abundance, group size and behaviour of bottlenose dolphins in the Florida coastal Everglades. Journal of the Marine Biological Association of the United Kingdom 98(5):1097–1107. doi: 10.1017/s002531541700090x

Schwacke, L., A.J. Hall, R.S. Wells, G.D. Bossart, P. Fair, A.A. Hohn, P.R. Becker, J. Kucklick, G.B. Mitchum, and P.E. Rosel. 2004. Health and risk assessment for bottlenose dolphin (*Tursiops truncatus*) populations along the southeast United States coast: Current status and future plans. Paper presented to the IWC Scientific Committee: Sorrento, Italy. SC/56/E20 15 p.

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Indian River Lagoon Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 100% of scores≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.2	
	Habitat Specificity	3.4	2.0	
	Site Fidelity	3.7	2.8	
	Lifetime Reproductive Potential	1.9	2.2	
	Generation Length	2.7	2.2	
	Reproductive Plasticity	1.2	2.0	
	Migration	3.9	3.0	
	Home Range	3.8	3.0	
	Stock Abundance	2.9	3.0	
	Stock Abundance Trend	2.7	2.2	
	Cumulative Stressors	3.5	2.5	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.8	3.0	
	Air Temperature (Change in mean)	3.2	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	3.4	2.8	
	Sea Surface Salinity (Change in variability)	1.1	2.8	
	Ocean pH (Change in mean)	3.7	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.7	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	3.9	2.5	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Indian River Lagoon Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Sea level rise (3.95), Sea Surface Temperature (Standard anomaly) (3.95), Circulation (3.90), Dissolved oxygen (Standard anomaly) (3.70), and Ocean pH (Standard anomaly) (3.70).

Biological Sensitivity: Very High. Four sensitivity attributes scored greater than or equal to 3.5: Migration (3.90), Home Range (3.80), Site Fidelity (3.70), and Cumulative Stressors (3.50).

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 100% of the data quality scores were 2 or greater, 100% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Indian River Lagoon Estuarine System (IRLES) Stock includes common bottlenose dolphins in estuarine waters of Florida from Ponce de Leon Inlet in the north to Jupiter Inlet in the south, including the Intracoastal Waterway, Mosquito Lagoon, Indian River, Banana River and the St. Lucie Estuary (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the IRLES stock is characterized by estuarine tidal marsh systems (Waring et al. 2016). Greller et al. (2020) found salinity and dissolved oxygen to be key factors in common bottlenose dolphin habitat use in the IRLES.

Site Fidelity

Common bottlenose dolphins in the IRLES show strong site fidelity (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b, 2020). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000; Torres 2007; Sarabia et al. 2018), northern Florida (Caldwell 2001), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), and South Carolina (Sloan 2006; Speakman et al. 2006; Waring et al. 2016).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). A mid-summer calving peak (July through August) has been reported for bottlenose dolphins off Puerto Rico

(Rodríguez-Ferrer 2001). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016). In the IRLES, Durden et al. (2011) suggested movement of common bottlenose dolphins between the estuary and nearshore coastal waters, which was later supported by satellite tag data (Hartel et al. 2020). However, other studies suggest minimal movement between the estuary and nearshore coastal waters (Mazzoil et al. 2008a, 2011; Durden et al. 2019).

Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Waring et al. 2014; Waring et al. 2016).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Waring et al. 2016), though studies may underestimate the size of the home range if the survey area is not sufficiently large (Nekolny et al. 2017). Two radio-tracked rehabilitated dolphins in the IRLES remained within the IRLES until their deaths (100 days and 7 days post-tagging; Mazzoil et al. 2008b). Stable isotope analysis has suggested subpopulations within the IRLES based on home range (Browning et al. 2014).

Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Mazzoil et al. (2008a) identified 615 individuals during 2002-2005 photo-ID studies. Aerial surveys conducted from summer 2002 through spring 2004 provided estimates ranging from 362 (CV=0.29) for summer 2003 to 1316 (CV=0.24; Durden et al. 2011). Overall mean abundance during the summer 2002 through spring 2004 period was estimated at 662 individuals (CV=0.09; Durden et al. 2011). Durden et al. (2017) estimated the population at 1,032 individuals (95% CI: 809–1,255) using 2005–2011 aerial survey data. Durden et al. (2021) estimated the population at 1,032 individuals (95% CI: 969–1,098) using 2016 and 2017 boat-based survey data.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Fire et al. 2015, 2020), recreational and commercial fishing gear (Stolen et al. 2013; Marks et al. 2020), vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the IRLES stock interact with the blue crab trap/pot, stone crab trap/pot, and hook and line fisheries (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2016; also see NOAA National Marine Mammal Health and Stranding Response Database). For example, Stolen et al. (2007) reported that 834 total dolphins stranded in the IRLES during the period 1977–2005, with more strandings in spring and summer. During the period 2009–2013, 227 common bottlenose dolphins stranded within the IRLES, with 30 individuals presenting interactions with fishing gear (Waring et al. 2016).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016). During 2013, the IRLES Stock experienced a separate UME attributed to ecological factors (NMFS 2022). The IRLES Stock also experienced UMEs in 2001 and 2008, with toxins and infections contributing as possible causes (Fire et al. 2015; Waring et al. 2016). Dolphin morbillivirus has been detected in individuals from this stock during and outside of UMEs (Bossart et al. 2010, 2011, 2017, 2019).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). In the IRLES, bottlenose dolphin tissues have shown high persistent POP concentrations (Hansen et al. 2004; Durden et al. 2007; Stavros et al. 2007, 2008; Fair et al. 2010; Stavros et al. 2011; Reif et al. 2017; Lynch et al. 2019), as well as high levels of lead, mercury, and selenium (Schaefer et al. 2011, 2015; Stavros et al. 2011; Titcomb et al. 2017; Reif et al. 2017; Page-

Karjian et al. 2020) that may result in adverse effects on health or reproductive rates. The IRLES stock has also been found to have high concentrations of per- and poly-fluoroalkyl substances (PFAS; Fair et al. 2012).

Human feeding of dolphins has been observed in the IRLES, with possible implications for increased interactions with fishing gear (Waring et al. 2016). Vessel strikes and altered behavior due to anthropogenic sound are additional threats to dolphins in IRLES (Bechdel et al. 2009).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bechdel, S.E., M.S. Mazzoil, M.E. Murdoch, E.M. Howells, J.S. Reif, S.D. McCulloch, A.M. Schaefer, and G.D. Bossart. 2009. Prevalence and impacts of motorized vessels on bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 35(3):367–377. doi: 10.1578/am.35.3.2009.367

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bossart, G.D., P. Fair, A.M. Schaefer, and J.S. Reif. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. I. Infectious diseases. Diseases of Aquatic Organisms 125(2):141–153. doi: 10.3354/dao03142

Bossart, G.D., J.S. Reif, A.M. Schaefer, J. Goldstein, P.A. Fair, and J.T. Saliki. 2010. Morbillivirus infection in free-ranging Atlantic bottlenose dolphins (*Tursiops truncatus*) from the Southeastern United States: Seroepidemiologic and pathologic evidence of subclinical infection. Veterinary Microbiology 143(2-4):160–166. doi: 10.1016/j.vetmic.2009.11.024

Bossart, G.D., T.A. Romano, M.M. Peden-Adams, A. Schaefer, S. McCulloch, J.D. Goldstein, C.D. Rice, J.T. Saliki, P.A. Fair, and J.S. Reif. 2011. Clinicoimmunopathologic findings in Atlantic bottlenose dolphins *Tursiops truncatus* with positive cetacean morbillivirus antibody titers. Diseases of Aquatic Organisms 97(2):103–112. doi: 10.3354/dao02410

Bossart, G.D., T.A. Romano, M.M. Peden-Adams, A.M. Schaefer, C.D. Rice, P.A. Fair, and J.S. Reif. 2019. Comparative innate and adaptive immune responses in Atlantic bottlenose dolphins (*Tursiops truncatus*) with viral, bacterial, and fungal infections. Frontiers in Immunology 10:1125. doi: 10.3389/fimmu.2019.01125

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Browning, N.E., S.D. McCulloch, G.D. Bossart, and G.A.J. Worthy. 2014. Fine-scale population structure of estuarine bottlenose dolphins (*Tursiops truncatus*) assessed using stable isotope ratios and fatty acid signature analyses. Marine Biology 161(6):1307–1317. doi: 10.1007/s00227-014-2420-z

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., G. O'Corry-Crowe, S. Shippee, T. Jablonski, S. Rodgers, M. Mazzoil, E. Howells, E. Hartel, B. Potgieter, C. Londono, L. Moreland, F. Townsend, S. McCulloch, and G. Bossart. 2019. Small-scale movement patterns, activity budgets, and association patterns of radio-tagged Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 45(1):66–87. doi: 10.1578/am.45.1.2019.66

Durden, W.N., E.D. Stolen, T. Jablonski, L. Moreland, E. Howells, A. Sleeman, M. Denny, G. Biedenbach, and M. Mazzoil. 2021. Abundance and demography of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Indian River Lagoon, Florida: A robust design capture-recapture analysis. PLoS ONE 16(4):e0250657. doi: 10.1371/journal.pone.0250657

Durden, W.N., E.D. Stolen, T.A. Jablonski, S.A. Puckett, and M.K. Stolen. 2017. Monitoring seasonal abundance of indian river lagoon bottlenose dolphins (*Tursiops truncatus*) using aerial surveys. Aquatic Mammals 43(1):90–112. doi: 10.1578/am.43.1.2017.90

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fair, P.A., M. Houde, T.C. Hulsey, G.D. Bossart, J. Adams, L. Balthis, and D.C.G. Muir. 2012. Assessment of perfluorinated compounds (PFCs) in plasma of bottlenose dolphins from two southeast US estuarine areas: relationship with age, sex and geographic locations. Marine Pollution Bulletin 64(1):66–74. doi: 10.1016/j.marpolbul.2011.10.022

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fire, S.E., J.A. Browning, W.N. Durden, and M.K. Stolen. 2020. Comparison of during-bloom and inter-bloom brevetoxin and saxitoxin concentrations in Indian River Lagoon bottlenose dolphins, 2002-2011. Aquatic Toxicolology 218:105371. doi: 10.1016/j.aquatox.2019.105371

Fire, S.E., L.J. Flewelling, M. Stolen, W. Noke Durden, M. de Wit, A.C. Spellman, and Z. Wang. 2015. Brevetoxin-associated mass mortality event of bottlenose dolphins and manatees along the east coast of Florida, USA. Marine Ecology Progress Series 526:241–251. doi: 10.3354/meps11225

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Greller, R., M. Mazzoli, E. Titcomb, B. Nelson, R. Paperno, and S.H. Markwith. 2020. Environmental drivers of habitat use by common bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida, USA. Marine Mammal Science 37(2):512–532. doi: 10.1111/mms.12767

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hartel, E.F., W. Noke Durden, and G. O’Corry-Crowe. 2020. Testing satellite telemetry within narrow ecosystems: nocturnal movements and habitat use of bottlenose dolphins within a convoluted estuarine system. Animal Biotelemetry 8(1):13. doi: 10.1186/s40317-020-00200-4

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In:

Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Lynch, K.M., P.A. Fair, M. Houde, D.C.G. Muir, K. Kannan, G.D. Bossart, S.M. Bartell, and M.O. Gribble. 2019. Temporal trends in per- and polyfluoroalkyl substances in bottlenose dolphins (*Tursiops truncatus*) of Indian River Lagoon, Florida and Charleston, South Carolina. Environmental Science & Technology 53(24):14194–14203. doi: 10.1021/acs.est.9b04585

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Marks, W., S. Burton, E. Stratton, E. Zolman, G. Biedenbach, and A. Page-Karjian. 2020. A case study of monofilament line entanglement in a common bottlenose dolphin (*Tursiops truncatus*): entanglement, disentanglement, and subsequent death. BMC Vet Res 16(1):223. doi: 10.1186/s12917-020-02436-x

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., Q. Gibson, W.N. Durden, R. Borkowski, G. Biedenbach, Z. McKenna, N. Gordon, K. Brightwell, M. Denny, E. Howells, J. Jakush, L. Moreland, A. Perna, G. Pinto, and M. Caldwell. 2020. Spatiotemporal movements of common bottlenose dolphins (*Tursiops truncatus truncatus*) in northeast Florida, USA. Aquatic Mammals 46(3):285–300. doi: 10.1578/am.46.3.2020.285

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., M.E. Murdoch, E. Howells, S.E. Bechdel, M. deSieyes, J.S. Reif, G.D. Bossart, and S.D. McCulloch. 2011. Occurrence, site fidelity, and group size of bottlenose dolphins (*Tursiops truncatus*) along the Atlantic Ocean in Florida, and evaluation of movements into the Indian River Lagoon, Florida. Florida Scientist 74:25–37.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

National Marine Fisheries Service (NMFS). 2022. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Nekolny, S.R., M. Denny, G. Biedenbach, E.M. Howells, M. Mazzoil, W.N. Durden, L. Moreland, J. David Lambert, and Q.A. Gibson. 2017. Effects of study area size on home range estimates of common bottlenose dolphins *Tursiops truncatus*. Curr Zool 63(6):693–701. doi: 10.1093/cz/zox049

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rodríguez-Ferrer, G. 2001. The bottlenose dolphin (*Tursiops truncatus* Montague 1821) of the southwest coast of Puerto Rico: An assessment of its status and habitat use. University of Puerto Rico. Thesis.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sarabia, R.E., M.R. Heithaus, and J.J. Kiszka. 2018. Spatial and temporal variation in abundance, group size and behaviour of bottlenose dolphins in the Florida coastal Everglades. Journal of the

Marine Biological Association of the United Kingdom 98(5):1097–1107. doi: 10.1017/s002531541700090x

Schaefer, A.M., H.C. Stavros, G.D. Bossart, P.A. Fair, J.D. Goldstein, and J.S. Reif. 2011. Associations between mercury and hepatic, renal, endocrine, and hematological parameters in Atlantic bottlenose dolphins (*Tursiops truncatus*) along the eastern coast of Florida and South Carolina. Arch Environ Contam Toxicol 61(4):688–695. doi: 10.1007/s00244-011-9651-5

Schaefer, A.M., E.M. Titcomb, P.A. Fair, H.W. Stavros, M. Mazzoil, G.D. Bossart, and J.S. Reif. 2015. Mercury concentrations in Atlantic bottlenose dolphins (*Tursiops truncatus*) inhabiting the Indian River Lagoon, Florida: Patterns of spatial and temporal distribution. Marine Pollution Bulletin 97(1-2):544–547. doi: 10.1016/j.marpolbul.2015.05.007

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Stolen, M.K., W.N. Durden, and D.K. Odell. 2007. Historical synthesis of bottlenose dolphin (*Tursiops truncatus*) stranding data in the Indian River Lagoon system, Florida, from 1977–2005. Florida Scientist 70(1):45–54.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Jacksonville Estuarine System Stock

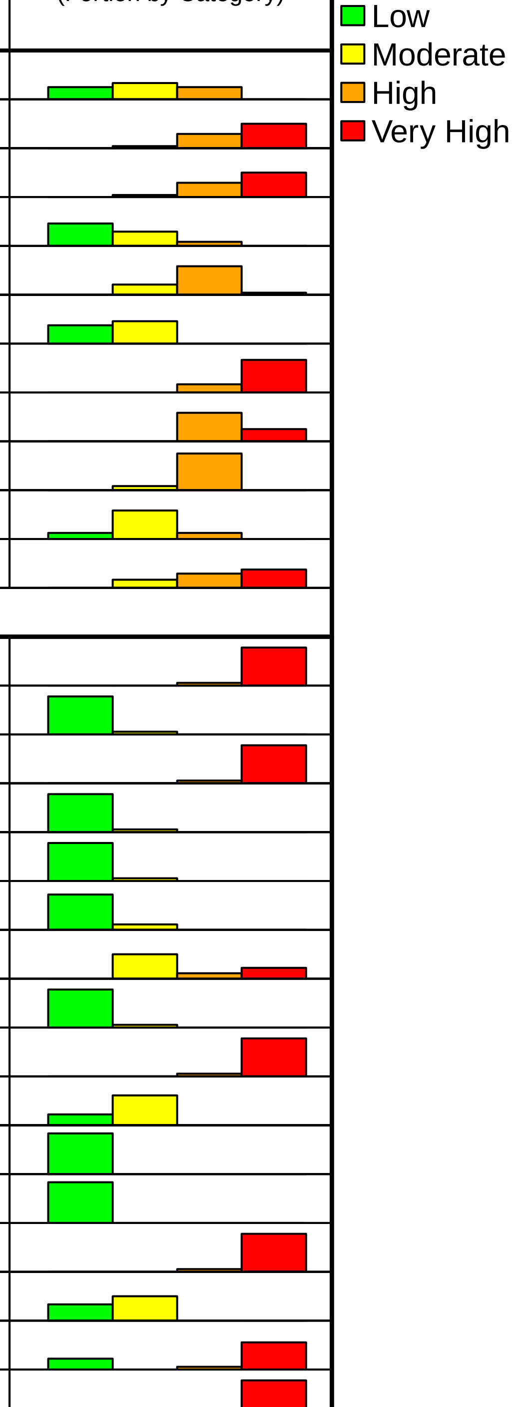
Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.0	
	Habitat Specificity	3.5	1.8	
	Site Fidelity	3.5	2.5	
	Lifetime Reproductive Potential	1.6	2.2	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.6	2.0	
	Migration	3.8	2.2	
	Home Range	3.3	2.2	
	Stock Abundance	2.9	2.2	
	Stock Abundance Trend	2.0	1.0	
	Cumulative Stressors	3.2	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.7	
	Sea Surface Temperature (Change in variability)	1.1	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.1	2.7	
	Precipitation (Change in mean)	1.1	2.7	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	2.7	2.7	
	Sea Surface Salinity (Change in variability)	1.1	2.7	
	Ocean pH (Change in mean)	3.9	2.7	
	Ocean pH (Change in variability)	1.7	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	2.7	
	Dissolved oxygen (Change in variability)	1.6	2.7	
	Circulation	3.1	2.3	
	Sea level rise	3.9	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		



Common bottlenose dolphin (Jacksonville Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (3.93), Dissolved oxygen (Standard anomaly) (3.93), Ocean pH (Standard anomaly) (3.93), Sea level rise (3.93), and Sea Surface Temperature (Standard anomaly) (3.93).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Migration (3.80), Habitat Specificity (3.55), and Site Fidelity (3.55).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Jacksonville Estuarine System (JES) Stock includes common bottlenose dolphins found in estuarine waters of Florida from the Florida/Georgia border at Cumberland Sound in the north to Jacksonville Beach in the south, including St. Mary's, Amelia, Nassau, Fort George, and St. Johns Rivers (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the JES stock is characterized by estuarine tidal marshes and shallow riverine systems with sand, mud or oyster bed substrate (Waring et al. 2016). One river, the St. Johns River, is deep with swift currents (Caldwell 2001). Individuals within this stock have shown variable patterns of preference for different types of habitat, with individuals in the northern areas of the range showing greater preference and individuals in the southern areas showing less preference (Caldwell 2016a, 2016b).

Site Fidelity

Common bottlenose dolphins in the JES comprise several groups with differing site fidelity: one group showed year-round site fidelity, one showed summer site fidelity, and one group showed no long-term site fidelity (Caldwell 2001, 2016a). A separate study also found subgroups with high levels of fidelity to distinct areas of the estuary (Mazzoil et al. 2020). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000; Torres 2007; Sarabia et al. 2018), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), and South Carolina (Sloan 2006; Speakman et al. 2006; Waring et al. 2016).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). A mid-summer calving peak (July through August) has been reported for bottlenose dolphins off Puerto Rico (Rodríguez-Ferrer 2001). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016). In the JES, Caldwell (2001) identified one group of dolphins with year-round residency, and two groups that showed movement into and out of the JES.

Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Waring et al. 2014; Waring et al. 2016).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Waring et al. 2016), though studies may underestimate the size of the home range if the survey area is not sufficiently large (Nekolny et al. 2017). In the nearby Indian River Lagoon Estuarine System (IRLES), two radio-tracked rehabilitated dolphins remained within the IRLES until their deaths (100 days and 7 days post-tagging; Mazzoil et al. 2008b). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Caldwell (2001) identified 122 dolphins that were resighted at least 10 times in the JES from 1994 to 1997. Gubbins et al. (2003) estimated the abundance in the JES at 412 individuals (CV=0.06), however did not distinguish between resident and non-resident (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Brown et al. 2018, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the JES stock interact with the blue crab trap/pot, stone crab trap/pot, and hook and line fisheries (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2016; also see NOAA National Marine Mammal Health and Stranding Response Database). For example, during the period 2009–2013, 71 common bottlenose dolphins stranded within the JES, with 18 individuals presenting human interactions such as fishing gear and vessel interactions (Waring et al. 2016).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016). In 2010, 23 individuals in the St. Johns River were involved in a UME of undetermined cause (Waring et al. 2016; NMFS 2022).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). The JES Stock inhabits a highly urbanized and industrialized area. No published contaminant studies were found for the JES Stock.

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727
Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x
Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052
Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2
Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2
Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113
Brown, A., A. Foss, M.A. Miller, and Q. Gibson. 2018. Detection of cyanotoxins (microcystins/nodularins) in livers from estuarine and coastal bottlenose dolphins (*Tursiops truncatus*) from Northeast Florida. Harmful Algae 76:22–34. doi: 10.1016/j.hal.2018.04.011
Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.
Caldwell, M. 2016a. Historical evidence of *Tursiops truncatus* exhibiting habitat preference and seasonal fidelity in Northeast Florida. Aquatic Mammals 42(1):89–103. doi: 10.1578/am.42.1.2016.89
Caldwell, M. 2016b. Historical seasonal density and distribution patterns of *Tursiops truncatus* in Northeast Florida. Aquatic Mammals 42(1):74–88. doi: 10.1578/am.42.1.2016.74
Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.
Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., Q. Gibson, W.N. Durden, R. Borkowski, G. Biedenbach, Z. McKenna, N. Gordon, K. Brightwell, M. Denny, E. Howells, J. Jakush, L. Moreland, A. Perna, G. Pinto, and M. Caldwell. 2020. Spatiotemporal movements of common bottlenose dolphins (*Tursiops truncatus truncatus*) in northeast Florida, USA. Aquatic Mammals 46(3):285–300. doi: 10.1578/am.46.3.2020.285

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

National Marine Fisheries Service (NMFS). 2022. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Nekolny, S.R., M. Denny, G. Biedenbach, E.M. Howells, M. Mazzoil, W.N. Durden, L. Moreland, J. David Lambert, and Q.A. Gibson. 2017. Effects of study area size on home range estimates of common bottlenose dolphins *Tursiops truncatus*. Curr Zool 63(6):693–701. doi: 10.1093/cz/zox049

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rodríguez-Ferrer, G. 2001. The bottlenose dolphin (*Tursiops truncatus* Montague 1821) of the southwest coast of Puerto Rico: An assessment of its status and habitat use. University of Puerto Rico. Thesis.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sarabia, R.E., M.R. Heithaus, and J.J. Kiszka. 2018. Spatial and temporal variation in abundance, group size and behaviour of bottlenose dolphins in the Florida coastal Everglades. Journal of the Marine Biological Association of the United Kingdom 98(5):1097–1107. doi: 10.1017/s002531541700090x

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.
Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235
Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Northern Georgia/ Southern South Carolina Estuarine System Stock

Overall Vulnerability Rank = Very High

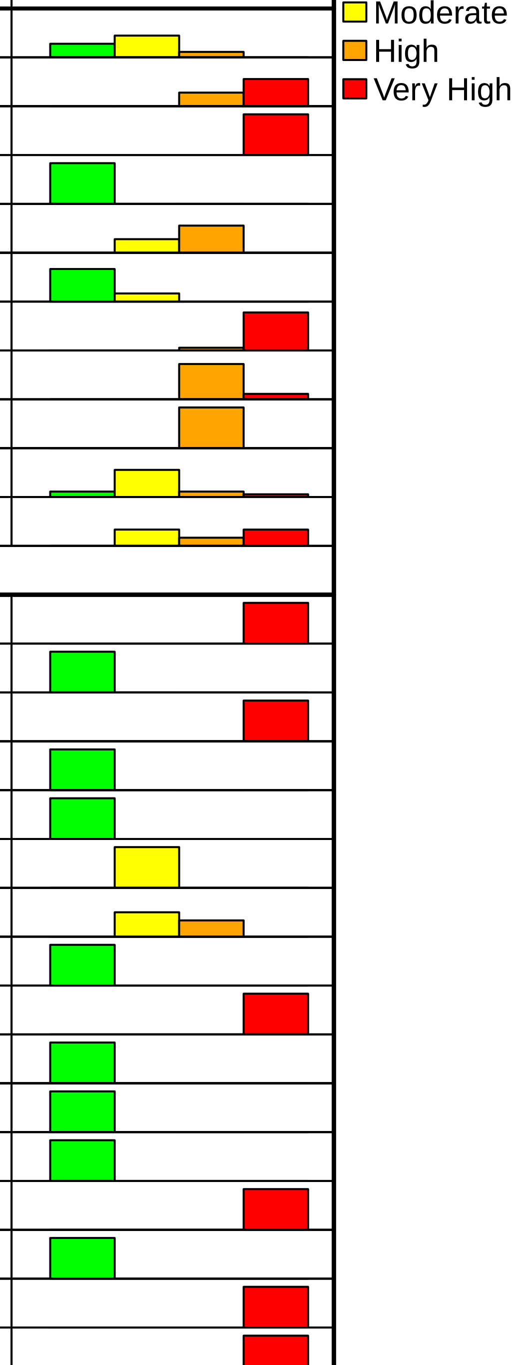
Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality
Sensitivity attributes	Prey/Diet Specificity	1.8	2.0
	Habitat Specificity	3.7	2.0
	Site Fidelity	4.0	2.7
	Lifetime Reproductive Potential	1.0	2.3
	Generation Length	2.7	2.3
	Reproductive Plasticity	1.2	2.3
	Migration	3.9	2.7
	Home Range	3.1	2.7
	Stock Abundance	3.0	2.3
	Stock Abundance Trend	2.1	1.7
	Cumulative Stressors	3.0	2.7
	Sensitivity Score	Very High	
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0
	Sea Surface Temperature (Change in variability)	1.0	3.0
	Air Temperature (Change in mean)	4.0	3.0
	Air Temperature (Change in variability)	1.0	3.0
	Precipitation (Change in mean)	1.0	3.0
	Precipitation (Change in variability)	2.0	3.0
	Sea Surface Salinity (Change in mean)	2.4	3.0
	Sea Surface Salinity (Change in variability)	1.0	3.0
	Ocean pH (Change in mean)	4.0	3.0
	Ocean pH (Change in variability)	1.0	3.0
	Sea ice coverage (Change in mean)	1.0	3.0
	Sea ice coverage (Change in variability)	1.0	3.0
	Dissolved oxygen (Change in mean)	4.0	3.0
	Dissolved oxygen (Change in variability)	1.0	3.0
	Circulation	4.0	1.7
	Sea level rise	4.0	3.0
	Exposure Score	Very High	
Overall Vulnerability Rank		Very High	

Expert Scores Plots (Portion by Category)



Common bottlenose dolphin (Northern Georgia/Southern South Carolina Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Circulation (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), and Sea Surface Temperature (Standard anomaly) (4.0).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Site Fidelity (4.00), Migration (3.93), and Habitat Specificity (3.67).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stock includes common bottlenose dolphins found in estuarine waters and nearshore waters (out to 1km) of Georgia and South Carolina from the southern extent of the North Edisto River in the north to the northern extent of Ossabaw Sound in the south, including St. Helena, Port Royal, Calibogue and Wassaw Sounds (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017). Individuals of this stock have been observed strand-feeding for mullet (*Mugil* sp.) and menhaden (*Brevoortia tyrannus*; Gisburne and Connor 2015). Stable isotope data suggests differences in common bottlenose dolphin forage composition among estuaries along the South Carolina coast and between estuaries and the nearshore coastal populations (Olin et al. 2012).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the NGSSCES Stock is characterized by extensive tidal marshes, shallow estuaries, and riverine input (Savannah, Coosawhatchie, Combahee Rivers; Waring et al. 2016).

Site Fidelity

No specific site fidelity information was found for this stock. Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in South Carolina (Sloan 2006; Speakman et al. 2006; Waring et al. 2016), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings.

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016).

Gubbins et al. (2003) reported seasonal variation in dolphin abundance near Hilton Head, with peaks in abundance during May and July. Taylor et al. (2016) found stronger interannual variation in abundance compared to seasonal variation in abundance in the area around St. Catherine's. Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Durden et al. 2011; Waring et al. 2014; Waring et al. 2016), though some remain entirely in estuarine waters (Mazzoil et al. 2008a).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Waring et al. 2016). Gubbins (2002a, 2002b, 2002c) identified both resident and transient individuals in the area around Hilton Head. Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Based on photo-ID data from 1994 to 1998, 234 individually identified dolphins were observed (Gubbins et al. 2003), which included 52 year-round residents and an unspecified number of seasonal residents and transients.

Gubbins et al. (2003) estimated to abundance of common bottlenose dolphins in the area around Hilton head be 525 individuals (CV=0.16) based on mark-recapture analyses; however, this estimate did not differentiate between resident and transient dolphins and did not include the entire range occupied by the NGSSCES Stock.

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the NGSSCES stock interact with the blue crab trap/pot and hook and line fisheries (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2016; also see NOAA National Marine Mammal Health and Stranding Response Database). During the period 2009–2013, 105 common bottlenose dolphins stranded within the NGSSCES, with 18 individuals presenting human interactions such as fishing gear and vessel interactions (Waring et al. 2016; Seguel et al. 2020). The cause of death for six of the other stranded individuals was likely high concentrations of persistent organic pollutants (POPs; Seguel et al. 2020).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016). A UME for bottlenose dolphins was declared in winter and spring of 2011 in South Carolina, during which common bottlenose dolphins stranded at a rate nearly three times the historical average, with evidence suggesting an unusually cold winter and decreased prey abundance contributed to the UME (Waring et al. 2016).

Common bottlenose dolphins stranded in South Carolina show a high prevalence of the gram-negative facultative intracellular bacterium *Brucella ceti* found in the tissues of brain, lung, and other tissues (McFee et al. 2020). Nearly 32% of dolphins tested positive for *B. ceti* over the six year study period, coinciding with the calving period.

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). The NGSSCES Stock inhabits a highly urbanized and industrialized area that includes the large population centers of Savannah, Georgia, and Hilton Head, South Carolina. Analyses of contaminants have found elevated PCB concentrations in dolphins in the Turtle/Brunswick River Estuary relative to dolphins in the Savannah area (Pulster and Maryua 2008; Pulster et al. 2009). Common bottlenose dolphins stranded along the South Carolina coast have been found with ingested microplastics (Battaglia et al. 2020).

Human feeding of dolphins has been observed in the NGSSCES, with possible implications for increased interactions with fishing gear and behavioral adaptation (Powell and Wells 2011; Wu 2013; Kovacs and Cox 2014; Perrtree et al. 2014; Hazelkorn et al. 2016). Vessel strikes, habitat degradation, and altered behavior due to boating activity are additional threats to dolphins in NGSSCES (Richardson et al. 1995; Ketten 1998; Gubbins 2002b, 2003; Mattson et al. 2005).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Battaglia, F.M., B.A. Beckingham, and W.E. McFee. 2020. First report from North America of microplastics in the gastrointestinal tract of stranded bottlenose dolphins (*Tursiops truncatus*). Marine Pollution Bulletin 160:111677. doi: 10.1016/j.marpolbul.2020.111677

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gisburne, T.J. and R.C. Connor. 2015. Group size and feeding success in strand-feeding bottlenose dolphins (*Tursiops truncatus*) in Bull Creek, South Carolina. Marine Mammal Science 31(3):1252–1257. doi: 10.1111/mms.12207

Gubbins, C. 2002a. Use of home ranges by resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. Journal of Mammalogy 83(1):178–187. doi: 10.1644/1545-1542(2002)083<0178:Uohrbr>2.0.Co;2

Gubbins, C.M. 2002b. Association patterns of resident bottlenose dolphins (*Tursiops truncatus*) in a South Carolina estuary. Aquatic Mammals 28:24–31.

Gubbins, C.M. 2002c. The dolphins of Hilton Head: Their natural history. University of South Carolina Press, Columbia, SC. 96 p. doi: 10.2307/j.ctv1htpdsv

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hazelkorn, R.A., B.A. Schulte, and T.M. Cox. 2016. Persistent effects of begging on common bottlenose dolphin (*Tursiops truncatus*) behavior in an estuarine population. Aquatic Mammals 42(4):531–541. doi: 10.1578/am.42.4.2016.531

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Ketten, D.R. 1998. Marine mammal auditory systems: A summary of audiometric and anatomical data and its implications for underwater acoustic impacts. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. NOAA Technical Memorandum NMFS-SWFSC-256. 74 p.

Kovacs, C. and T. Cox. 2014. Quantification of interactions between common bottlenose dolphins (*Tursiops truncatus*) and a commercial shrimp trawler near Savannah, Georgia. Aquatic Mammals 40(1):81–94. doi: 10.1578/Am.40.1.2014.81

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mattson, M.C., J.A. Thomas, and D. St. Aubin. 2005. Effects of boat activity on the behavior of bottlenose dolphins (*Tursiops truncatus*) in waters surrounding Hilton Head Island, South Carolina. Aquatic Mammals 31(1):133–140. doi: 10.1578/am.31.1.2005.133

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.
McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055
McFee, W.E., D. Wu, K. Colegrove, K. Terio, L. Balthis, and R. Young. 2020. Occurrence of *Brucella ceti* in stranded bottlenose dolphins *Tursiops truncatus* coincides with calving season. Diseases of Aquatic Organisms 141:185–193. doi: 10.3354/dao03526
Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.
Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.
Olin, J.A., P.A. Fair, M.A. Recks, E. Zolman, J. Adams, and A.T. Fisk. 2012. Unique seasonal forage bases within a local population of bottlenose dolphin (*Tursiops truncatus*). Marine Mammal Science 28(1):E28–E40. doi: 10.1111/j.1748-7692.2011.00470.x
Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630
Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101
Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.
Perrtree, R.M., C.J. Kovacs, and T.M. Cox. 2014. Standardization and application of metrics to quantify human-interaction behaviors by the bottlenose dolphin (*Tursiops* spp.). Marine Mammal Science 30(4):1320–1334. doi: 10.1111/mms.12114
Powell, J.R. and R.S. Wells. 2011. Recreational fishing depredation and associated behaviors involving common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Mammal Science 27(1):111–129. doi: 10.1111/j.1748-7692.2010.00401.x
Pulster, E.L. and K.A. Maruya. 2008. Geographic specificity of Aroclor 1268 in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia (USA). Science of the Total Environment 393(2-3):367–375. doi: 10.1016/j.scitotenv.2007.12.031
Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1
Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143
Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D. Thomas, II. 1995. Marine mammals and noise. Academic Press, San Diego, CA. 576 p.
Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Seguel, M., R.C. George, G. Maboni, S. Sanchez, A. Page-Karjian, E. Wirth, W. McFee, and N.L. Gottdenker. 2020. Pathologic findings and causes of death in bottlenose dolphins *Tursiops truncatus* stranded along the Georgia coast, USA (2007-2013). Diseases of Aquatic Organisms 141:25–38. doi: 10.3354/dao03509

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, A.R., J.H. Schacke, T.R. Speakman, S.B. Castleberry, and R.B. Chandler. 2016. Factors related to common bottlenose dolphin (*Tursiops truncatus*) seasonal migration along South Carolina and Georgia coasts, USA. Animal Migration 3(1):14–26. doi: 10.1515/ami-2016-0002

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Wu, C. 2013. Human and boat interactions with common bottlenose dolphins (*Tursiops truncatus*) in the waterways around Savannah, Georgia. Savannah State University. Thesis. 101 p.

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Northern North Carolina Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 100% of scores≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	2.5	
	Habitat Specificity	3.4	2.0	
	Site Fidelity	3.9	2.0	
	Lifetime Reproductive Potential	1.3	2.5	
	Generation Length	3.0	2.5	
	Reproductive Plasticity	1.5	2.5	
	Migration	3.9	2.5	
	Home Range	3.7	2.0	
	Stock Abundance	3.0	3.0	
	Stock Abundance Trend	2.0	3.0	
	Cumulative Stressors	3.1	2.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.5	2.5	
	Sea Surface Salinity (Change in mean)	3.3	2.5	
	Sea Surface Salinity (Change in variability)	1.4	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.0	2.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.0	2.5	
	Circulation	3.8	2.5	
	Sea level rise	4.0	2.5	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Northern North Carolina Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea level rise (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Circulation (3.8).

Biological Sensitivity: Very High. Three sensitivity attributes score greater than 3.5: Migration (3.9), Site Fidelity (3.9), and Home Range (3.7).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 100 % of the data quality scores were 2 or greater, 100 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Northern North Carolina Estuarine System (NNCES) Stock includes common bottlenose dolphins found in waters of the Pamlico Sound estuarine system and nearshore coastal waters (out to 1km) of North Carolina from Beaufort north to southern Virginia and the lower Chesapeake Bay (Hayes et al. 2021). During colder water months, many animals move out of the estuaries and occupy coastal waters (≤3 km from shore) between the New River and Oregon Inlet, North Carolina.

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the NNCES Stock is characterized by tidal marshes, estuarine waters, and shallow open water (Hayes et al. 2021).

Site Fidelity

No specific site fidelity information was found for this stock. Other estuarine stocks in the western North Atlantic have shown site fidelity (Hayes et al. 2021), such as in South Carolina (Sloan 2006; Speakman et al. 2006; Hayes et al. 2021), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida coast (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000). The site fidelity shown in other estuarine stocks suggests this stock may also show site fidelity.

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings in the Charleston Estuarine System Stock peak in spring and early summer and again in early autumn (McFee et al. 2014).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2021).

Some of the NNCES Stock moves out of Pamlico Sound during colder water months to occupy coastal waters (< 3km from shore) between the New River and Cape Hatteras (Goodman Hall et al. 2013; Hayes et al. 2021). Individuals of the NNCES Stock that are found in Chesapeake Bay show a similar seasonal pattern with a peak in sightings during the summer (Rodriguez et al. 2021).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Hayes et al. 2021). Individuals of this stock are known to move as far north as Virginia Beach and Chesapeake Bay, as far south as New River, North Carolina and into the coastal waters off of Cape Hatteras (Hayes et al. 2021; also see Hansen and Wells 1996; Cortese 2000; NMFS 2001; Read et al. 2003; Goodman Hall et al. 2013). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

The best available abundance estimate for the NNCES stock is 823 individuals (CV=0.06) based on photo-ID mark-recapture surveys in summer 2013 (Gorgone et al. 2014). The survey did not cover the entire stock's range (i.e., coastal waters), thus, the estimate may be negatively biased.

Stock Abundance Trend

A trend analysis has not been conducted for this stock (Hayes et al. 2021), however Gorgone et al. (2014) noted that the 2013 abundance estimate was similar to estimates using different methods from 2006 (Urian et al. 2013) and 2000 (Read et al. 2003).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Goodman Hall et al. 2013; Byrd et al. 2014; Byrd and Hohn 2017), vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the NNCES Stock interact with several commercial fisheries. These include gillnet, long haul seine, haul/beach seine, pound net, roe mullet stop net, blue crab trap/pot, and hook and line fisheries. The minimum total mean annual human-caused mortality and serious injury for fisheries and other human causes ranged between 7.2 and 30.0 dolphins annually during 2014–2018 (Hayes et al. 2021). During 2014–2018, 480 common bottlenose dolphins stranded that could be considered part of the NNCES, with 66 individuals presenting evidence of human interactions such as fishing gear and vessel interactions (Hayes et al. 2021; also see NOAA National Marine Mammal Health and Stranding Response Database).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1600 common bottlenose dolphins stranding as a result of morbillivirus (Hayes et al. 2021). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Hayes et al. 2021). In 2009, 40 individuals in Virginia were involved in a UME of undetermined cause (NMFS 2022).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). The NNCES Stock inhabits an area that receives runoff from agricultural, industrial, and urban sources. Analyses of common bottlenose dolphins around the Beaufort, NC area have found elevated levels of POPs(Schwacke et al. 2002; Hansen et al. 2004). Individuals from this stock have been found to have detectable concentrations of lead, mercury, and selenium, though at lower levels than the Indian River Lagoon Estuarine System in Florida (Page-Karjian et al. 2020).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Byrd, B.L. and A.A. Hohn. 2017. Differential risk of bottlenose dolphin (*Tursiops truncatus*) bycatch in North Carolina, USA. Aquatic Mammals 43(5):558–569. doi: 10.1578/Am.43.5.2017.558

Byrd, B.L., A.A. Hohn, G.N. Lovewell, K.M. Altman, S.G. Barco, A. Friedlaender, C.A. Harms, W.A. McLellan, K.T. Moore, P.E. Rosel, and V.G. Thayer. 2014. Strandings as indicators of marine mammal biodiversity and human interactions off the coast of North Carolina. Fishery Bulletin 112(1):1–23. doi: 10.7755/fb.112.1.1

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Cortese, N.A. 2000. Delineation of bottlenose dolphin populations in the western Atlantic Ocean using stable isotopes. University of Virginia. Thesis. 118 p.

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Goodman Hall, A., J. Braun McNeill, P.B. Conn, E. Davenport, and A.A. Hohn. 2013. Seasonal co-occurrence of sea turtles, bottlenose dolphins, and commercial gill nets in southern Pamlico and northern Core Sounds, and adjacent coastal waters of North Carolina, USA. Endangered Species Research 22(3):235–249. doi: 10.3354/esr00539

Gorgone, A.M., T. Eguchi, B.L. Byrd, K.M. Altman, and A.A. Hohn. 2014. Estimating the abundance of the Northern North Carolina Estuarine System Stock of common bottlenose dolphins (*Tursiops truncatus*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, NOAA Beaufort Laboratory: Beaufort, NC. NOAA Technical Memorandum NMFS-SEFSC-664. 22 p. doi: 10.7289/V5VH5KS8

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hansen, L.J. and R.S. Wells. 1996. Bottlenose dolphin health assessment: Field report on sampling near Beaufort, North Carolina, during July, 1995. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Charleston Laboratory: Charleston, SC. NOAA Technical Memorandum NMFS-SEFSC-382. 24 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

National Marine Fisheries Service (NMFS). 2001. Preliminary stock structure of coastal bottlenose dolphins along the Atlantic coast of the US. NMFS/SEFSC Report prepared for the Bottlenose Dolphin Take Reduction Team. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center. 41 p.

National Marine Fisheries Service (NMFS). 2022. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Read, A.J., K.W. Urian, B. Wilson, and D.M. Waples. 2003. Abundance of bottlenose dolphins in the bays, sounds, and estuaries of North Carolina. Marine Mammal Science 19(1):59–73. doi: 10.1111/j.1748-7692.2003.tb01092.x

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rodriguez, L.K., A.D. Fandel, B.R. Colbert, J.C. Testa, and H. Bailey. 2021. Spatial and temporal variation in the occurrence of bottlenose dolphins in the Chesapeake Bay, USA, using citizen science sighting data. PLoS ONE 16(5):e0251637. doi: 10.1371/journal.pone.0251637

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Northern South Carolina Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	3.7	2.0	
	Site Fidelity	4.0	2.7	
	Lifetime Reproductive Potential	1.5	2.0	
	Generation Length	3.0	2.0	
	Reproductive Plasticity	1.7	2.0	
	Migration	3.9	2.7	
	Home Range	3.3	2.7	
	Stock Abundance	3.0	2.7	
	Stock Abundance Trend	2.2	1.3	
	Cumulative Stressors	2.2	2.3	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	2.0	3.0	
	Sea Surface Salinity (Change in mean)	3.7	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	4.0	2.0	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (Northern South Carolina Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Seven exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Circulation (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Sea Surface Salinity (Standard anomaly) (3.73).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Site Fidelity (4.00), Migration (3.93), and Habitat Specificity (3.67).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96 % of the data quality scores were 2 or greater 91 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Northern South Carolina Estuarine System (NSCES) Stock includes common bottlenose dolphins found in estuarine waters and nearshore waters (out to 1km) of South Carolina from the southern extent of the Murrells Inlet in the north to Price Inlet in the south (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the NSCES Stock is characterized by tidal salt marshes, estuarine waters, and shallow open water with mudflats and oyster reefs (Waring et al. 2016).

Site Fidelity

No specific site fidelity information was found for this stock. Sloan (2006) observed twelve year-round residents of the NSCES Stock in Cape Romain National Wildlife Refuge that showed long-term site fidelity. Brusa (2012) identified 84 individuals displaying short-term site fidelity and 11 individuals displaying long-term site fidelity in North Inlet and Winyah Bay. Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in South Carolina (Speakman et al. 2006; Waring et al. 2016), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf

sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings.

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016).

Dunn et al. (2014) suggested seasonal migrations of common bottlenose dolphins in the NSCES Stock, with different assemblages in the summer and winter.

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Waring et al. 2016). In a photo ID study in North Inlet and Winyah Bay, Brusa (2012) identified 3 dolphins that were sighted only in North Inlet, 38 dolphins sighted only in Winyah Bay only, and 41 dolphins sighted in both, suggesting that part of the population maintains a constrained range while another segment of the population ventures farther. Brusa (2012) estimated mean home range of 32.79±13.02 km2 during the warm season and 4.73±3.51 km2 during the cold season.

Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Sloan (2006) identified 121 unique individuals in Cape Romain National Wildlife Refuge. Brusa et al. (2016) estimated 117 individuals (95% CI 92 to 142) during the warm season and 74 individuals (95% CI 48 to 100) during the cold season in North Inlet and Winyah Bay. Previously, Brusa (2012) identified 103 unique individuals during the warm season and 37 unique individuals during the cold season in North Inlet and Winyah Bay. However, all three of these estimates did not differentiate between resident and transient dolphins and did not include the entire range occupied by the NSCES Stock.

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the NSCES stock interact with the inshore gillnet and blue crab trap/pot fisheries (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Waring et al. 2016; also see NOAA National Marine Mammal Health and Stranding Response Database). During the period 2009–2013, 11 common bottlenose dolphins stranded within the NSCES, with one individual presenting interactions with fishing gear (Waring et al. 2016).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016; NMFS 2022). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016). An UME for bottlenose dolphins was declared in winter and spring of 2011 in South Carolina, during which common bottlenose dolphins stranded at a rate nearly three times the historical average, with evidence suggesting an unusually cold winter and decreased prey abundance contributed to the UME (Waring et al. 2016; NMFS 2022).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). In South Carolina, urban areas showed greater numbers of strandings than areas with primarily agricultural input (McFee and Burdett 2007). Common bottlenose dolphins in the nearby Charleston Estuarine System have been found with elevated levels of POPs (Hansen et al. 2004), polybrominated diphenyl ethers (PBDE; Fair et al. 2007; Kucklick et al. 2011; Adams et al. 2014), perfluoroalkyl compounds (PFCs; Adams et al. 2008). Adams et al. (2008) found dolphins in the Charleston Estuarine System that spent most of their time in urbanized and industrial areas had significantly higher plasma PFC concentrations than dolphins that spent most of their time in less developed areas. Common bottlenose dolphins stranded along the South Carolina coast have been found with ingested microplastics (Battaglia et al. 2020).

Common bottlenose dolphins stranded in South Carolina show a high prevalence of the gram-negative facultative intracellular bacterium *Brucella ceti* found in the tissues of brain, lung, and other tissues (McFee et al. 2020). Nearly 32% of dolphins tested positive for *B. ceti* over the six year study period, coinciding with the calving period.

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Adams, J., M. Houde, D. Muir, T. Speakman, G. Bossart, and P. Fair. 2008. Land use and the spatial distribution of perfluoroalkyl compounds as measured in the plasma of bottlenose dolphins (*Tursiops truncatus*). Marine Environmental Research 66(4):430–437. doi: 10.1016/j.marenvres.2008.07.004

Adams, J., T. Speakman, E. Zolman, G. Mitchum, E. Wirth, G.D. Bossart, and P.A. Fair. 2014. The relationship between land use and emerging and legacy contaminants in an Apex predator, the bottlenose dolphin (*Tursiops truncatus*), from two adjacent estuarine watersheds. Environmental Research 135:346–353. doi: 10.1016/j.envres.2014.08.037

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Battaglia, F.M., B.A. Beckingham, and W.E. McFee. 2020. First report from North America of microplastics in the gastrointestinal tract of stranded bottlenose dolphins (*Tursiops truncatus*). Marine Pollution Bulletin 160:111677. doi: 10.1016/j.marpolbul.2020.111677

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Brusa, J.L. 2012. Distribution and social structure of an estuarine bottlenose dolphin (*Tursiops truncatus*) population in northern South Carolina. Coastal Carolina University. Thesis. 84 p.

Brusa, J.L., R.F. Young, and T. Swanson. 2016. Abundance, ranging patterns, and social behavior of bottlenose dolphins (*Tursiops truncatus*) in an estuarine terminus. Aquatic Mammals 42(1):109–121. doi: 10.1578/am.42.1.2016.109

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Dunn, C.N., D.C. Silva, E.P. Deborde, and R.F. Young. 2014. Distribution and movements of bottlenose dolphins (*Tursiops truncatus*) along the northern South Carolina coast: A research partnership with ecotourism. The Coastal Business Journal 14(1):63–76.

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fair, P.A., G. Mitchum, T.C. Hulsey, J. Adams, E. Zolman, W. McFee, E. Wirth, and G.D. Bossart. 2007. Polybrominated diphenyl ethers (PBDEs) in blubber of free-ranging bottlenose dolphins (*Tursiops truncatus*) from two southeast Atlantic estuarine areas. Archives of Environmental Contamination and Toxicology 53(3):483–494. doi: 10.1007/s00244-006-0244-7

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E. and L.G. Burdett. 2007. Spatial and temporal analysis of bottlenose dolphin strandings in South Carolina, 1992-2005. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-46. 12 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McFee, W.E., D. Wu, K. Colegrove, K. Terio, L. Balthis, and R. Young. 2020. Occurrence of *Brucella ceti* in stranded bottlenose dolphins *Tursiops truncatus* coincides with calving season. Diseases of Aquatic Organisms 141:185–193. doi: 10.3354/dao03526

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Puerto Rico and US Virgin Islands Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 59% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	2.0	
	Habitat Specificity	2.4	1.8	
	Site Fidelity	2.5	1.5	
	Lifetime Reproductive Potential	1.6	2.0	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.8	1.5	
	Migration	3.5	1.2	
	Home Range	2.7	1.8	
	Stock Abundance	2.6	1.0	
	Stock Abundance Trend	2.3	0.8	
	Cumulative Stressors	2.3	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	2.2	
	Sea Surface Temperature (Change in variability)	1.5	2.2	
	Air Temperature (Change in mean)	3.6	2.2	
	Air Temperature (Change in variability)	1.4	2.2	
	Precipitation (Change in mean)	1.6	2.2	
	Precipitation (Change in variability)	1.6	2.2	
	Sea Surface Salinity (Change in mean)	2.6	2.2	
	Sea Surface Salinity (Change in variability)	1.4	2.2	
	Ocean pH (Change in mean)	3.8	2.2	
	Ocean pH (Change in variability)	1.6	2.2	
	Sea ice coverage (Change in mean)	1.0	1.8	
	Sea ice coverage (Change in variability)	1.0	1.8	
	Dissolved oxygen (Change in mean)	3.6	2.2	
	Dissolved oxygen (Change in variability)	1.4	2.2	
	Circulation	2.4	1.5	
	Sea level rise	2.2	1.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low

Moderate

High

Very High

Common bottlenose dolphin (Puerto Rico and US Virgin Islands Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (83% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Ocean pH (Standard anomaly) (3.85), Sea Surface Temperature (Standard anomaly) (3.75), Air Temperature (Standard anomaly) (3.65), and Dissolved oxygen (Standard anomaly) (3.65).

Biological Sensitivity: Moderate. Five sensitivity attributes scored greater than or equal to 2.5: Migration (3.55), Generation Time (2.90), Home Range (2.70), Species Abundance (2.65), and Site Fidelity (2.50).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 59% of the data quality scores were 2 or greater, 36% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins found in the waters of Puerto Rico and U.S. Virgin Islands and adjacent offshore waters. This stock is considered separate from the Atlantic Ocean and Gulf of Mexico stocks for management purposes (Waring et al. 2012).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017). Few records of common bottlenose diet exist for Puerto Rico and the U.S. Virgin Islands, though two records describe mortality due to ingestion of prey: an agujon (*Tylosurus acus*) that punctured the pleural cavity (Carrasquillo-Casado et al. 2002) and a black margate (*Anisotremus surinamensis*) that become lodged in the esophagus (Mignucci-Giannoni et al. 2009).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The common bottlenose dolphin is found in nearshore shelf waters of Puerto Rico and the U.S. Virgin Islands (Erdman 1970; Erdman et al. 1973; Taruski and Winn 1976; Mignucci-Giannoni 1998; Rodriguez-Ferrer et al. 2020). Common bottlenose dolphins are known to use inshore waters such as mangrove channels (Erdman 1970) and also have been sighted in offshore waters and near the self-edge (Mignucci-Giannoni 1998; Rodriguez-Ferrer et al. 2020). Mignucci-Giannoni (1998) noted a high occurrence of common bottlenose dolphins found associated with areas of low sea floor relief. Off the southwest coast of Puerto Rico, Rodriguez-Ferrer et al. (2020) found common bottlenose dolphins most frequently with sea grass beds, sandy bottom, and reefs, while few common bottlenose dolphins were found associated with silty-clay substrate.

Site Fidelity

No specific site fidelity information was found for this stock.

Estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2012) in South Carolina (Sloan 2006; Waring et al. 2016), Georgia (Pulster and Maruya 2008; Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005; Mazzoil et al. 2008a; Mazzoil et al. 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000). Common bottlenose dolphins in Gulf of Mexico bay, sound, and estuary (BSE) stocks show site fidelity (LaBrecque et al. 2015; Hayes et al. 2022), such as in Matagorda Bay, Espiritu Santo Bay, and San Luis Pass in Texas (Maze and Würsig 1999; Lynn and Würsig 2002; Irwin and Würsig 2004); Barataria Bay in Louisiana (Miller 2003; McDonald et al. 2017; Wells et al. 2017); Mississippi Sound in Mississippi (Hubard et al. 2004; Mackey 2010; Mullin et al. 2017); Charlotte Harbor and Pine Island Sound (Bassos-Hull et al. 2013), Sarasota Bay (Wells 1986; Wells 1991; Wells 2014), St. Andrew Bay (Balmer et al. 2019), St. Joseph Bay (Balmer et al. 2008; Balmer et al. 2018), St. Vincent Sound and Apalachicola Bay (Tyson et al. 2011), and Tampa Bay in Florida (Wells et al. 1996; Urian et al. 2009).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003).

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). A mid-summer calving peak (July through August) has been reported for bottlenose dolphins off Puerto Rico (Rodríguez-Ferrer 2001). Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Off Puerto Rico, bottlenose dolphins are common throughout the year (Mignucci-Giannoni 1989, 1998) with a peak occurrence during the fall (Rodríguez-Ferrer 2001). Seasonal inshore-offshore movements are suspected (Mignucci-Giannoni 1998).

Home Range

Bottlenose dolphins are common throughout the Caribbean (Waring et al. 2012). This species has been reported off Cuba (van Waerebeek et al. 2006; Whitt et al. 2011), Dominican Republic (Whaley et al. 2006; Parsons et al. 2010), Puerto Rico and the Virgin Islands (Erdman et al. 1973; Mignucci-Giannoni 1998; Rodríguez-Ferrer 2001), Guadeloupe, St. Lucia and Barbados (Yoshida et al. 2010), Martinique (Jérémie et al. 2006), the eastern Caribbean (Guadeloupe to St. Vincent and the Grenadines; Caldwell et al. 1971; Caldwell and Caldwell 1975; Yoshida et al. 2010), Trinidad (van Bree 1975), Venezuela (Romero et al. 2001; Romero et al. 2002; Oviedo et al. 2005), Leeward Netherlands Antilles (Debrot et al. 1998), Colombia (Romero et al. 2001; Pardo and Palacios 2006; Fraija et al. 2009; Pardo et al. 2009), Panama (Pardo et al. 2009), and Belize (Jefferson and Lynn 1994; Grigg and Markowitz 1997; Campbell et al. 2002; Kerr et al. 2005).

Because bottlenose dolphins are widely distributed throughout the Caribbean Sea, bottlenose dolphins of the Puerto Rico and U.S. Virgin Islands stock are likely trans-boundary with waters near adjacent Caribbean islands (Waring et al. 2012).

Stock Abundance

The most recent abundance estimate of 314 individuals was based on surveys conducted off southwest Puerto Rico between April 1999 and January 2002 (Rodríguez-Ferrer 2001).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Waring et al. 2012).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Although no longer present in U.S. waters, common bottlenose dolphin fisheries continue to exist elsewhere in the Caribbean (e.g., Caldwell et al. 1971; Caldwell and Caldwell 1975; Price 1985; Reeves 1988; Romero et al. 2001; Hoyt and Hvenegaard 2002; Mohammed et al. 2003; Vail 2005; World Council of Whalers 2008) and also in Venezuela (Romero et al. 2001). Live-capture fisheries for use in captivity exist or have existed recently in the Dominican Republic, Haiti, Cuba, and Honduras (van Waerebeek et al. 2006; Espinosa and Orta 2007; Parsons et al. 2010; Waring et al. 2012).

Common bottlenose dolphins in the Puerto Rico and U.S. Virgin Islands stock interact with pelagic longline fisheries (e.g., pelagic swordfish, tunas, billfish) and trap/pot fisheries (spiny lobster and mixed-species; Waring et al. 2012). Although no mortality or serious injury was reported during the period 2001-2015, this may represent an underestimation due to a lack of observer coverage in some years and some fisheries (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010; 2012a; 2012b; 2013; 2014; 2016; 2017)

Legacy impacts on common bottlenose dolphins from naval operations at Roosevelt Roads in Puerto Rico that ceased in 2004 are unknown (Waring et al. 2012).

Coastal pollution may be an issue for the common bottlenose dolphin Puerto Rico and U.S. Virgin Islands stock. Parts of Vieques Island, Puerto Rico are listed on the U.S. Environmental Protection Agency's (EPA) Superfund National Priorities List due to unexploded ordnance and associated hazardous materials (Whitall et al. 2016; EPA 2018).

Distribution

Modeled distribution of the common bottlenose dolphin in southwestern Puerto Rico is presented by Rodriguez-Ferrer et al. (2020).

Further Reading

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine Mammals of the World (Second Edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., S. Watwood, B. Quigley, T. Speakman, K. Barry, K. Mullin, P. Rosel, C. Sinclair, E. Zolman, and L. Schwacke. 2019. Common bottlenose dolphin (*Tursiops truncatus*) abundance and distribution patterns in St. Andrew Bay, Florida, USA. Aquatic Conservation: Marine and Freshwater Ecosystems 29(3):486–498. doi: 10.1002/aqc.3001

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C. 2011. Bottlenose dolphin (*Tursiops truncatus*) stock structure within the estuaries of southern Georgia. University of North Carolina Wilmington. 134 p.

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Schwacke, W.A. McLellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. Journal of Cetacean Research and Management 10(2):157–167.

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Bassos-Hull, K., R.M. Perrtree, C.C. Shepard, S. Schilling, A.A. Barleycorn, J.B. Allen, B.C. Balmer, W.E. Pine, and R.S. Wells. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. Journal of Cetacean Research and Management 13(1):19–30. doi: 10.47536/jcrm.v13i1.551

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, D.K. and M.C. Caldwell. 1975. Dolphin and small whale fisheries of the Caribbean and West Indies: Occurrence, history, and catch statistics — with special reference to the Lesser Antillean island of St. Vincent. Journal of the Fisheries Research Board of Canada 32(7):1105–1110. doi: 10.1139/f75-132

Caldwell, D.K., M.C. Caldwell, W.F. Rathjen, and J.R. Sullivan. 1971. Cetaceans from the Lesser Antillean island of St. Vincent. Fishery Bulletin 69:303–312.

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Campbell, G.S., B.A. Bilgre, and R.H. Defran. 2002. Bottlenose dolphins (*Tursiops truncatus*) in Turneffe Atoll, Belize: Occurrence, site fidelity, group size, and abundance. Aquatic Mammals 28:170–180.

Carrasquillo-Casado, B., M. Alsina-Guerrero, M.A. Cardona-Maldonado, E.H. Williams, and A.A. Mignucci-Giannoni. 2002. Fatal pneumonia and pleuritis caused by an agujon beak penetration in a bottlenose dolphin from Puerto Rico. Journal of Aquatic Animal Health 14(1):65–67. doi: 10.1577/1548-8667(2002)014<0065:fpapcb>2.0.co;2

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Debrot, A.O., J.A. De Meyer, and P.J.E. Dezentjé. 1998. Additional records and a review of the cetacean fauna of the Leeward Dutch Antilles. Caribbean Journal of Science 34(3-4):204–210.

Environmental Protection Agency (EPA). 2021. Atlantic Fleet Weapons Training Area, Vieques, PR. https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR

Erdman, D.S. 1970. Marine mammals from Puerto Rico to Antigua. Journal of Mammalogy 51(3):636. doi: 10.2307/1378416

Erdman, D.S., J. Harms, and M. Marcial-Flores. 1973. Cetacean records from the northeastern Caribbean region. Cetology 17:1–14.

Espinosa, J. and J. Orta. 2007. Biota marina. In: González, H.A. (Ed.), Biodiversidad de Cuba. Ediciones Polymita, S.A., Ciudad de Guatemala. pp. 72–141.

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fraija, N., L. Flórez-González, and A. Jáuregui. 2009. Cetacean occurrence in the Santa Marta Region, Colombian Caribbean, February-May 2007. Latin American Journal of Aquatic Mammals 7(1-2):69–73. doi: 10.5597/lajam00137

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.

Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-607. 64 p.

Garrison, L.P. and L. Stokes. 2012a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.

Garrison, L.P. and L. Stokes. 2012b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-632. 61 p.

Garrison, L.P. and L. Stokes. 2013. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-655. 62 p.

Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.

Grigg, E. and H. Markowitz. 1997. Habitat use by bottlenose dolphins (*Tursiops truncatus*) at Turneffe Atoll, Belize. Aquatic Mammals 23:163–170.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Hoyt, E. and G.T. Hvenegaard. 2002. A review of whale-watching and whaling with applications for the Caribbean. Coastal Management 30(4):381–399. doi: 10.1080/089207502900273

Hubard, C.W., K. Maze-Foley, K.D. Mullin, and W.W. Schroeder. 2004. Seasonal abundance and site fidelity of bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound. Aquatic Mammals 30(2):299–310. doi: 10.1578/am.30.2.2004.299

Irwin, L.-J. and B. Würsig. 2004. A small resident community of bottlenose dolphins, *Tursiops truncatus*, in Texas: Monitoring recommendations. Gulf of Mexico Science 22(1):13–21. doi: 10.18785/goms.2201.02

Jefferson, T.A. and S.K. Lynn. 1994. Marine mammal sightings in the Caribbean Sea and Gulf of Mexico, summer 1991. Caribbean Journal of Science 30(1-2):83–89.

Jérémie, S., A. Gannier, S. Bourreau, and J.-C. Nicolas. 2006. Cetaceans of Martinique Island (Lesser Antilles): Occurrence and distribution obtained from a small boat dedicated survey. Paper SC/58/SM23. 58th Annual Meeting of the International Whaling Commission, June 2006, St. Kitts and Nevis, West Indies.

Kerr, K.A., R.H. Defran, and G.S. Campbell. 2005. Bottlenose dolphins (*Tursiops truncatus*) in the Drowned Cayes, Belize: Group size, site fidelity and abundance. Caribbean Journal of Science 41(1):172–177.

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Lynn, S.K. and B. Würsig. 2002. Summer movement patterns of bottlenose dolphins in a Texas bay. Gulf of Mexico Science 20(1):25–37. doi: 10.18785/goms.2001.03

Mackey, A.D. 2010. Site fidelity and association patterns of bottlenose dolphins (*Tursiops truncatus*) in the Mississippi Sound. University of Southern Mississippi. Thesis. 133 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze, K.S. and B. Würsig. 1999. Bottlenosed dolphins of San Luis Pass, Texas: Occurrence patterns, site-fidelity, and habitat use. Aquatic Mammals 25:91–104.

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the Deepwater Horizon oil spill. Endangered Species Research 33:193–209. doi: 10.3354/esr00806

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Mignucci-Giannoni, A.A. 1989. Zoogeography of marine mammals in Puerto Rico and the Virgin Islands. University of Rhode Island. Thesis. 448 p.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mignucci-Giannoni, A.A., R.J. Rosario-Delestre, M.M. Alsina-Guerrero, L. Falcon-Matos, L. Guzman-Ramirez, E.H. Williams, Jr., G.D. Bossart, and J.S. Reidenberg. 2009. Asphyxiation in a bottlenose dolphin (*Tursiops truncatus*) from Puerto Rico due to choking on a black margate (*Anisotremus surinamensis*). Aquatic Mammals 35(1):48–54. doi: 10.1578/AM.35.1.2009.48

Miller, C.E. 2003. Abundance trends and environmental habitat usage patterns of bottlenose dolphins (*Tursiops truncatus*) in lower Barataria and Caminada bays, Louisiana. Louisiana State University and Agricultural & Mechanical College. Dissertation. 125 p.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Mohammed, E., L.E. Straker, and C. Jardine. 2003. St. Vincent and the Grenadines: Reconstructed fisheries catches and fishing effort, 1942-2001. Fisheries Centre Research Reports 11(6):95–116.

Mullin, K.D., T. McDonald, R.S. Wells, B.C. Balmer, T. Speakman, C. Sinclair, E.S. Zolman, F. Hornsby, S.M. McBride, K.A. Wilkinson, and L.H. Schwacke. 2017. Density, abundance, survival, and ranging patterns of common bottlenose dolphins (*Tursiops truncatus*) in Mississippi Sound following the Deepwater Horizon oil spill. PLoS ONE 12(10):e0186265. doi: 10.1371/journal.pone.0186265

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Oviedo, L., N. Silva, L. Bermudez, and D.K. Odell. 2005. Distribution of bottlenose dolphins (*Tursiops truncatus*) on the east coast of Isla Margarita and the Los Frailes Archipelago, Venezuela. Aquatic Mammals 31(4):442–446. doi: 10.1578/AM.31.4.2005.442

Pardo, M.A., A. Mejía-Fajardo, S. Beltrán-Pedreros, F. Trujillo, I. Kerr, and D.M. Palacios. 2009. Odontocete sightings collected during offshore cruises in the western and southwestern Caribbean Sea. Latin American Journal of Aquatic Mammals 7(1-2):57–62. doi: 10.5597/lajam00135

Pardo, M.A. and D.M. Palacios. 2006. Cetacean occurrence in the Santa Marta region, Colombian Caribbean, 2004-2005. Latin American Journal of Aquatic Mammals 5(2):129–134. doi: 10.5597/lajam00105

Parsons, E.C.M., I. Bonnelly de Calventi, A. Whaley, N.A. Rose, and S. Sherwin. 2010. A note on illegal captures of wild bottlenose dolphins (*Tursiops truncatus*) from the coastal waters of the Dominican Republic. Journal of International Wildlife Law and Policy 13(3):240–244. doi: 10.1080/13880292.2010.503123

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Pulster, E.L. and K.A. Maruya. 2008. Geographic specificity of Aroclor 1268 in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia (USA). Science of the Total Environment 393(2-3):367–375. doi: 10.1016/j.scitotenv.2007.12.031

Reeves, R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. Reports of the International Whaling Commission 38(445-447).

Rodríguez-Ferrer, G. 2001. The bottlenose dolphin (*Tursiops truncatus* Montague 1821) of the southwest coast of Puerto Rico: An assessment of its status and habitat use. University of Puerto Rico. Thesis.

Rodriguez-Ferrer, G., J.J. Cruz-Motta, N.V. Schizas, and R.S. Appeldoorn. 2020. Modelling distribution of the common bottlenose dolphin, *Tursiops truncatus* off the southwest coast of Puerto Rico. Journal of Marine Systems 210:103371. doi: 10.1016/j.jmarsys.2020.103371

Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo di Sciara. 2001. Cetaceans of Venezuela: Their distribution and conservation status. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS 151. 60 p.

Romero, A., R. Baker, and J.E. Creswell. 2002. Environmental history of marine mammal exploitation in Trinidad and Tobago, W.I., and its ecological impact. Environment and History 8:255–274.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Taruski, A.G. and H.E. Winn. 1976. Winter sightings of odontocetes in the West Indies. Cetology 22:1–12.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Tyson, R.B., S.M. Nowacek, and D.P. Nowacek. 2011. Community structure and abundance of bottlenose dolphins *Tursiops truncatus* in coastal waters of the northeast Gulf of Mexico. Marine Ecology Progress Series 438:253–265. doi: 10.3354/meps09292

Urian, K.W., S. Hofmann, R.S. Wells, and A.J. Read. 2009. Fine-scale population structure of bottlenose dolphins (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 25(3):619–638. doi: 10.1111/j.1748-7692.2009.00284.x

Vail, C. 2005. Socio-economic assessment of marine mammal utilization in the wider Caribbean region: Captivity, viewing and hunting. Information paper presented at the United Nations Environment Programme Regional Workshop of Experts on the Development of the Marine Mammal Action Plan for the Wider Caribbean Region, Barbados, 18-21 July 2005.

van Bree, P.J.H. 1975. Preliminary list of the cetaceans of the southern Caribbean. Stud. Fauna Curacao Carib. Isl 48:79–87.

van Waerebeek, K., M. Sequeira, C. Williamson, G.P. Sanino, P. Gallego, and P. Carmo. 2006. Live-captures of common bottlenose dolphins *Tursiops truncatus* and unassessed bycatch in Cuban waters: Evidence of sustainability found wanting. Latin American Journal of Aquatic Mammals 5(1):39–48. doi: 10.5597/lajam00090

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 1986. Population structure of bottlenose dolphins: Behavioral studies along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-003BB. 58 p.

Wells, R.S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. In: Pryor, K. and K. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, CA. pp. 199–226.

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., M.K. Bassos, K.W. Urian, W.J. Carr, and M.D. Scott. 1996. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-384. 86 p.

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., L.H. Schwacke, T.K. Rowles, B.C. Balmer, E. Zolman, T. Speakman, F.I. Townsend, M.C. Tumlin, A. Barleycorn, and K.A. Wilkinson. 2017. Ranging patterns of common bottlenose dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Endangered Species Research 33:159–180. doi: 10.3354/esr00732

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Whaley, A.R., E.C.M. Parsons, R. Sellares, and I. de C. Bonnelly. 2006. Dolphin ecology and behavior in the southeastern waters of the Dominican Republic: Preliminary observations. 58th Annual Meeting of the International Whaling Commission: St. Kitts and Nevis. SC/58/SM12. 8 p.

Whitall, D.R., A.L. Mason, M. Fulton, E. Wirth, D. Wehner, A. Ramos-Alvarez, A.S. Pait, B. West, E. Pisarski, B. Shaddrix, and L. Reed. 2016. Contaminants in marine resources of Vieques, Puerto Rico. NOAA's National Centers for Coastal Ocean Science Office of Response and Restoration and Coral Reef Conservation Program and Coral Reef Conservation Program: Silver Spring, MD. NOAA Technical Memorandum NOS-NCCOS-223. 70 p. doi: 10.7289/V5/TM-NOS-NCCOS-223

Whitt, A.D., T.A. Jefferson, M. Blanco, D. Fertl, and D. Rees. 2011. A review of marine mammal records of Cuba. Latin American Journal of Aquatic Mammals 9(2):65–122. doi: 10.5597/lajam00175

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

World Council of Whalers. 2008. World whaling – Caribbean. http://www.worldwhalers.com/whaling_around_the_world/caribbean.htm

Yoshida, H., J. Compton, S. Punnett, T. Lovell, K. Draper, G. Franklin, N. Norris, P. Phillip, R. Wilkins, and H. Kato. 2010. Cetacean sightings in the eastern Caribbean and adjacent waters, spring 2004. Aquatic Mammals 36(2):154–161. doi: 10.1578/Am.36.2.2010.154

Common bottlenose dolphin − *Tursiops truncatus*

Southern Georgia Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	3.4	2.0	
	Site Fidelity	4.0	2.7	
	Lifetime Reproductive Potential	1.3	2.0	
	Generation Length	2.9	2.0	
	Reproductive Plasticity	1.1	2.3	
	Migration	4.0	2.3	
	Home Range	3.5	2.3	
	Stock Abundance	3.0	2.7	
	Stock Abundance Trend	2.3	1.3	
	Cumulative Stressors	2.7	2.3	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.7	3.0	
	Sea Surface Salinity (Change in mean)	1.8	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.1	3.0	
	Circulation	3.9	2.0	
	Sea level rise	4.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Southern Georgia Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Six exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Circulation (3.93).

Biological Sensitivity: High. Five sensitivity attributes scored greater than or equal to 3.0: Migration (4.00), Site Fidelity (4.00), Home Range (3.47), Habitat Specificity (3.40), and Species Abundance (3.00).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Southern Georgia Estuarine System Stock (SGES) Stock includes common bottlenose dolphins found in estuarine waters of Georgia from the Altamaha River in the north to the Florida/Georgia border at Cumberland Sound in the south (Waring et al. 2016).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the SGES Stock is characterized by extensive tidal marshes and shallow riverine systems (Waring et al. 2016).

Site Fidelity

Common bottlenose dolphins in the SGES Stock show evidence of site fidelity (Balmer et al. 2011; Balmer et al. 2013). Other estuarine stocks in the western North Atlantic have shown site fidelity (Waring et al. 2016), such as in South Carolina (Sloan 2006; Speakman et al. 2006; Waring et al. 2016), central Georgia (Kucklick et al. 2011), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Waring et al. 2016). Other estuarine stocks in the western North Atlantic are known to spend warm months in estuarine waters then move to nearshore waters during cool months (Gubbins et al. 2003; Waring et al. 2014; Waring et al. 2016).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (reviewed in LaBrecque et al. 2015). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2013). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the SGES Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Balmer et al. (2013) estimated the abundance of a portion of the SGES stock at 194 individuals (CV=0.05) based on winter 2008 and winter 2009 surveys. However, this estimate did not cover the entire range of the stock, and may represent an undercount (Waring et al. 2016).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Waring et al. 2016).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the SGES Stock interact with the blue crab trap/pot fishery (Waring et al. 2016). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; also see NOAA National Marine Mammal Health and Stranding Response Database). For example, During the period 2009–2013, 31 common bottlenose dolphins stranded within the SGES, with no individuals presenting clear indications of human interactions such as fishing gear and vessel interactions (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited by

Waring et al. 2016; Seguel et al. 2020). The cause of death for six other stranded individuals was likely high concentrations of persistent organic pollutants (POPs; Seguel et al. 2020).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). The SGES Stock inhabits a highly industrialized area that includes four Environmental Protection Agency declared Superfund sites (EPA 2021). Analyses of contaminants have found elevated polychlorinated biphenyl (PCB) concentrations in dolphins in the Turtle/Brunswick River Estuary relative to dolphins in other areas (Pulster and Maryua 2008; Sanger et al. 2008; Pulster et al. 2009; Kucklick et al. 2011; Schwacke et al. 2012). Human feeding of dolphins has been observed in the SGES, with possible implications for increased interactions with fishing gear and behavioral adaptation (Kovacs and Cox 2014; Perrtree et al. 2014; Wu 2013).

Further Reading

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Environmental Protection Agency (EPA). 2021. Superfund. https://www.epa.gov/superfund

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Gubbins, C.M., M. Caldwell, S.G. Barco, K.A. Rittmaster, N. Bowles, and V.G. Thayer. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. Journal of Cetacean Research and Management 5(2):141–148.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kovacs, C. and T. Cox. 2014. Quantification of interactions between common bottlenose dolphins (*Tursiops truncatus*) and a commercial shrimp trawler near Savannah, Georgia. Aquatic Mammals 40(1):81–94. doi: 10.1578/Am.40.1.2014.81

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze-Foley, K. and L.P. Garrison. 2018. Serious injury determinations for small cetaceans off the southeast U.S. coast, 2012–2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2018-04. 31 p. doi: 10.25923/xhfz-5g76

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Perrtree, R.M., C.J. Kovacs, and T.M. Cox. 2014. Standardization and application of metrics to quantify human-interaction behaviors by the bottlenose dolphin (*Tursiops* spp.). Marine Mammal Science 30(4):1320–1334. doi: 10.1111/mms.12114

Pulster, E.L. and K.A. Maruya. 2008. Geographic specificity of Aroclor 1268 in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia (USA). Science of the Total Environment 393(2-3):367–375. doi: 10.1016/j.scitotenv.2007.12.031

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sanger, D., A. Blair, G. DiDonato, T. Washburn, S. Jones, R. Chapman, D. Bergquist, G. Riekerk, E. Wirth, J. Stewart, D. White, L. Vandiver, S. White, and D. Whitall. 2008. Support for integrated ecosystem assessments of NOAA's National Estuarine Research Reserves System (NERRS), Volume I: The impacts of coastal development on the ecology and human well-being of tidal creek ecosystems of the US Southeast. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-82. 76 p.

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Seguel, M., R.C. George, G. Maboni, S. Sanchez, A. Page-Karjian, E. Wirth, W. McFee, and N.L. Gottdenker. 2020. Pathologic findings and causes of death in bottlenose dolphins *Tursiops truncatus* stranded along the Georgia coast, USA (2007-2013). Diseases of Aquatic Organisms 141:25–38. doi: 10.3354/dao03509

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.

Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.

Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.
Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x
Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390
Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.
Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x
Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165
Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601
Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN
Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.
Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.
Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8
Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en
Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.
Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals

(Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Wu, C. 2013. Human and boat interactions with common bottlenose dolphins (*Tursiops truncatus*) in the waterways around Savannah, Georgia. Savannah State University. Thesis. 101 p.

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Southern North Carolina Estuarine System Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 100% of scores≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.3	
	Habitat Specificity	3.6	2.0	
	Site Fidelity	4.0	2.3	
	Lifetime Reproductive Potential	1.3	2.3	
	Generation Length	2.6	2.3	
	Reproductive Plasticity	1.5	2.3	
	Migration	3.9	2.7	
	Home Range	3.4	2.7	
	Stock Abundance	3.0	2.7	
	Stock Abundance Trend	2.2	2.3	
	Cumulative Stressors	2.9	3.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	2.0	2.7	
	Sea Surface Salinity (Change in mean)	3.9	2.7	
	Sea Surface Salinity (Change in variability)	1.5	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.0	2.7	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	3.9	2.3	
	Sea level rise	4.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low

Moderate

High

Very High

Common bottlenose dolphin (Southern North Carolina Estuarine System Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Seven exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea level rise (4.00), Sea Surface Temperature (Standard anomaly) (4.00), Sea Surface Salinity (Standard anomaly) (3.93), and Circulation (3.87).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Site Fidelity (4.00), Migration (3.93), and Habitat Specificity (3.60).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 100 % of the data quality scores were 2 or greater. 100 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Southern North Carolina Estuarine System (SNCES) Stock includes common bottlenose dolphins found in estuarine and nearshore coastal waters (≤ 3 km from shore) between the Little River Inlet estuary and the New River, North Carolina (Hayes et al. 2021).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). The area inhabited by the SNCES Stock is characterized by tidal marshes, estuarine waters, and shallow open water (Hayes et al. 2021).

Site Fidelity

No specific site fidelity information was found for this stock. Other estuarine stocks in the western North Atlantic have shown site fidelity (Hayes et al. 2021), such as in South Carolina (Sloan 2006; Speakman et al. 2006; Hayes et al. 2021), central and southern Georgia (Balmer et al. 2011; Kucklick et al. 2011; Balmer et al. 2013), northern Florida (Caldwell 2001), central Florida (Odell and Asper 1990; Mazzoil et al. 2005, 2008a, 2008b), and southern Florida (Litz 2007; Torres 2007; McClellan et al. 2000).

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings in the Charleston Estuarine System Stock peak in spring and early summer and again in early autumn (McFee et al. 2014).

Migration

The estuarine stocks in the western North Atlantic are thought to primarily comprise stable resident communities. However, transient or seasonal movements of some individuals into and out of stock areas are recorded in some areas (LaBrecque et al. 2015; Hayes et al. 2021).

Members of the SNCES Stock do not undertake large-scale migratory movements but do display seasonal movements, expanding their range slightly north to include parts of Core Sound and southern Pamlico Sound during warm months (Hayes et al. 2021).

Home Range

The home ranges of individuals within the western North Atlantic estuarine stocks are considered to generally include the areas within the stock boundaries and brief excursions beyond the stock boundaries (LaBrecque et al. 2015; Hayes et al. 2021). Members of the SNCES Stock show relatively constrained ranges based on photo-ID, tag telemetry and genetic data (Hansen and Wells 1996; Hayes et al. 2018). Studies have shown dolphin populations with constrained ranges in Georgia (Brunswick and Sapelo; Balmer et al. 2013); South Carolina (Silva et al. 2019), and North Carolina (Urian et al. 2014). Balmer et al. (2018), using satellite telemetry data, identified that dolphins considered to be members of the South Georgia Estuarine System Stock had different movement patterns with some individuals remaining entirely within the estuarine waters, while other animals use the larger estuarine waters, sounds, and to some degree coastal waters.

Stock Abundance

Urian et al. (2014) estimated the abundance for the SNCES Stock at 188 individuals (CV=0.19, 95% confidence interval=118-257) based on 2006 photo-ID mark-recapture surveys. However, the current population size of the SNCES Stock is considered unknown because the surveys are more than eight years old.

Stock Abundance Trend

A trend analysis has not been conducted for this stock (Hayes et al. 2021). Previously, Read et al. (2003) estimated the abundance of the SNCES Stock at 141 individuals (CV=0.15, 95% confidence interval=112-200) based on a 2000 photo-ID mark-recapture survey of inshore waters. However, this survey did not include coastal waters and should be considered negatively biased.

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Byrd and Hohn 2010, 2017; Byrd et al. 2014), vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the SNCES Stock interact with several commercial fisheries, including gillnet, long haul seine, roe mullet stop net, blue crab trap/pot, and hook and line fisheries. The minimum total mean annual human-caused mortality and serious injury for fisheries and other human causes was 0.4 individuals per year during 2014–2018 (Hayes et al. 2021). During 2014–2018, 53 common bottlenose dolphins stranded within the SNCES Stock. No evidence of human interaction, such as fishing gear and vessel interactions, could be detected for 30 of these animals and it could not be determined if there was evidence of human interaction for 18 animals (Maze-Foley et al. 2019).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1600 common bottlenose dolphins stranding as a result of morbillivirus (Hayes et al. 2021; NMFS 2022). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Hayes et al. 2021).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010a; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas. In Biscayne Bay, Florida, elevated POP concentrations were observed in individuals associated with more polluted areas compared to individuals associated with the less polluted areas of Biscayne Bay, suggesting that exposure to pollutants may be highly variable based on geography (Litz et al. 2007; Kucklick et al. 2011). The SNCES Stock inhabits an area that receives runoff from agricultural, industrial, and urban sources. Analyses of common bottlenose dolphins along the North Carolina coast have found elevated levels of POPs, including polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs; Schwacke et al. 2002; Hansen et al. 2004; Yordy et al. 2010a, 2010b). Individuals from this stock have been found to have detectable concentrations of lead, mercury, and selenium, though at lower levels than the Indian River Lagoon Estuarine System in Florida (Page-Karjian et al. 2020).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, J.D. Adams, R. Clay George, S.M. Lane, W.A. McLellan, P.E. Rosel, K. Sparks, T. Speakman, E.S. Zolman, and D. Ann Pabst. 2013. Comparison of abundance and habitat usage for common bottlenose dolphins between sites exposed to differential anthropogenic stressors within the estuaries of southern Georgia, U.S.A. Marine Mammal Science 29(2):E114–E135. doi: 10.1111/j.1748-7692.2012.00598.x

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Byrd, B.L. and A.A. Hohn. 2017. Differential risk of bottlenose dolphin (*Tursiops truncatus*) bycatch in North Carolina, USA. Aquatic Mammals 43(5):558–569. doi: 10.1578/Am.43.5.2017.558

Byrd, B.L., A.A. Hohn, G.N. Lovewell, K.M. Altman, S.G. Barco, A. Friedlaender, C.A. Harms, W.A. McLellan, K.T. Moore, P.E. Rosel, and V.G. Thayer. 2014. Strandings as indicators of marine mammal biodiversity and human interactions off the coast of North Carolina. Fishery Bulletin 112(1):1–23. doi: 10.7755/fb.112.1.1

Caldwell, M. 2001. Social and genetic structure of bottlenose dolphin (*Tursiops truncatus*) in Jacksonville, Florida. University of Miami. 143 p.

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hansen, L.J. and R.S. Wells. 1996. Bottlenose dolphin health assessment: Field report on sampling near Beaufort, North Carolina, during July, 1995. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Charleston Laboratory: Charleston, SC. NOAA Technical Memorandum NMFS-SEFSC-382. 24 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2018. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2017: (Second Edition). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-245. 371 p. doi: 10.25923/e764-9g81

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 2. Biologically Important Areas for Cetaceans Within U.S. Waters – East Coast Region. Aquatic Mammals 41(1):17–29. doi: 10.1578/am.41.1.2015.17

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Litz, J.A., L.P. Garrison, L.A. Fieber, A. Martinez, J.P. Contillo, and J.R. Kucklick. 2007. Fine-scale spatial variation of persistent organic pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. Environmental Science & Technology 41(21):7222–7228. doi: 10.1021/es070440r

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

Maze-Foley, K., B.L. Byrd, S.C. Horstman, and J.R. Powell. 2019. Analysis of stranding data to support estimates of mortality and serious injury in common bottlenose dolphin (*Tursiops truncatus truncatus*) stock assessments for the Atlantic Ocean and Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-742. 31 p. doi: 10.25923/jt1x-jv75

Mazzoil, M., S.D. McCulloch, and R.H. Defran. 2005. Observations on the site fidelity of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Florida Scientist 68(4):217–226.

Mazzoil, M., J.S. Reif, M. Youngbluth, M.E. Murdoch, S.E. Bechdel, E. Howells, S.D. McCulloch, L.J. Hansen, and G.D. Bossart. 2008a. Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. Ecohealth 5(3):278–288. doi: 10.1007/s10393-008-0194-9

Mazzoil, M.S., S.D. McCulloch, M.J. Youngbluth, D.S. Kilpatrick, M.E. Murdoch, B. Mase-Guthrie, D.K. Odell, and G.D. Bossart. 2008b. Radio-tracking and survivorship of two rehabilitated bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 34:54–64. doi: 10.1578/AM.34.1.2008.54

McClellan, D.B., J. Browder, J.L. Tobias, G.J. Konoval, M.D. Heron, O.L. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, *Tursiops truncatus*, along the southeast Florida coast and Florida Bay, 1992-1997. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-435. 18 p.

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

National Marine Fisheries Service (NMFS). 2022. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Odell, D.K. and E.D. Asper. 1990. Distribution and movements of freeze-branded bottlenose dolphins in the Indian and Banana Rivers, Florida. In: Leatherwood, S. and R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 515–540.

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Read, A.J., K.W. Urian, B. Wilson, and D.M. Waples. 2003. Abundance of bottlenose dolphins in the bays, sounds, and estuaries of North Carolina. Marine Mammal Science 19(1):59–73. doi: 10.1111/j.1748-7692.2003.tb01092.x

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a

trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6
Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232
Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665
Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165
Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x
Silva, D., B. Tramutolo, E. DeSalvio, T. Speakman, and R. Young. 2019. Abundance and movements of the Northern South Carolina Estuarine System Stock of bottlenose dolphins (*Tursiops truncatus*) (USA). Journal of Marine Animals and Their Ecology 11(1):8–18.
Sloan, P.E. 2006. Residency patterns, seasonality and habitat use among bottlenose dolphins, *Tursiops truncatus*, in the Cape Romain National Wildlife Refuge, S.C. University of North Carolina Wilmington. Thesis. 75 p.
Speakman, T., E. Zolman, J. Adams, R.H. Defran, D. Laska, L. Schwacke, J. Craigie, and P. Fair. 2006. Temporal and spatial aspects of bottlenose dolphin occurrence in coastal and estuarine waters near Charleston, South Carolina. National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Charleston, SC. NOAA Technical Memorandum NOS-NCCOS-37. 50 p.
Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030
Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030
Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.
Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. 2007. Top predator distribution and foraging ecology in Florida Bay, Florida. Duke University. Dissertation. 225 p.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Urian, K.W., D.M. Waples, R.B. Tyson, L.E. Hodge, and A.J. Read. 2013. Abundance of bottlenose dolphins (*Tursiops truncatus*) in estuarine and near-shore waters of North Carolina, USA. Journal of the North Carolina Academy of Science 129(4):165–171. doi: 10.7572/2167-5880-129.4.165

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010a. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Yordy, J.E., D.A. Pabst, W.A. McLellan, R.S. Wells, T.K. Rowles, and J.R. Kucklick. 2010b. Tissue-specific distribution and whole-body burden estimates of persistent organic pollutants in the bottlenose dolphin (*Tursiops truncatus*). Environmental Toxicology and Chemistry 29(6):1263–1273. doi: 10.1002/etc.152

Common bottlenose dolphin − *Tursiops truncatus*

Western North Atlantic migratory stocks

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.5	
	Habitat Specificity	2.0	2.5	
	Site Fidelity	2.0	2.0	
	Lifetime Reproductive Potential	1.2	2.2	
	Generation Length	2.8	2.2	
	Reproductive Plasticity	1.4	1.5	
	Migration	2.4	2.5	
	Home Range	2.0	2.8	
	Stock Abundance	1.6	2.0	
	Stock Abundance Trend	2.8	2.0	
	Cumulative Stressors	2.5	2.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.4	2.5	
	Sea Surface Salinity (Change in mean)	2.4	2.5	
	Sea Surface Salinity (Change in variability)	2.6	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.1	2.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.2	2.5	
	Circulation	2.1	2.2	
	Sea level rise	3.8	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Western North Atlantic, Northern and Southern Migratory Coastal Stocks)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (98% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (3.95), and Sea level rise (3.85).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Generation Time (2.85), Species Abundance Trend (2.75), Cumulative Stressors (2.55).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock group includes the western North Atlantic common bottlenose dolphin Northern Migratory Coastal Stock and Southern Migratory Coastal Stock.

The Northern Migratory Coastal Stock overlaps the least with other stocks during the warm water months (July and August) and is best defined during this time period when the animals occupy waters from the shoreline to approximately the 20-m isobath between Assateague, Virginia and Long Island, New York. The offshore boundary of the Northern Migratory Stock is the 20-m isobath in the summer north of Cape Hatteras, North Carolina and the 200-m isobath in the winter between Cape Hatteras and Cape Lookout, North Carolina (Hayes et al. 2021).

The Southern Migratory Coastal Stock are poorly understood and thought to migrate seasonally along the Atlantic coast between North Carolina and northern Florida. The offshore boundary of the Southern Migratory Stock is the 20-m isobath north of Cape Hatteras and the 200-m isobath south of Cape Hatteras (Hayes et al. 2021).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010;

Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018). Sea surface temperature and chlorophyll a have been correlated with common bottlenose dolphin passive acoustic monitoring detections in the coastal waters of Maryland (Bailey et al. 2021). In coastal waters off of New Jersey, two clusters of common bottlenose dolphin have been identified that differ in depth and distance from shore (Toth et al. 2012).

Site Fidelity

No specific site fidelity information was found for this stock.

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

During winter months, the Northern Migratory Coastal Stock moves from waters as far north as New Jersey south to waters near Cape Lookout, North Carolina (Kenney 1990; Read et al. 2003; Torres et al. 2005). During January and February, the Southern Migratory Coastal Stock migrates south from waters of southern Virginia and north central North Carolina to waters south of Cape Fear, North Carolina, and as far south as northern Florida (Barco et al. 1999).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for these migratory stocks. Tracking studies have shown common bottlenose dolphins can travel distances greater than 2000 km (Wells et al. 1999). Estrada and Hohn (2003) observed migrating bottlenose dolphins along the East Coast of the United States travel a mean distance of 32.7 km/day while non-migrating dolphins traveled a mean distance of 24.5 km/day. Klatsky et al. (2007) found dolphins off Bermuda traveled a mean distance of 28.3 km/day.

Stock Abundance

The best available abundance estimate for the Northern Migratory Coastal Stock of common bottlenose dolphins in the western North Atlantic is 6,639 (CV=0.41; Garrison et al. 2017). This estimate was derived from aerial surveys conducted during the summer of 2016 covering coastal and shelf waters from Assateague, Virginia, to Sandy Hook, New Jersey.

The best available abundance estimate for the Southern Migratory Coastal Stock of common bottlenose dolphins in the western North Atlantic is 3,751 (CV=0.60; Garrison et al. 2017). This estimate was derived from aerial surveys conducted during the summer of 2016 covering coastal and shelf waters from Florida to New Jersey.

Stock Abundance Trend

Although there was no statistically significant difference in abundance for this stock between the 2010–2011 and 2016 surveys, a statistically significant decline in population size of all common bottlenose dolphins in coastal waters from New Jersey to Florida between 2010–2011 and 2016 was detected (Garrison et al. 2017), concurrent with a large UME in the area; however, there is limited power to evaluate trends given uncertainty in stock distribution, lack of precision in abundance estimates, and a limited number of surveys (Hayes et al. 2021).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear (Barco et al. 2010; Hall et al. 2013; Byrd et al. 2014; Wirth and Warren 2019; Epple et al. 2020), vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the Northern Migratory Coastal Stock interact with several commercial fisheries. These include gillnet, pound net, menhaden purse seine, blue crab trap/pot, haul/beach seine, and hook and line fisheries. The minimum total mean annual human-caused mortality and serious injury for fisheries and other human causes ranged between 12.2 and 21.5 individuals per year during 2014–2018 (Hayes et al. 2021). During 2014–2018, 692 common bottlenose dolphins stranded that were assigned to the Northern Migratory Coastal Stock, with 80 of these strandings showing evidence of human interaction such as fishing gear and vessel interactions (Hayes et al. 2021; also see NOAA National Marine Mammal Health and Stranding Response Database).

Common bottlenose dolphins in the Southern Migratory Coastal Stock interact with several commercial fisheries, including gillnet, pound net, blue crab trap/pot, roe mullet stop net, menhaden purse seine, haul/beach seine, shrimp trawl, and hook and line fisheries. The minimum total mean annual human-caused mortality and serious injury for fisheries and other human causes ranged between 0 and 18.3 individuals per year during 2014–2018 (Hayes et al. 2021). During 2014–2018, 565 common bottlenose dolphins stranded that were assigned to the Southern Migratory Coastal Stock, with 59 of these strandings showing evidence of human interaction such as fishing gear and vessel interactions (Hayes et al. 2021; also see NOAA National Marine Mammal Health and Stranding Response Database).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1600 common bottlenose dolphins stranding as a result of morbillivirus (Hayes et al. 2021). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Hayes et al. 2021). Almost 350 strandings were recovered from New York, New Jersey, Delaware, and Maryland. The majority of these likely came from the Northern Migratory Coastal Stock. It is unknown how many dolphins from the Southern Migratory Coastal Stocks died during the event (Hayes et al. 2021).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; ; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas.

Storm events have been shown to affect common bottlenose dolphin distribution and foraging (Fandel et al. 2020).

Distribution and Sightings

Density model results for common bottlenose dolphins in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Bailey, H., A.D. Fandel, K. Silva, E. Gryzb, E. McDonald, A.L. Hoover, M.B. Ogburn, and A.N. Rice. 2021. Identifying and predicting occurrence and abundance of a vocal animal species based on individually specific calls. Ecosphere 12(8):e03685. doi: 10.1002/ecs2.3685

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barco, S.G., L.R. D'Eri, B.L. Woodward, J.P. Winn, and D.S. Rotstein. 2010. Spectra (R) fishing twine entanglement of a bottlenose dolphin: A case study and experimental modeling. Marine Pollution Bulletin 60(9):1477–1481. doi: 10.1016/j.marpolbul.2010.05.005

Barco, S.G., W.M. Swingle, W.A. Mclellan, R.N. Harris, and D.A. Pabst. 1999. Local abundance and distribution of bottlenose dolphins (*Tursiops truncatus*) in the nearshore waters of Virginia Beach, Virginia. Marine Mammal Science 15(2):394–408. doi: 10.1111/j.1748-7692.1999.tb00809.x

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Byrd, B.L., A.A. Hohn, G.N. Lovewell, K.M. Altman, S.G. Barco, A. Friedlaender, C.A. Harms, W.A. McLellan, K.T. Moore, P.E. Rosel, and V.G. Thayer. 2014. Strandings as indicators of marine mammal biodiversity and human interactions off the coast of North Carolina. Fishery Bulletin 112(1):1–23. doi: 10.7755/fb.112.1.1

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Epple, A.L., J.T. Daniel, S.G. Barco, D.S. Rotstein, and A.M. Costidis. 2020. Novel necropsy findings linked to peracute underwater entrapment in bottlenose dolphins (*Tursiops truncatus*). Frontiers in Marine Science 7:503. doi: 10.3389/fmars.2020.00503

Estrada, E.L. and A.A. Hohn. 2003. Satellite monitored movements of bottlenose dolphins along the Atlantic coast of the US. 15th Biennial Conference on the Biology of Marine Mammals, Greensboro, NC, 14-19 December 2003

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fandel, A.D., A. Garrod, A.L. Hoover, J.E. Wingfield, V. Lyubchich, D.H. Secor, K.B. Hodge, A.N. Rice, and H. Bailey. 2020. Effects of intense storm events on dolphin occurrence and foraging behavior. Scientific Reports 10(1):19247. doi: 10.1038/s41598-020-76077-3

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Garrison, L.P., A.A. Hohn, and L.J. Hansen. 2017. Seasonal movements of Atlantic common bottlenose dolphin stocks based on tag telemetry data. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2017-02. 75 p.

Hall, A.G., J.B. McNeill, P.B. Conn, E. Davenport, and A.A. Hohn. 2013. Seasonal co-occurrence of sea turtles, bottlenose dolphins, and commercial gill nets in southern Pamlico and northern Core Sounds, and adjacent coastal waters of North Carolina, USA. Endangered Species Research 22(3):235–249. doi: 10.3354/esr00539

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kenney, R.D. 1990. Bottlenose dolphins off the northeastern United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 369–386.

Klatsky, L.J., R.S. Wells, and J.C. Sweeney. 2007. Offshore bottlenose dolphins (*Tursiops truncatus*): movement and dive behavior near the Bermuda Pedestal. Journal of Mammalogy 88(1):59–66. doi: 10.1644/05-mamm-a-365r1.1

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Page-Karjian, A., C.F. Lo, B. Ritchie, C.A. Harms, D.S. Rotstein, S. Han, S.M. Hassan, A.F. Lehner, J.P. Buchweitz, V.G. Thayer, J.M. Sullivan, E.F. Christiansen, and J.R. Perrault. 2020. Anthropogenic contaminants and histopathological findings in stranded cetaceans in the southeastern United States, 2012–2018. Frontiers in Marine Science 7:630. doi: 10.3389/fmars.2020.00630

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment

Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Read, A.J., K.W. Urian, B. Wilson, and D.M. Waples. 2003. Abundance of bottlenose dolphins in the bays, sounds, and estuaries of North Carolina. Marine Mammal Science 19(1):59–73. doi: 10.1111/j.1748-7692.2003.tb01092.x

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G., W.A. Mclellan, E. Meagher, and D.A. Pabst. 2005. Seasonal distribution and relative abundance of bottlenose dolphins, *Tursiops truncatus*, along the US mid-Atlantic coast. Journal of Cetacean Research and Management 7(2):153–161.

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Toth, J.L., A.A. Hohn, K.W. Able, and A.M. Gorgone. 2011. Patterns of seasonal occurrence, distribution, and site fidelity of coastal bottlenose dolphins (*Tursiops truncatus*) in southern New Jersey, U.S.A. Marine Mammal Science 27(1):94–110. doi: 10.1111/j.1748-7692.2010.00396.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., H.L. Rhinehart, P. Cunningham, J. Whaley, M. Baran, C. Koberna, and D.P. Costa. 1999. Long distance offshore movements of bottlenose dolphins. Marine Mammal Science 15(4):1098–1114. doi: 10.1111/j.1748-7692.1999.tb00879.x

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Wirth, C. and J.D. Warren. 2019. Overlapping use of an artificial reef by humans and an apex predator (*Tursiops truncatus*) in the New York Bight. Marine Mammal Science 35(1):271–283. doi: 10.1111/mms.12515

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Western North Atlantic non-migratory coastal stocks

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 96% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.5	
	Habitat Specificity	2.6	2.8	
	Site Fidelity	2.4	2.8	
	Lifetime Reproductive Potential	1.1	2.0	
	Generation Length	2.7	2.0	
	Reproductive Plasticity	1.4	2.0	
	Migration	3.3	2.2	
	Home Range	2.3	2.8	
	Stock Abundance	1.8	2.5	
	Stock Abundance Trend	2.5	1.8	
	Cumulative Stressors	2.3	2.8	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.2	3.0	
	Sea Surface Salinity (Change in mean)	3.7	3.0	
	Sea Surface Salinity (Change in variability)	1.0	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.1	3.0	
	Circulation	2.3	2.7	
	Sea level rise	2.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Common bottlenose dolphin (Western North Atlantic: South Carolina-Georgia, Northern Florida, and Central Florida Coastal Stocks)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: High (91% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Sea Surface Temperature (Standard anomaly) (4.00), and Sea Surface Salinity (Standard anomaly) (3.73).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than or equal to 2.5: Migration (3.30), Generation Time (2.70), Habitat Specificity (2.60), and Species Abundance Trend (2.50).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 96% of the data quality scores were 2 or greater, 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock group includes the western North Atlantic common bottlenose dolphin South Carolina/Georgia Coastal Stock, Northern Florida Coastal Stock, and Central Florida Coastal Stock. This group includes dolphins of the coastal morphotype inhabiting coastal waters from the shoreline to approximately the 200m isobath from the Little River Inlet, South Carolina (33.8°N), south to the western end of Vaca Key (24.7°N, 81.1°W; Hayes et al. 2018).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock.

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

This stock group is considered non-migratory.

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock.

Stock Abundance

The abundance of the South Carolina/Georgia Coastal Stock of common bottlenose dolphins in the western North Atlantic was estimated at 6,027 individuals (CV=0.34); for the Northern Florida Coastal Stock is 877 individuals (CV=0.49); and for the Central Florida Coastal Stock is 1,218 individuals (CV=0.35) based on summer 2016 aerial surveys over coastal and shelf waters from Florida to New Jersey (Hayes et al. 2018) .

Stock Abundance Trend

Analysis of trends in abundance suggest a possible decline in the South Carolina/Georgia Coastal Stock abundance between 2002–2004 and 2016; a probable decline in Northern Florida Coastal Stock abundance between 2010–2011, and 2016; and a possible decline in Central Florida Coastal Stock abundance between 2010–2011, and 2016; however, the ability to detect trends is limited by uncertainty in stock distribution, lack of precision in abundance estimates, and gaps in surveys (Hayes et al. 2018).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms (Fire et al. 2015; Davis et al. 2019), recreational and commercial fishing gear (Kroetz et al. 2020), vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the South Carolina/Georgia Coastal Stock, Northern Florida Coastal Stock, and Central Florida Coastal Stock interact with several commercial fisheries, including the Southeastern U.S. Atlantic Shark Gillnet, Southeast Atlantic Gillnet, blue crab trap/pot, shrimp trawl, cannonball jellyfish trawl, Florida spiny lobster trap/pot, and hook and line fisheries (Hayes et al. 2018). Individuals of this stock have been reported stranded, with some strandings showing evidence of human interactions, and other strandings occurring during Unusual Mortality Events (UMEs; Hayes et al. 2018; also see NOAA National Marine Mammal Health and Stranding Response Database).

A UME was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1600 common bottlenose dolphins stranding as a result of morbillivirus (Morris et al. 2015; Balmer et al. 2018; Hayes et al. 2018; NMFS 2022). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Hayes et al. 2018).

The nearshore and estuarine habitats along the Atlantic seaboard are adjacent to areas of high human population and some are highly industrialized. Studies of bottlenose dolphin tissues from estuaries in the southeast U.S. have shown persistent organic pollutant (POP; Schwacke et al. 2002, 2012; Hansen et al. 2004; Litz et al. 2007; Pulster et al. 2009; Fair et al. 2010; Yordy et al. 2010; Balmer et al. 2011; Kucklick et al. 2011; Reif et al. 2017) and heavy metal (Durden et al. 2007; Stavros et al. 2007, 2008, 2011; Titcomb et al. 2017; Reif et al. 2017; Page-Karjian et al. 2020) concentrations that may result in adverse effects on health or reproductive rates, particularly in urbanized, developed, and agricultural areas.

Distribution and Sightings

Density model results for common bottlenose dolphins in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021).

Further Reading

Hayes, S.A., E. Josephson, and K. Maze-Foley, P.E. Rosel. 2018. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2017: (Second Edition). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-245. 371 p. doi: 10.25923/e764-9g81

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Balmer, B., E. Zolman, T. Rowles, C. Smith, F. Townsend, D. Fauquier, C. George, T. Goldstein, L. Hansen, B. Quigley, W. McFee, J. Morey, P. Rosel, J. Saliki, T. Speakman, and L. Schwacke. 2018. Ranging patterns, spatial overlap, and association with dolphin morbillivirus exposure in common bottlenose dolphins (*Tursiops truncatus*) along the Georgia, USA coast. Ecology and Evolution 8(24):12890–12904. doi: 10.1002/ece3.4727

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409(11):2094–2101. doi: 10.1016/j.scitotenv.2011.01.052

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Davis, D.A., K. Mondo, E. Stern, A.K. Annor, S.J. Murch, T.M. Coyne, L.E. Brand, M.E. Niemeyer, S. Sharp, W.G. Bradley, P.A. Cox, and D.C. Mash. 2019. Cyanobacterial neurotoxin BMAA and brain pathology in stranded dolphins. PLoS ONE 14(3):e0213346. doi: 10.1371/journal.pone.0213346

Durden, W.N., M.K. Stolen, D.H. Adams, and E.D. Stolen. 2007. Mercury and selenium concentrations in stranded bottlenose dolphins from the Indian River Lagoon system, Florida. Bulletin of Marine Science 81(1):37–54.

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Fire, S.E., L.J. Flewelling, M. Stolen, W. Noke Durden, M. de Wit, A.C. Spellman, and Z. Wang. 2015. Brevetoxin-associated mass mortality event of bottlenose dolphins and manatees along the east coast of Florida, USA. Marine Ecology Progress Series 526:241–251. doi: 10.3354/meps11225

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2018. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2017: (Second Edition). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-245. 371 p. doi: 10.25923/e764-9g81

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kroetz, A.M., A.N. Mathers, and J.K. Carlson. 2020. Evaluating protected species bycatch in the U.S. Southeast Gillnet Fishery. Fisheries Research 228:105573. doi: 10.1016/j.fishres.2020.105573

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and Northern Gulf of Mexico. Environmental Science & Technology 45(10):4270–4277. doi: 10.1021/es1042244

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Litz, J.A. 2007. Social structure, genetic structure, and persistent organohalogen pollutants in bottlenose dolphins (*Tursiops truncatus*) in Biscayne Bay, Florida. University of Miami. 140 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Morris, S.E., J.L. Zelner, D.A. Fauquier, T.K. Rowles, P.E. Rosel, F. Gulland, and B.T. Grenfell. 2015. Partially observed epidemics in wildlife hosts: modelling an outbreak of dolphin morbillivirus in the northwestern Atlantic, June 2013-2014. Journal of the Royal Society Interface 12(112):20150676. doi: 10.1098/rsif.2015.0676

National Marine Fisheries Service (NMFS). 2022. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pulster, E.L., K.L. Smalling, E. Zolman, L. Schwacke, and K.A. Maruya. 2009. Persistent organochlorine pollutants and toxaphene congener profiles in bottlenose dolphins (*Tursiops truncatus*) frequenting the Turtle/Brunswick River Estuary, Georgia, USA. Environmental Toxicology and Chemistry 28(7):1390–1399. doi: 10.1897/08-240.1

Reif, J.S., A.M. Schaefer, G.D. Bossart, and P.A. Fair. 2017. Health and Environmental Risk Assessment Project for bottlenose dolphins *Tursiops truncatus* from the southeastern USA. II. Environmental aspects. Diseases of Aquatic Organisms 125(2):155–166. doi: 10.3354/dao03143

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Schwacke, L.H., E.O. Voit, L.J. Hansen, R.S. Wells, G.B. Mitchum, A.A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environmental Toxicology and Chemistry 21(12):2752–2764. doi: 10.1002/etc.5620211232

Schwacke, L.H., E.S. Zolman, B.C. Balmer, S. De Guise, R.C. George, J. Hoguet, A.A. Hohn, J.R. Kucklick, S. Lamb, M. Levin, J.A. Litz, W.E. McFee, N.J. Place, F.I. Townsend, R.S. Wells, and T.K. Rowles. 2012. Anaemia, hypothyroidism and immune suppression associated with polychlorinated biphenyl exposure in bottlenose dolphins (*Tursiops truncatus*). Proceedings of the Royal Society B: Biological Sciences 279(1726):48–57. doi: 10.1098/rspb.2011.0665

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2007. Trace element concentrations in skin of free-ranging bottlenose dolphins (*Tursiops truncatus*) from the southeast Atlantic coast. Science of the Total Environment 388(1-3):300–315. doi: 10.1016/j.scitotenv.2007.07.030

Stavros, H.-C.W., G.D. Bossart, T.C. Hulsey, and P.A. Fair. 2008. Trace element concentrations in blood of free-ranging bottlenose dolphins (*Tursiops truncatus*): Influence of age, sex and location. Marine Pollution Bulletin 56(2):371–379. doi: 10.1016/j.marpolbul.2007.10.030

Stavros, H.-C.W., M. Stolen, W.N. Durden, W. McFee, G.D. Bossart, and P.A. Fair. 2011. Correlation and toxicological inference of trace elements in tissues from stranded and free-ranging bottlenose dolphins (*Tursiops truncatus*). Chemosphere 82(11):1649–1661. doi: 10.1016/j.chemosphere.2010.11.019

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Titcomb, E.M., J.S. Reif, P.A. Fair, H.-C.W. Stavros, M. Mazzoil, G.D. Bossart, and A.M. Schaefer. 2017. Blood mercury concentrations in common bottlenose dolphins from the Indian River Lagoon, Florida: Patterns of social distribution. Marine Mammal Science 33(3):771–784. doi: 10.1111/mms.12390

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Yordy, J.E., M.A. Mollenhauer, R.M. Wilson, R.S. Wells, A. Hohn, J. Sweeney, L.H. Schwacke, T.K. Rowles, J.R. Kucklick, and M.M. Peden-Adams. 2010. Complex contaminant exposure in cetaceans: a comparative E-Screen analysis of bottlenose dolphin blubber and mixtures of four persistent organic pollutants. Environmental Toxicology and Chemistry 29(10):2143–2153. doi: 10.1002/etc.279

Common bottlenose dolphin − *Tursiops truncatus*

Western North Atlantic, offshore Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = High

Data Quality = 93% of scores ≥ 2

	Tursiops truncatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.7	
	Habitat Specificity	1.8	3.0	
	Site Fidelity	1.0	2.7	
	Lifetime Reproductive Potential	1.4	2.3	
	Generation Length	2.5	1.7	
	Reproductive Plasticity	1.4	2.3	
	Migration	1.7	2.7	
	Home Range	2.1	2.7	
	Stock Abundance	1.3	2.7	
	Stock Abundance Trend	1.9	1.3	
	Cumulative Stressors	1.6	2.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	3.0	
	Sea Surface Temperature (Change in variability)	1.3	3.0	
	Air Temperature (Change in mean)	3.0	2.3	
	Air Temperature (Change in variability)	1.0	2.3	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.2	3.0	
	Sea Surface Salinity (Change in mean)	2.3	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	3.3	3.0	
	Ocean pH (Change in variability)	1.1	3.0	
	Sea ice coverage (Change in mean)	1.1	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.0	3.0	
	Dissolved oxygen (Change in variability)	1.1	3.0	
	Circulation	1.3	2.7	
	Sea level rise	1.1	3.0	
	Exposure Score	High		
Overall Vulnerability Rank		Low		

Low
Moderate
High
Very High

Common bottlenose dolphin (Western North Atlantic, Offshore Stock)

Tursiops truncatus

CVA Results Summary

Overall Climate Vulnerability Rank: Low (92% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than or equal to 3.0: Sea Surface Temperature (Standard anomaly) (3.80), Ocean pH (Standard anomaly) (3.33), Air Temperature (Standard anomaly) (3.00), and Dissolved oxygen (Standard anomaly) (3.00).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.50: Generation Time (2.53).

Distributional Response: High

Abundance Response: Low

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater, 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

This stock includes common bottlenose dolphins of the oceanic morphotype, generally found seaward from the 25 m isobath in the U.S. Exclusive Economic Zone and adjacent offshore and Canadian waters of the western North Atlantic (Hayes et al. 2020).

Prey/Diet Specificity

Generally, common bottlenose dolphins consume a large variety of fish and/or squid (Barros and Odell 1990; Mead and Potter 1990; Wells and Scott 2018). Common bottlenose dolphins seem to show a consistent preference for sound-producing fishes (e.g., sciaenids, toadfish; Berens McCabe et al. 2010; Bowen-Stevens et al. 2021). Estuarine stocks along the southeast U.S. Atlantic coast have been reported to consume a variety of prey, with preference for sciaenids (Gannon and Waples 2004; Pate and McFee 2012). Pate and McFee (2012) identified 42 prey species from 24 families in a study of stranded dolphins along the South Carolina coast. In Sarasota Bay, Florida, Rossman et al. (2015) found some individual common bottlenose dolphins to show diet specialization despite the broader study group showing a generalist diet. Specialization can be influenced by locally abundant prey species (Shane et al. 1986; Vollmer and Rosel 2013) or can result from resource partitioning amongst sympatric populations (e.g., Torres and Read 2009; Wilson et al. 2017).

Habitat Specificity

Common bottlenose dolphins are found in a variety of marine and estuarine habitats (Wells and Scott 2018).

Site Fidelity

No specific site fidelity information was found for this stock.

Lifetime Reproductive Potential

Taylor et al. (2007) reported the interbirth interval of common bottlenose dolphins as 3.80 years, though other studies have shown it to be closer to three years (Leatherwood 1977; Wells and Scott 1999; Connor et al. 2000; Wells 2003). Thayer (2008) estimated mean interbirth interval of 2.9 years in North Carolina.

Generally, females reach sexual maturity before males, with females reaching sexual maturity at 5–13 years (Sergeant et al. 1973; Perrin and Reilly 1984; Wells et al. 1987; Mead and Potter 1990; Mann et al. 2000; Wells 2000; Wells and Scott 2018).

Females reproduce through most of their adult lives (Leatherwood 1977; Hohn et al. 1989; Wells and Scott 1999; Wells 2000; Wells 2003), but may produce fewer calves after they reach 30 years of age (Wells 2000). Sarasota Bay common bottlenose dolphins can give birth when they are as young as 6 years of age, and can continue until they are 48 years old (Wells and Scott 2018). Reproductive lifespan would therefore be up to 42 years based on long-term observation studies (Wells 2014; Wells and Scott 2018).

Longitudinal studies from Sarasota Bay, Florida have found that female bottlenose dolphins can live up to 67 years (Wells and Scott 2018). Studies based on growth layer groups in teeth suggest female bottlenose dolphins can live to 41 years along the Texas coast (Fernandez and Hohn 1998) and to 30 years along the Mississippi coast (Mattson et al. 2006).

Generation Length

Taylor et al. (2007) reported common bottlenose dolphin generation length of 20.6–21.1 years.

Reproductive Plasticity

Common bottlenose dolphin calving is generally diffusely seasonal, with one or more peaks, although births have been reported from all seasons (Vollmer and Rosel 2013; Wells and Scott 2018). Calf sightings in South Carolina peak in spring and early summer and again in early autumn (McFee et al. 2014). In North Carolina, Thayer et al. (2003) observed a strong birth peak in spring based on stranding data and a diffuse birth peak from late spring to early fall based on sightings. Calf sightings peak in the spring and summer months in Florida (Wells et al. 1987), Mississippi/Louisiana (Miller et al. 2010; Miller et al. 2013), and Texas (McHugh 1989; Henderson and Würsig 2007).

Migration

Studies relating to the migratory patterns (or the lack thereof) for this stock were not found in the literature. The nearby coastal migratory stocks display seasonal north-south movements. During winter months, the Northern Migratory Coastal Stock moves from waters as far north as New Jersey to waters near Cape Hatteras (Kenney 1990; Read et al. 2003; Torres et al. 2005). During January and February, the Southern Migratory Coastal Stock migrates south from waters of southern Virginia and north central North Carolina to waters south of Cape Fear, North Carolina, and as far south as coastal Florida (Barco et al. 1999).

Home Range

Data are insufficient to characterize home range patterns (or the lack thereof) for this stock. Tracking studies have shown common bottlenose dolphins can travel distances greater than 2000km (Wells et al. 1999). Estrada and Hohn (2003) observed migrating bottlenose dolphins along the East Coast of the United States travel a mean distance of 32.7 km/day while non-migrating dolphins traveled a mean distance of 24.5 km/day. Klatsky et al. (2007) found dolphins off Bermuda traveled a mean distance of 28.3 km/day.

Stock Abundance

The best abundance estimate for this stock is 62,851 individuals (CV=0.23) based on summer 2016 surveys (Garrison 2020; Palka 2020).

Stock Abundance Trend

An analysis of population estimates from 2004 (54,739; CV=0.24), 2011 (77,532; CV=0.40), and 2016 (62,851; CV=0.23) did not indicate a statistically significant trend in abundance (Hayes et al. 2020).

Cumulative Stressors

Common bottlenose dolphins face a wide range of individual and cumulative natural and anthropogenic threats (see reviews by Vollmer and Rosel 2013; Wells and Scott 2018; and Wells et al. 2019). These include such threats as shark predation, harmful algal blooms, recreational and commercial fishing gear, vessel traffic, pollution, habitat alteration, and provisioning.

Common bottlenose dolphins in the Western North Atlantic Offshore Stock interact with the bottom trawl fishery, with mean annual human-caused mortality and serious injury of 10.42 (CV=0.62) dolphins in the Northeast and 12.08 (CV=0.39) dolphins in the Mid-Atlantic during the period 2014–2018 (Lyssikatos et al. 2020).

An Unusual Mortality Event (UME) was declared in the summer of 2013 for the mid-Atlantic coast from New York to Brevard County, Florida, with more than 1500 common bottlenose dolphins stranding as a result of morbillivirus (Waring et al. 2016; NMFS 2022). Strandings were more prevalent along oceanic shores than in estuaries, suggesting that coastal stocks were more impacted by the UME than estuarine stocks (Waring et al. 2016).

Storm events have been shown to affect common bottlenose dolphin distribution and foraging (Fandel et al. 2020).

Distribution and Sightings

Density model results for common bottlenose dolphins in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Wells, R.S. and M.D. Scott. 2018. Bottlenose Dolphin, *Tursiops truncatus*, Common Bottlenose Dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). The IUCN Red List of Threatened Species 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

References

Barco, S.G., W.M. Swingle, W.A. Mclellan, R.N. Harris, and D.A. Pabst. 1999. Local abundance and distribution of bottlenose dolphins (*Tursiops truncatus*) in the nearshore waters of Virginia Beach, Virginia. Marine Mammal Science 15(2):394–408. doi: 10.1111/j.1748-7692.1999.tb00809.x

Barros, N.B. and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 309–328. doi: 10.1016/B978-0-12-440280-5.50020-2

Berens McCabe, E.J., D.P. Gannon, N.B. Barros, and R.S. Wells. 2010. Prey selection by resident common bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. Marine Biology 157(5):931–942. doi: 10.1007/s00227-009-1371-2

Bowen-Stevens, S.R., D.P. Gannon, R.A. Hazelkorn, G. Lovewell, K.M. Volker, S. Smith, M.C. Tumlin, and J. Litz. 2021. Diet of common bottlenose dolphins, *Tursiops truncatus*, that stranded in and near Barataria Bay, Louisiana, 2010–2012. Southeastern Naturalist 20(1). doi: 10.1656/058.020.0113

Connor, R.C., R.S. Wells, J. Mann, and A.J. Read. 2000. The bottlenose dolphin: Social relationships in a fission-fusion society. In: Mann, J., R. Connor, P. Tyack, and H. Whitehead (Eds.), Cetacean Societies: Field Studies of Dolphins and Whales. University of Chicago Press, Chicago, IL. pp. 91–126.

Durden, W.N., E.D. Stolen, and M.K. Stolen. 2011. Abundance, distribution, and group composition of Indian River Lagoon bottlenose dolphins (*Tursiops truncatus*). Aquatic Mammals 37(2):175–186. doi: 10.1578/Am.37.2.2011.175

Estrada, E.L. and A.A. Hohn. 2003. Satellite monitored movements of bottlenose dolphins along the Atlantic coast of the US. 15th Biennial Conference on the Biology of Marine Mammals, Greensboro, NC, 14-19 December 2003

Fair, P.A., J. Adams, G. Mitchum, T.C. Hulsey, J.S. Reif, M. Houde, D. Muir, E. Wirth, D. Wetzel, E. Zolman, W. McFee, and G.D. Bossart. 2010. Contaminant blubber burdens in Atlantic bottlenose dolphins (*Tursiops truncatus*) from two southeastern US estuarine areas: Concentrations and patterns of PCBs, pesticides, PBDEs, PFCs, and PAHs. Science of the Total Environment 408(7):1577–1597. doi: 10.1016/j.scitotenv.2009.12.021

Fandel, A.D., A. Garrod, A.L. Hoover, J.E. Wingfield, V. Lyubchich, D.H. Secor, K.B. Hodge, A.N. Rice, and H. Bailey. 2020. Effects of intense storm events on dolphin occurrence and foraging behavior. Scientific Reports 10(1):19247. doi: 10.1038/s41598-020-76077-3

Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. Fishery Bulletin 96(2):357–365.

Gannon, D.P. and D.M. Waples. 2004. Diets of coastal bottlenose dolphins from the U. S. Mid-Atlantic coast differ by habitat. Marine Mammal Science 20(3):527–545. doi: 10.1111/j.1748-7692.2004.tb01177.x

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Hansen, L.J., L.H. Schwacke, G.B. Mitchum, A.A. Hohn, R.S. Wells, E.S. Zolman, and P.A. Fair. 2004. Geographic variation in polychorinated biphenyl and organochlorine pesticide concentrations in the blubber of bottlenose dolphins from the US Atlantic coast. Science of the Total Environment 319(1-3):147–172. doi: 10.1016/S0048-9697(03)00371-1

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Henderson, E.E. and B. Würsig. 2007. Behavior patterns of bottlenose dolphins in San Luis Pass, Texas. Gulf of Mexico Science 25(2):153–161. doi: 10.18785/goms.2502.06

Hohn, A.A., M.D. Scott, R.S. Wells, J.C. Sweeney, and A.B. Irvine. 1989. Growth layers in teeth from known-age, free-ranging bottlenose dolphins. Marine Mammal Science 5(4):315–342. doi: 10.1111/j.1748-7692.1989.tb00346.x

Kenney, R.D. 1990. Bottlenose dolphins off the northeastern United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 369–386.

Klatsky, L.J., R.S. Wells, and J.C. Sweeney. 2007. Offshore bottlenose dolphins (*Tursiops truncatus*): movement and dive behavior near the Bermuda Pedestal. Journal of Mammalogy 88(1):59–66. doi: 10.1644/05-mamm-a-365r1.1

Leatherwood, S. 1977. Some preliminary impressions on the numbers and social behavior of free-swimming bottlenosed dolphin calves (*Tursiops truncatus*) in the northern Gulf of Mexico. In: Ridgway, S.H. and K. Bernirschke (Eds.), Breeding Dolphins; Present Status, Suggestions for the Future. Final report to the US Marine Mammal Commission, Contract MM6AC009, MMC-76/07, Washington, DC. pp. 143–167.

Lyssikatos, M.C., S. Chavez-Rosales, and J. Hatch. 2021. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2014-2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 21-02. 12 p.

Mann, J., R.C. Connor, L.M. Barre, and M.R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. Behavioral Ecology 11(2):210–219. doi: 10.1093/beheco/11.2.210

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mattson, M.C., K.D. Mullin, G.W. Ingram, and W. Hoggard. 2006. Age structure and growth of the bottlenose dolphin (*Tursiops truncatus*) from strandings in the Mississippi sound region of the north-central Gulf of Mexico from 1986 to 2003. Marine Mammal Science 22(3):654–666. doi: 10.1111/j.1748-7692.2006.00057.x

McFee, W.E., T.R. Speakman, L. Balthis, J.D. Adams, and E.S. Zolman. 2014. Reproductive seasonality of a recently designated bottlenose dolphin stock near Charleston, South Carolina, U.S.A. Marine Mammal Science 30(2):528–543. doi: 10.1111/mms.12055

McHugh, M.B. 1989. Population numbers and feeding behavior of the Atlantic bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. University of Texas at Austin. Thesis. 96 p.

Mead, J.G. and C.W. Potter. 1990. Natural history of bottlenose dolphins along the central Atlantic coast of the United States. In: Leatherwood, S. and R.R. Reeves (Eds.), The Bottlenose Dolphin. Academic Press, San Diego, CA. pp. 165–195.

Miller, L.J., A.D. Mackey, T. Hoffland, M. Solangi, and S.A. Kuczaj. 2010. Potential effects of a major hurricane on Atlantic bottlenose dolphin (*Tursiops truncatus*) reproduction in the Mississippi Sound. Marine Mammal Science 26(3):707–715. doi: 10.1111/j.1748-7692.2010.00371.x

Miller, L.J., A.D. Mackey, M. Solangi, and S.A. Kuczaj. 2013. Population abundance and habitat utilization of bottlenose dolphins in the Mississippi Sound. Aquatic Conservation: Marine and Freshwater Ecosystems 23(1):145–151. doi: 10.1002/aqc.2278

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pate, S.M. and W.E. McFee. 2012. Prey species of bottlenose dolphins (*Tursiops truncatus*) from South Carolina Waters. Southeastern Naturalist 11(1):1–22. doi: 10.1656/058.011.0101

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Read, A.J., K.W. Urian, B. Wilson, and D.M. Waples. 2003. Abundance of bottlenose dolphins in the bays, sounds, and estuaries of North Carolina. Marine Mammal Science 19(1):59–73. doi: 10.1111/j.1748-7692.2003.tb01092.x

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Rossman, S., P.H. Ostrom, M. Stolen, N.B. Barros, H. Gandhi, C.A. Stricker, and R.S. Wells. 2015. Individual specialization in the foraging habits of female bottlenose dolphins living in a trophically diverse and habitat rich estuary. Oecologia 178(2):415–425. doi: 10.1007/s00442-015-3241-6

Sergeant, D.E., D.K. Caldwell, and M.C. Caldwell. 1973. Age, growth, and maturity of bottlenosed dolphin (*Tursiops-truncatus*) from northeast Florida. Journal of the Fisheries Research Board of Canada 30(7):1009–1011. doi: 10.1139/f73-165

Shane, S.H., R.S. Wells, and B. Würsig. 1986. Ecology, behavior and social organization of the bottlenose dolphin: A review. Marine Mammal Science 2:34–63. doi: 10.1111/j.1748-7692.1986.tb00026.x

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Thayer, V.G. 2008. Life history parameters and social associations of female bottlenose dolphins (*Tursiops truncatus*) off North Carolina, USA. Duke University. Dissertation. 164 p.

Thayer, V.G., A.J. Read, A.S. Friedlaender, D.R. Colby, A.A. Hohn, W.A. McLellan, D.A. Pabst, J.L. Dearolf, N.I. Bowles, J.R. Russell, and K.A. Rittmaster. 2003. Reproductive seasonality of western Atlantic bottlenose dolphins off North Carolina, USA. Marine Mammal Science 19(4):617–629. doi: 10.1111/j.1748-7692.2003.tb01120.x

Torres, L.G. and A.J. Read. 2009. Where to catch a fish? The influence of foraging tactics on the ecology of bottlenose dolphins (*Tursiops truncatus*) in Florida Bay, Florida. Marine Mammal Science 25(4):797–815. doi: 10.1111/j.1748-7692.2009.00297.x

Torres, L.G. and D.L. Urban. 2005. Using spatial analysis to assess bottlenose dolphins as an indicator of healthy fish habitat. In: Bortone, S.A. (Ed.), Estuarine indicators. CRC Press, Boca Raton, FL. pp. 423–436.

Vollmer, N.L. and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Gulf of Mexico: Population biology, potential threats, and management. Southeastern Naturalist 12(m6):1–43. doi: 10.1656/058.012.m601

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R.S. 2000. Reproduction in wild bottlenose dolphins: Overview of patterns observed during a long-term study. In: Duffield, D. and T. Robeck (Eds.), Bottlenose Dolphin Reproduction Workshop. AZA Marine Mammal Taxon Advisory Group, Silver Spring, MD. pp. 57–74.

Wells, R.S. 2003. Dolphin social complexity: Lessons from long-term study and life history. In: de Waal, F.B.M. and P.L. Tyack (Eds.), Animal Social Complexity: Intelligence, Culture, and Individualized Societies Harvard University Press, Cambridge, MA. pp. 32–56.

Wells, R.S. 2014. Social structure and life history of bottlenose dolphins near Sarasota Bay, Florida: Insights from four decades and five generations. Primates and cetaceans. pp. 149–172. doi: 10.1007/978-4-431-54523-1_8

Wells, R.S., A. Natoli, and G. Braulik. 2019. *Tursiops truncatus* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en

Wells, R.S., H.L. Rhinehart, P. Cunningham, J. Whaley, M. Baran, C. Koberna, and D.P. Costa. 1999. Long distance offshore movements of bottlenose dolphins. Marine Mammal Science 15(4):1098–1114. doi: 10.1111/j.1748-7692.1999.tb00879.x

Wells, R.S. and M.D. Scott. 1999. Bottlenose dolphin *Tursiops truncatus* (Montagu, 1821). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 137–182.

Wells, R.S. and M.D. Scott. 2018. Bottlenose dolphin, *Tursiops truncatus*, common bottlenose dolphin. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 118–125. doi: 10.1016/B978-0-12-804327-1.00072-8

Wells, R.S., M.D. Scott, and A.B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. In: Genoways, H.H. (Ed.), Current Mammalogy. Plenum Press, New York, NY. pp. 247–305.

Wilson, R.M., R.B. Tyson, J.A. Nelson, B.C. Balmer, J.P. Chanton, and D.P. Nowacek. 2017. Niche differentiation and prey selectivity among common bottlenose dolphins (*Tursiops truncatus*) sighted in St. George Sound, Gulf of Mexico. Frontiers in Marine Science 4:235. doi: 10.3389/fmars.2017.00235

Common dolphin − *Delphinus delphis delphis*

Western North Atlantic Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = High

Data Quality = 85% of scores ≥ 2

	Delphinus delphis delphis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.5	2.8	
	Habitat Specificity	1.8	3.0	
	Site Fidelity	1.8	1.8	
	Lifetime Reproductive Potential	1.6	2.5	
	Generation Length	1.8	1.8	
	Reproductive Plasticity	1.6	1.8	
	Migration	2.4	2.8	
	Home Range	1.8	3.0	
	Stock Abundance	1.1	3.0	
	Stock Abundance Trend	2.0	0.8	
	Cumulative Stressors	1.8	2.5	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	3.0	
	Sea Surface Temperature (Change in variability)	1.2	3.0	
	Air Temperature (Change in mean)	3.1	2.5	
	Air Temperature (Change in variability)	1.1	2.5	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.3	3.0	
	Sea Surface Salinity (Change in mean)	2.4	2.5	
	Sea Surface Salinity (Change in variability)	2.1	2.5	
	Ocean pH (Change in mean)	3.4	3.0	
	Ocean pH (Change in variability)	1.4	3.0	
	Sea ice coverage (Change in mean)	1.1	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	2.5	3.0	
	Dissolved oxygen (Change in variability)	1.2	3.0	
	Circulation	2.0	2.2	
	Sea level rise	1.4	2.2	
	Exposure Score	High		
Overall Vulnerability Rank		Low		

Low

Moderate

High

Very High

Common dolphin, short-beaked (Western North Atlantic Stock)

Delphinus delphis delphis

CVA Results Summary

Overall Climate Vulnerability Rank: Low (98% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.50), Ocean pH (Standard anomaly) (3.35), and Air Temperature (Standard anomaly) (3.15).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5.

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 85 % of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The short-beaked common dolphin western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore and Canadian waters (Hayes et al. 2022).

Prey/Diet Specificity

Common dolphins consume a variety of epipelagic and mesopelagic fishes and squids associated with the deep scattering layer and are known to adapt their diet based on prey abundance (Young and Cockcroft 1994; Evans 1994; Ohizumi et al. 1998; Goold 2000; De Pierrepont et al. 2005; Pusineri et al. 2007). In the western North Atlantic, long-finned squid (*Loligo pealei*) and Atlantic mackerel (*Scomber scombrus*) are frequent prey species while herring, whiting (*Micromesistius poutassou*), pilchard, and anchovy are also part of the diet (Waring et al. 1990; Overholtz and Waring 1991; Lahaye et al. 2005).

Habitat Specificity

In the western North Atlantic, short-beaked common dolphins are found in continental shelf waters, over prominent underwater topography, and in association with Gulf Stream features (Hui 1979; CETAP 1982; Selzer and Payne 1988; Waring et al. 1992; Evans 1994; Hamazaki 2002; Doksaeter et al. 2008; Waring et al. 2008).

Site Fidelity

Short-beaked common dolphins are generally considered to have low site fidelity; however a study from the coast of Portugal suggested some degree of site fidelity (Ball et al. 2017).

Lifetime Reproductive Potential

Calving intervals of 1-3 years have been reported for this species (Jefferson et al. 2015). Taylor et al. (2007) reported an interbirth interval of 2.10 years based on values reported by Danil and Chivers (2007).

Reported sexual maturity ages vary greatly across populations (Jefferson et al. 2015). For short-beaked common dolphins in the western North Atlantic, Westgate and Read (2007) reported 8.3 and 9.5 years as the age of female and male sexual maturity, respectively.

Generation Length

Taylor et al. (2007) reported a generation length of 14.1 years at r = 0.02 and 14.8 years at r = 0.0 based on values reported by Perrin and Reilly (1984), Ferrero and Walker (1995), and Danil and Chivers (2007).

Reproductive Plasticity

In the western North Atlantic, mating occurs primarily during July and August and gestation is estimated at 11-12 months (Westgate and Read 2007). Calving peaks during mid-summer (Westgate and Read 2007).

Migration

Although short-beaked common dolphins can be found from Cape Hatteras to Nova Scotia year-round (CETAP 1982), they do exhibit seasonal movements. From mid-January to May, they are most common Cape Hatteras to Georges Bank. They are known to move onto Georges Bank, Gulf of Maine, and the Scotian Shelf from mid-summer to autumn (Sergeant et al. 1970; Hain et al. 1981; CETAP 1982; Payne et al. 1984; Selzer and Payne 1988; Gowans and Whitehead 1995).

Home Range

In the western North Atlantic, short-beaked common dolphins are known to range from Newfoundland to Florida. They are more common in temperate, cooler waters of the northwestern Atlantic (Gaskin 1992; Waring and Palka 2002; Jefferson et al. 2009; Perrin 2018) and are not currently thought to occur south of South Carolina with any regularity (Jefferson et al. 2009).

Stock Abundance

Recent abundance estimates have been generated for portions of this stock based on 2016 surveys: 48,723 (CV=0.48) for the Newfoundland/Labrador portion, 43,124 (CV=0.28) for the Bay of Fundy/Scotian Shelf/Gulf of St. Lawrence portion, and 80,227 (CV=0.31) and 900 (CV=0.57) for U.S. waters of the western North Atlantic (Lawson and Gosselin 2018; Garrison 2020; Palka 2020). The entire stock estimate is 172,974 individuals (CV=0.21) and the minimum population estimate for this stock is 145,216 (Hayes et al. 2022).

Stock Abundance Trend

A trend analysis has not been conducted for this stock.

Cumulative Stressors

Short-beaked common dolphins interact with the Northeast sink gillnet, Mid-Atlantic gillnet, Northeast bottom trawl, Mid-Atlantic bottom trawl, and pelagic longline fisheries. During 2014–2018, total annual estimated average fishery-related mortality or serious injury to this stock was 399 individuals (CV=0.05), and 499 strandings were reported along the U.S. Atlantic coast (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b; Lyssikatos et al. 2020; Hayes et al. 2022.

Distribution and Sightings

Density model results for sho dolphin in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Virginia Capes Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 711 p.

Hammond, P.S., G. Bearzi, A. Bjørge, K. Forney, L. Karczmarski, T. Kasuya, W.F. Perrin, M.D. Scott, J.Y. Wang, R.S. Wells, and B. Wilson. 2008. *Delphinus delphis*. The IUCN Red List of Threatened Species 2008: e.T6336A12649851. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T6336A12649851.en

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine Mammals of the World (Second Edition). 616 p. doi: 10.1016/c2012-0-06919-0

Perrin, W.F. 2018. Common Dolphin: *Delphinus delphis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 205–209. doi: 10.1016/B978-0-12-804327-1.00095-9

References

Ball, L., K. Shreves, M. Pilot, and A.E. Moura. 2017. Temporal and geographic patterns of kinship structure in common dolphins (*Delphinus delphis*) suggest site fidelity and female-biased long-distance dispersal. Behavioral Ecology and Sociobiology 71(8):123. doi: 10.1007/s00265-017-2351-z

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Danil, K. and S.J. Chivers. 2007. Growth and reproduction of female short-beaked common dolphins, *Delphinus delphis*, in the eastern tropical Pacific. Canadian Journal of Zoology 85:108–121. doi: 10.1139/z06-188

De Pierrepont, J.F., B. Dubois, S. Desormonts, M.B. Santos, and J.P. Robin. 2005. Stomach contents of English Channel cetaceans stranded on the coast of Normandy. Journal of the Marine Biological Association of the United Kingdom 85(6):1539–1546. doi: 10.1017/s0025315405012762

Doksaeter, L., E. Olsen, L. Nottestad, and A. Ferno. 2008. Distribution and feeding ecology of dolphins along the Mid-Atlantic Ridge between Iceland and the Azores. Deep-Sea Research Part Ii-Topical Studies in Oceanography 55(1-2):243–253. doi: 10.1016/j.dsr2.2007.09.009

Evans, W.E. 1994. Common dolphin, white-bellied porpoise *Delphinus delphis* Linnaeus, 1758. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 191–224.

Ferrero, R.C. and W.A. Walker. 1995. Growth and reproduction of the common dolphin, Delphinus delphis Linnaeus, in the offshore waters of the north Pacific Ocean. Fishery Bulletin 93:483–494.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Gaskin, D.E. 1992. Status of the common dolphin, *Delphinus delphis*, in Canada. Canadian Field-Naturalist 106(1):55–63.

Goold, J.C. 2000. A diel pattern in vocal activity of short-beaked common dolphins, *Delphinus delphis*. Marine Mammal Science 16(1):240–244. doi: 10.1111/j.1748-7692.2000.tb00915.x

Gowans, S. and H. Whitehead. 1995. Distribution and habitat partitioning by small odontocetes in the Gully, a submarine-canyon on the Scotian-Shelf. Canadian Journal of Zoology 73(9):1599–1608. doi: 10.1139/z95-190

Hain, J.H.W., R.K. Edel, H.E. Hays, S.K. Katona, and J.D. Roanowicz. 1981. General distribution of cetaceans in the continental shelf waters of the northeastern United States. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the US outer continental shelf. Annual report for 1979. Bureau of Land Management, Washington, DC. pp. II.1–II.345.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Hui, C.A. 1979. Undersea topography and distribution of dolphins of the genus *Delphinus* in the Southern-California Bight. Journal of Mammalogy 60(3):521–527. doi: 10.2307/1380092

Jefferson, T.A., D. Fertl, J. Bolaños-Jiménez, and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus* spp.) in the western Atlantic Ocean: a critical re-examination. Marine Biology 156(6):1109–1124. doi: 10.1007/s00227-009-1152-y

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Lahaye, V., P. Bustamante, J. Spitz, W. Dabin, K. Das, G.J. Pierce, and F. Caurant. 2005. Long-term dietary segregation of common dolphins *Delphinus delphis* in the Bay of Biscay, determined using cadmium as an ecological tracer. Marine Ecology Progress Series 305:275–285. doi: 10.3354/meps305275

Lawson, J. and J.-F. Gosselin. 2018. Estimates of cetacean abundance from the 2016 NAISS aerial surveys of eastern Canadian waters, with a comparison to estimates from the 2007 TNASS. NAMMCO SC/25/AE/09. 40 p.

Lyssikatos, M.C., S. Chavez-Rosales, and J.M. Hatch. 2020. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2013-2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-04. 11 p. doi: 10.25923/5we2-g460

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Ohizumi, H., M. Yoshioka, K. Mori, and N. Miyazaki. 1998. Stomach contents of common dolphins (*Delphinus delphis*) in the pelagic western North Pacific. Marine Mammal Science 14(4):835–844. doi: 10.1111/j.1748-7692.1998.tb00767.x

Overholtz, W.J. and G.T. Waring. 1991. Diet composition of pilot whales *Globicephala sp* and common dolphins *Delphinus-delphis* in the Mid-Atlantic Bight during Spring 1989. Fishery Bulletin 89(4):723–728.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Contract number NA-81-FA-C-00023. 246 p.

Perrin, W.F. 2018. Common dolphin: *Delphinus delphis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 205–209. doi: 10.1016/B978-0-12-804327-1.00095-9

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pusineri, C., V. Magnin, L. Meynier, J. Spitz, S. Hassani, and V. Ridoux. 2007. Food and feeding ecology of the common dolphin (*Delphinus delphis*) in the oceanic Northeast Atlantic and comparison with its diet in neritic areas. Marine Mammal Science 23(1):30–47. doi: 10.1111/j.1748-7692.2006.00088.x

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Selzer, L.A. and P.M. Payne. 1988. The distribution of white-sided (*Lagenorhynchus-acutus*) and common dolphins (*Delphinus-delphis*) vs environmental features of the continental-shelf of the northeastern United-States. Marine Mammal Science 4(2):141–153. doi: 10.1111/j.1748-7692.1988.tb00194.x

Sergeant, D.E., A.W. Mansfield, and B. Beck. 1970. Inshore records of cetacea for eastern Canada, 1949-68. Journal of the Fisheries Research Board of Canada 27(11):1903–&. doi: 10.1139/f70-216

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., P. Gerrior, P.M. Payne, B.L. Parry, and J.R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the Northeast United-States, 1977-88. Fishery Bulletin 88(2):347–360.

Waring, G.T., L. Nøttestad, E. Olsen, H. Skov, and G. Vikingsson. 2008. Distribution and density estimates of cetaceans along the mid-Atlantic Ridge during summer 2004. Journal of Cetacean Research and Management 10(2):137–146.

Waring, G.T. and D.L. Palka. 2002. North Atlantic marine mammals. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals. Academic Press., San Diego, CA. pp. 802–806.

Westgate, A.J. and A.J. Read. 2007. Reproduction in short-beaked common dolphins (*Delphinus delphis*) from the western North Atlantic. Marine Biology 150(5):1011–1024. doi: 10.1007/s00227-006-0394-1

Young, D.D. and V.G. Cockcroft. 1994. Diet of common dolphins (*Delphinus delphis*) off the south-east coast of southern Africa: opportunism or specialization? Journal of Zoology 234(1):41–53. doi: 10.1111/j.1469-7998.1994.tb06055.x

Cuvier's beaked whale − *Ziphius cavirostris*

Gulf of Mexico Stock

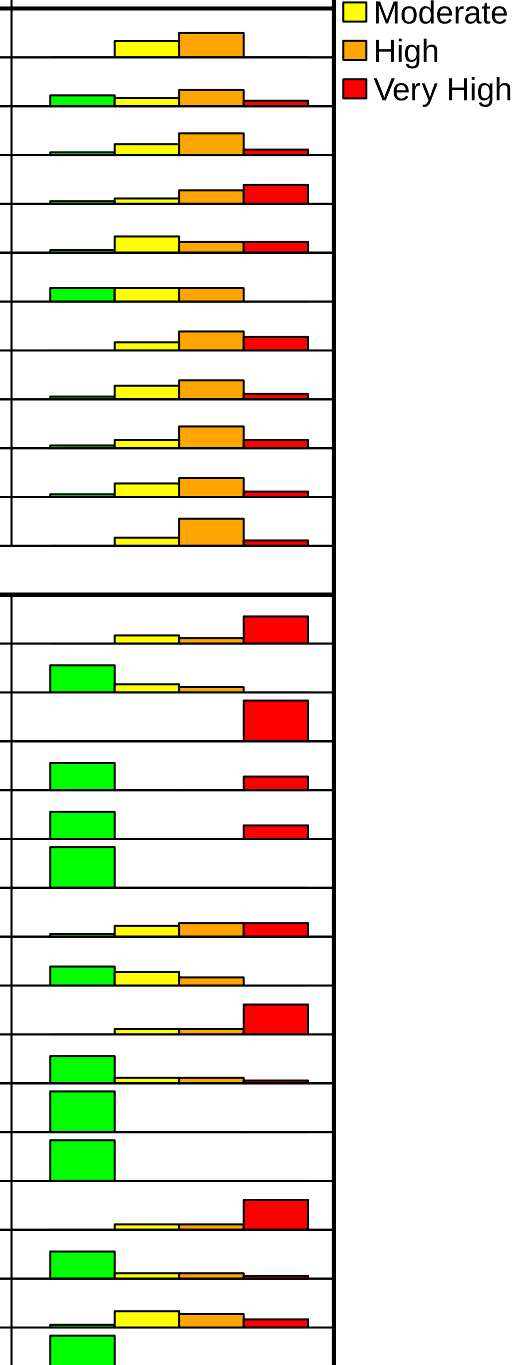
Overall Vulnerability Rank = Very High

Biological Sensitivity = High

Climate Exposure = Very High

Data Quality = 70% of scores ≥ 2

	Ziphius cavirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.6	2.0	
	Habitat Specificity	2.4	2.3	
	Site Fidelity	2.7	1.3	
	Lifetime Reproductive Potential	3.2	1.3	
	Generation Length	2.7	1.3	
	Reproductive Plasticity	2.0	1.0	
	Migration	3.1	1.7	
	Home Range	2.7	1.7	
	Stock Abundance	2.9	1.7	
	Stock Abundance Trend	2.7	0.7	
	Cumulative Stressors	2.9	2.0	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.7	
	Sea Surface Temperature (Change in variability)	1.5	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	2.0	2.7	
	Precipitation (Change in mean)	2.0	2.7	
	Precipitation (Change in variability)	1.0	2.3	
	Sea Surface Salinity (Change in mean)	2.9	2.3	
	Sea Surface Salinity (Change in variability)	1.7	2.3	
	Ocean pH (Change in mean)	3.6	2.7	
	Ocean pH (Change in variability)	1.6	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.6	2.7	
	Dissolved oxygen (Change in variability)	1.6	2.7	
	Circulation	2.7	2.0	
	Sea level rise	1.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		



Cuvier's beaked whale (Gulf of Mexico Stock)

Ziphius cavirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (63% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (3.60), and Ocean pH (Standard anomaly) (3.60).

Biological Sensitivity: High. Two sensitivity attributes scored greater than 3.0: Lifetime Reproductive Potential (3.20) and Migration (3.13).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 70% of the data quality scores were 2 or greater, 27% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Cuvier's beaked whale Gulf of Mexico stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone of Gulf of Mexico and adjacent offshore and Mexican waters (Hayes et al. 2021). This stock is considered separately from the Puerto Rico/U.S. Virgin Islands and western North Atlantic stocks.

Prey/Diet Specificity

West et al. (2017) compiled Cuvier's beaked whale diet information from 18 studies, which included 45 stomach analyses. World-wide, the most important cephalopod families in the diet are Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuthidae, Ommastrephidae, Onychoteuthidae, Pholidoteuthidae, and Mastigoteuthidae, all within the order Oegopsida (West et al. 2017). Cranchiidae is common prey in all locations (West et al. 2017). Histioteuthidae and Cranchiidae are the most common prey in the North Atlantic (West et al. 2017).

Stomach content data for Cuvier's beaked whales in the Gulf of Mexico is limited to a single stranding, which contained remains of the squid *Loligo peali* and unidentified cephalopods (Fertl et al. 1997).

Habitat Specificity

Generally, little is known about beaked whale habitat preferences due to their elusive nature (Barlow et al. 2006). Beaked whales are typically found in continental slope and oceanic waters deeper than 200 m

(Ritter and Brederlau 1999; Gannier 2000; Waring et al. 2001; Cañadas et al. 2002; Pitman 2002; MacLeod et al. 2004; Ferguson 2005; MacLeod and Zuur 2005; Ferguson et al. 2006; MacLeod and Mitchell 2006). Beaked whales are only occasionally reported in waters over the continental shelf (Pitman 2002). Cuvier's beaked whales have been found associated with physical features such as the continental slope, canyons, escarpments, and oceanic islands (Waring et al. 2001; Baird et al. 2004; MacLeod et al. 2004; MacLeod and D'Amico 2006).

In the Gulf of Mexico, beaked whales are found in waters with a bottom depth ranging from 420m to 3,487m (Ward et al. 2005) while few beaked whales are sighted on the continental shelf (e.g., Fritts et al. 1983; Esher et al. 1992). Habitat characterization modeling predicted areas greater than 1000m in bottom depth as potential beaked whale habitat (Ward et al. 2005). The probability of beaked whale presence is greatest along the continental slope (Ward et al. 2005). Habitat-based density models predicted concentrations of beaked whales (and sperm whales) near off-shelf submarine canyons at the mouth of the Mississippi River and the central northern Gulf, and along the continental slope (Roberts et al. 2016a). Off the U.S. East Coast, the models predicted highest densities along the continental slope, in and around submarine canyons, and near seamounts, particularly in cold, productive waters, consistent with their reported habitats (Roberts et al. 2016a).

Based on data collected during GulfCet I, Davis et al. (1998) reported that beaked whales were found in areas of steep SST gradients, and suggested that beaked whales (and other deep-diving cetaceans in the Gulf) may be foraging along thermal fronts associated with eddy systems.

Würsig (2017) [adapted from Maze-Foley and Mullin 2006] reported that Cuvier's beaked whales were encountered during on-effort surveys by NMFS in the Northern Oceanic Gulf during the period from 1991–2001 at a mean depth of 1884m (range 1179m-3221m depth) and mean water temperature of 26.01 degrees C (range 24.3-28.3 degrees C).

Martinez et al. (2010) reported sighting Cuvier's beaked whales within or near the Deepwater Horizon site between 28 April – 31 July, 2010. Martinez et al. (2010) also reported sighting beaked whales in the southeastern Gulf of Mexico near the Dry Tortugas.

Site Fidelity

Site fidelity information for the Gulf of Mexico is not available, though there are known hotspots such as Mississippi Canyon (e.g., Hildebrand et al. 2015). Site fidelity has been reported for Cuvier's beaked whales in the Ligurian Sea (Ballardini et al. 2005), Hawaii (McSweeney et al. 2007), and Canary Islands (Aguilar de Soto and Hammond 2014).

From passive acoustic monitoring data, beaked whales (Cuvier's and Gervais') showed a significant higher detection rate in the Dry Tortugas site (13.4 animals/1000km2) when compared to the Mississippi and Green canyons sites (2.6 animals/1,000 km2 and 1.8 animals/1,000 km2, respectively; Table 9 in Hildebrand et al. 2012).

Lifetime Reproductive Potential

Taylor et al. (2007) did not include interbirth intervals for Ziphiids. Interbirth intervals for other odontocetes (not including phocoenids or highly matrilineal species) range between 2-4.7 years (Taylor et al. 2007). In Hawaii, one photo-identified female had a calving interval greater than 6 years (Baird

2018). In the Canary Islands, Aguilar de Soto and Hammond (2014) estimated calving interval to be approximately 4 years using photo-ID of two females associated with calves.

Taylor et al. (2007) reported age of last reproduction for Cuvier's beaked whale as 46 and for Mesoplodont species as ranging between 21-44, with most around 40. While Ziphiid age of first reproduction is not reported, odontocetes (not including phocoenids or highly matrilineal species) range between 7-14 years (Taylor et al. 2007). Other studies suggest a maximum age of females at 30 years and males at 36 years, based on growth layer groups that may be annual layers (Mitchell 1975; Mead 1984; Houston 1990; Baird 2018).

Research on related Blainville's beaked whales in the Bahamas suggests males and females reach sexual maturity at age nine and maximum age is greater than 23 years (Claridge 2013).

Generation Length

Taylor et al. (2007) did not report Ziphiid generation length, but other odontocetes (not including phocoenids or highly matrilineal species) range between 11-27 years.

Reproductive Plasticity

Information regarding Cuvier's beaked whale reproductive seasonality, location, and habitat in the northern Gulf of Mexico was not found in the literature.

Migration

During a 3-year monitoring period following the Deepwater Horizon oil spill, Cuvier's beaked whales were present only seasonally in the western Gulf of Mexico (Green Canyon and Mississippi Canyon), with periods of low density during the summer and higher density in the winter, while a high density was maintained at an eastern Gulf of Mexico site (Dry Tortugas; Hildebrand et al. 2015).

Home Range

Information regarding Cuvier's beaked whale site fidelity in the northern Gulf of Mexico was not found in the literature.

Stock Abundance

Garrison et al. (2020) estimated Cuvier's beaked whales in the northern Gulf of Mexico at 18 (CV=0.75) and unidentified Ziiphidae in the northern Gulf of Mexico at 181 individuals (CV=0.31) based on 2018 surveys. Previously, Waring et al. (2013) estimated Cuvier's beaked whales in the northern Gulf of Mexico at 74 (CV=1.04) and unidentified Ziiphidae in the northern Gulf of Mexico at 74 (CV=1.04), based on a summer 2009 oceanic survey covering waters from the 200m isobath to the seaward extent of the U.S. EEZ, and not including the southern Gulf of Mexico.

Earlier estimates include a 1991-1994 survey, a 1996-2001 survey, and a 2003-2004 survey (Waring et al. 2009). From the 2003-2004 survey, the best estimate of Cuvier's beaked whales was 65 (CV=0.67), however Cuvier's beaked whales may also be in the estimate of unidentified Ziphiidae, which was 337 (CV=0.40; Mullin 2007). From the 1996-2001 survey 1996 to 2001, the best estimate of Cuvier's beaked whales was 95 (CV=0.47), while the estimate for unidentified Ziphiidae was 146 (CV=0.46; Mullin and Fulling 2004).

Survey Period	Area	Cuvier's beaked whale		Unidentified Ziphiidae		Reference
		NBest	CV	NBest	CV	
1991-1994	GOM Oceanic waters	30	0.50	117	0.38	Hansen et al. 1995
1996-2001	GOM Oceanic waters	95	0.47	146	0.46	Mullin and Fulling 2004
2003-2004	GOM Oceanic waters	65	0.67	337	0.40	Mullin 2007
2009	GOM Oceanic waters	74	1.04	74	1.04	Waring et al. 2013
2018	GOM Oceanic waters	18	0.75	181	0.31	Garrison et al. 2020

Stock Abundance Trend

Despite four point estimates of Cuvier's beaked whale abundance from 1991 through 2009, temporal trends remain difficult to discern without an analysis of all the survey data to understand the potential effects of covariates on the estimates (Waring et al. 2013).

Cumulative Stressors

Cuvier's beaked whale in the northern Gulf of Mexico may interact with longline fisheries. Hayes et al. (2021) reported no fishing-related mortality of a Cuvier's beaked whale during 2014–2018 (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). An interaction with the pelagic longline fishery resulted in 1 unidentified beaked whale released alive with no serious injury after an entanglement in 2007 (Fairfield and Garrison 2008). The stock has the potential to interact with commercial and recreational fisheries in the Gulf of Mexico through entanglement in or ingestion of fishing gear, declining prey stocks, and vessel strikes (MMC 2015).

One Cuvier's beaked whale stranded with no indication of human interaction in Texas in October 2004 and two unidentified beaked whales mass stranded in Florida in December 1999 (Waring et al. 2009).

Impacts on beaked whales associated with naval activities (e.g., sonar) include skin lesions (Jepson et al. 2003; Fernández et al. 2005; Jepson et al. 2016) and mass strandings (Simmonds and Lopez-Jurado 1991; Frantzis 1998).

The oil, dispersant and burn residue compounds from the Deepwater Horizon (DWH) incident present persistent ecological concerns along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). Aichinger Dias et al. (2017) documented occurrences of Cuvier's beaked whales swimming in or near petroleum products, or with oil adhered to their bodies, which may result in a number of adverse effects (Geraci 1990). Seismic exploration, explosive platform removal, vessel and air traffic, and oil spills are threats to marine mammals associated with oil and gas exploration (MMC 2015). Vessel strikes, oil spills and other hazardous material discharges, marine debris, and noise are threats to marine mammals associated with shipping (MMC 2015). The deep-diving nature of beaked whales that makes sighting them difficult during surveys may limit their exposure to vessel strikes.

Cuvier's beaked whale predators include tiger sharks, white sharks, and cookiecutter sharks (Pérez-Zayas et al. 2002; Cárdenas Hinojosa et al. 2015; Baird 2018).

Other relevant information

In his review of global climate change, range changes and potential implications for the conservation of marine cetaceans, MacLeod (2009) categorized the Cuvier's beaked whale as a warmer water-limited (WWL) species and speculated that as a WWL species, the range of Cuvier's beaked whale is likely to expand polewards in all oceans.

Learmonth et al. (2006) in their table for potential effects of climate change on species range had a question mark for Cuvier's bw and how they would be affected.

Studies of deep-water currents and their potential role in increasing deep-water productivity as well as other proximal factors need to be considered for deepwater species in the Gulf, as well as the dynamic nature of the warm- and cold-core rings.

Distribution and Sightings

Density model results for Cuvier's beaked whale in the Gulf of Mexico are presented by Roberts et al. (2016a, 2016b, 2017) and Mannocci et al. (2017).

Further Reading

Allen, B.M., Brownell, R.L. and Mead, J.G., 2012. Species review of Cuvier's beaked whale, *Ziphius cavirostris*. Reports of International Whaling Commission. https://swfsc.noaa.gov/publications/CR/2011/2011Allen2.pdf

Baird, R.W. 2018. Cuvier's beaked whale *Ziphius cavirostris*. Encyclopedia of marine mammals. Third edition. B. Würsig, J. G. M. Thewissen and K. M. Kovacs. San Diego, California, Elsevier/Academic Press: 254-257.

Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo di Sciara, G., Wade, P. & Pitman, R.L. 2008. *Ziphius cavirostris*. The IUCN Red List of Threatened Species 2008: e.T23211A9429826. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T23211A9429826.en

Valdivia, A (2017) Petition to list the Gulf of Mexico Cuvier's beaked whale (*Ziphius cavirostris*) as endangered under the Endangered Species Act. Center for Biological Diversity, 57 pp. http://sero.nmfs.noaa.gov/protected_resources/listing_petitions/documents/cbd_petition_to_list_the_gulf_of_mexico_cuvier_s_beaked_whale_under_the_esa_final.pdf

References

Aguilar de Soto, N. and P. Hammond. 2014. Population parameters of Blainville´s and Cuvier´s beaked whales. Report to Office of Naval Research for Award No. N00014-12-1-0626. 8 p.

Aichinger Dias, L., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the Deepwater Horizon oil spill in the Gulf of Mexico. Endangered Species Research 33:119–125. doi: 10.3354/esr00770

Baird, R.W. 2018. Cuvier's beaked whale: *Ziphius cavirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 234–237. doi: 10.1016/B978-0-12-804327-1.00100-X

Baird, R.W., D.J. McSweeney, A.D. Ligon, and D.L. Webster. 2004. Tagging feasibility and diving of Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's beaked whales (*Mesoplodon densirostris*) in Hawai'i. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Order No. AB133F-03-SE-0986. 15 p.

Ballardini, M., T. Pusser, and B. Nani. 2005. Photo-identification of Cuvier's beaked whales (*Ziphius cavirostris*) in the northern Ligurian Sea. Proceedings of the 14th annual conference of the European Cetacean Society, La Rochelle. pp. 4–7.

Barlow, J., M.C. Ferguson, W.F. Perrin, L. Ballance, T. Gerrodette, G. Joyce, C.D. MacLeod, K. Mullin, D.L. Palka, and G. Waring. 2006. Abundance and densities of beaked and bottlenose whales (family Ziphiidae). Journal of Cetacean Research and Management 7:263–270.

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

Cárdenas-Hinojosa, G., M. Hoyos-Padilla, and L. Rojas-Bracho. 2015. Occurrence of Cuvier's beaked whales (*Ziphius cavirostris*) at Guadalupe Island, Mexico, from 2006 to 2009. Latin American Journal of Aquatic Mammals 10(1):38–47. doi: 10.5597/lajam00192

Claridge, D.E. 2013. Population ecology of Blainville's beaked whales (*Mesoplodon densirostris*). University of St Andrews. 296 p.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Esher, R.J., C. Levenson, and T.D. Drummer. 1992. Aerial surveys of endangered and protected species in the Empress II ship trial operating area in the Gulf of Mexico. Final report. Naval Research Laboratory: Stennis Space Center, MS. NRL/MR/7174-92-7002. 55 p.

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Ferguson, M.C. 2005. Cetacean population density in the eastern Pacific Ocean: Analyzing patterns with predictive spatial models. University of California, San Diego. 203 p.

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Fernandez, A., J.F. Edwards, F. Rodriguez, A. Espinosa de los Monteros, P. Herraez, P. Castro, J.R. Jaber, V. Martin, and M. Arbelo. 2005. "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. Veterinary Pathology 42(4):446–457. doi: 10.1354/vp.42-4-446

Fertl, D., A.J. Schiro, S. Collier, and G.A.J. Worthy. 1997. Stranding of a Cuvier's beaked whale (*Ziphius cavirostris*) in southern Texas, with comments on stomach contents. Gulf of Mexico Science 15(2):92–93. doi: 10.18785/goms.1502.05

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Fritts, T.H., U.S. Fish and Wildlife Service. Division of Biological Services., United States. Minerals Management Service., and Denver Wildlife Research Center. Museum Section. 1983. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters : an overview based on aerial surveys of OCS areas, with emphasis on oil and gas effects. The Division : Minerals Management Service, Washington, DC. p.

Gannier, A. 2000. Distribution of cetaceans off the Society Islands (French Polynesia) as obtained from dedicated surveys. Aquatic Mammals 26(2):111–126.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Geraci, J.R. 1990. Physiologic and toxic effects on cetaceans. In: Geraci, J.R. and D.J. St. Aubin (Eds.), Sea mammals and oil: Confronting the risks. Academic Press, New York, NY. pp. 167–197.

Hansen, L.J., K.D. Mullin, and C.L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. MIA-94/95-25. 9 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Hildebrand, J.A., S. Baumann-Pickering, K.E. Frasier, J.S. Trickey, K.P. Merkens, S.M. Wiggins, M.A. McDonald, L.P. Garrison, D. Harris, T.A. Marques, and L. Thomas. 2015. Passive acoustic monitoring of beaked whale densities in the Gulf of Mexico. Scientific Reports 5(1):16343. doi: 10.1038/srep16343

Hildebrand, J.A., K.P. Merkens, K.E. Frasier, H. Bassett, S. Baumann-Pickering, A. Širović, S.M. Wiggins, M. McDonald, T.A. Marques, D. Harris, and L. Thomas. 2012. Passive acoustic monitoring of

cetaceans in the northern Gulf of Mexico during 2010-2011. Progress Report for Research Agreement #20105138. Prepared for Natural Resource Damage Assessment Program. 31 p.
Houston, J. 1990. Status of Blainville's beaked whale, *Mesoplodon densirostris*, in Canada. Canadian Field-Naturalist 104(1):117–120.
Jepson, P.D., M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martin, A.A. Cunningham, and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. Nature 425(6958):575–576. doi: 10.1038/425575a
Jepson, P.D., R. Deaville, I.A.P. Patterson, A.M. Pocknell, H.M. Ross, J.R. Baker, F.E. Howie, R.J. Reid, A. Colloff, and A.A. Cunningham. 2016. Acute and chronic gas bubble lesions in cetaceans stranded in the United Kingdom. Veterinary Pathology 42(3):291–305. doi: 10.1354/vp.42-3-291
Learmonth, J.A., C.D. MacLeod, M.B. Santos, G.J. Pierce, H.Q.P. Crick, and R.A. Robinson. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology - an Annual Review, Vol 44 44:431–464. doi: 10.1201/9781420006391
MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. Endangered Species Research 7:125–136. doi: 10.3354/esr00197
MacLeod, C.D. and A. D'Amico. 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. Journal of Cetacean Research and Management 7(3):211–221.
MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h
MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.
MacLeod, C.D. and A.F. Zuur. 2005. Habitat utilization by Blainville's beaked whales off Great Abaco, northern Bahamas, in relation to seabed topography. Marine Biology 147(1):1–11. doi: 10.1007/s00227-004-1546-9
Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856
Marine Mammal Commission (MMC). 2015. Gulf of Mexico Marine Mammal Research and Monitoring Meeting, Meeting Program and Project Descriptions, 7-8 April 2015, New Orleans, Louisiana.
Martinez, A., et al. 2010. Cruise results, GU-10-03 (59) 16 June – 8 August, 2010 Marine Mammal Oil Spill Assessment Survey (MaMOSAS). Unpublished cruise report. Pascagoula, MS.
McSweeney, D.J., R.W. Baird, and S.D. Mahaffy. 2007. Site fidelity, associations, and movements of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales off the island of Hawai'i. Marine Mammal Science 23(3):666–687. doi: 10.1111/j.1748-7692.2007.00135.x
Mead, J.G. 1984. Survey of reproductive data for the beaked whales (Ziphiidae). Reports of the International Whaling Commission (Special Issue) 6:91–96.
Mitchell, E. 1975. Report of the meeting on smaller cetaceans, Montreal, April 1-11, 1974. Subcommittee on smaller cetaceans, International Whaling Commission. Journal of the Fisheries Research Board of Canada 32(7):889–983. doi: 10.1139/f75-117
Mullin, K.D. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 26 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pérez-Zayas, J.J., A.A. Mignucci-Giannoni, G.M. Toyos-González, R.J. Rosario-Delestre, and J. Williams, E. H. 2002. Incidental predation by a largetooth cookiecutter shark on a Cuvier's beaked whale in Puerto Rico. Aquatic Mammals 28(3):308–311.

Pitman, R.L. 2002. Mesoplodont whales *Mesoplodon* spp. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals. Academic Press, San Diego, CA. pp. 738–742.

Ritter, F. and B. Brederlau. 1999. Behavioural observations of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). Aquatic Mammals 25(2):55–61.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Simmonds, M.P. and L.F. Lopez-Jurado. 1991. Whales and the military. Nature 351(6326):448–448. doi: 10.1038/351448a0

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Ward, J.A., G.H. Mitchell, A.M. Farak, and E.P. Keane. 2005. Beaked whale habitat characterization and prediction. NUWC-NPT Technical Report 11,548. Newport, RI.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2009. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-213. 528 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-223. 419 p.

West, K.L., W.A. Walker, R.W. Baird, J.G. Mead, and P.W. Collins. 2017. Diet of Cuvier's beaked whales *Ziphius cavirostris* from the North Pacific and a comparison with their diet world-wide. Marine Ecology Progress Series 574:227–242. doi: 10.3354/meps12214

Würsig, B. 2017. Marine mammals of the Gulf of Mexico. Habitats and biota of the Gulf of Mexico: Before the Deepwater Horizon Oil Spill. In: Ward, C.H. (Ed.), Volume 2: Fish Resources, Fisheries, Sea Turtles, Avian Resources, Marine Mammals, Diseases and Mortalities. . Springer, New York, NY. pp. 1489–1587.

Cuvier's beaked whale − *Ziphius cavirostris*

Puerto Rico and US Virgin Islands Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 59% of scores ≥ 2

Ziphius cavirostris		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.5	1.8	
	Habitat Specificity	1.9	2.2	
	Site Fidelity	2.4	1.8	
	Lifetime Reproductive Potential	2.2	1.5	
	Generation Length	2.4	1.8	
	Reproductive Plasticity	1.9	0.8	
	Migration	3.5	1.2	
	Home Range	2.4	1.8	
	Stock Abundance	2.6	1.0	
	Stock Abundance Trend	2.4	0.5	
	Cumulative Stressors	2.4	1.8	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	2.0	
	Sea Surface Temperature (Change in variability)	1.4	2.0	
	Air Temperature (Change in mean)	3.4	2.0	
	Air Temperature (Change in variability)	1.2	2.0	
	Precipitation (Change in mean)	1.4	2.0	
	Precipitation (Change in variability)	1.5	2.0	
	Sea Surface Salinity (Change in mean)	2.4	2.0	
	Sea Surface Salinity (Change in variability)	1.4	2.0	
	Ocean pH (Change in mean)	3.6	2.0	
	Ocean pH (Change in variability)	1.4	2.0	
	Sea ice coverage (Change in mean)	1.4	2.0	
	Sea ice coverage (Change in variability)	1.4	2.0	
	Dissolved oxygen (Change in mean)	3.6	2.0	
	Dissolved oxygen (Change in variability)	1.4	2.0	
	Circulation	2.1	1.2	
	Sea level rise	1.4	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low

Moderate

High

Very High

Cuvier's beaked whale (Puerto Rico and US Virgin Islands Stock)

Ziphius cavirostris

CVA Results Summary

Overall Climate Vulnerability Rank: High (64% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Sea Surface Temperature (Standard anomaly) (3.65), Dissolved oxygen (Standard anomaly) (3.60), and Ocean pH (Standard anomaly) (3.60).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (3.50), Species Abundance (2.65), and Prey/Diet Specificity (2.55).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 59% of the data quality scores were 2 or greater, 9% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The Cuvier's beaked whale Puerto Rico and U.S. Virgin Islands stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone of Puerto Rico and the U.S. Virgin Islands as well as adjacent Caribbean and Atlantic waters (Waring et al. 2012). This stock is considered separately from the Gulf of Mexico and western North Atlantic stocks.

Prey/Diet Specificity

West et al. (2017) compiled Cuvier's beaked whale diet information from 45 stomach analyses. Worldwide, the most important cephalopod families in the diet are Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuthidae, Ommastrephidae, Onychoteuthidae, Pholidoteuthidae, and Mastigoteuthidae, which are all within the order Oegopsida (West et al. 2017). Cranchiidae is common prey in all locations, and Histioteuthidae and Cranchiidae are the most common prey in the North Atlantic (West et al. 2017).

Diet information from the Caribbean is limited. One stomach analysis from Curacao contained the remains of unidentified cephalopods (77% by weight) and the crustacean *Gnathophausia ingens* (23% by weight; Debrot and Barros 1994). *Gnathophausia* sp. was found in the stomach contents of four Cuvier's beaked whales that stranded in Puerto Rico and the Virgin Islands (Mignucci-Giannoni 1996).

Habitat Specificity

Cuvier's beaked whales are generally found in waters with a bottom depth greater than 200 m and are frequently recorded at bottom depths greater than 1,000 m (e.g., Ritter and Brederlau 1999; Gannier 2000; MacLeod et al. 2004; Ferguson et al. 2006; Claridge 2006). This species is often found associated with physical features such as the continental slope, canyons, escarpments, and oceanic islands (Baird et al. 2004; MacLeod et al. 2004; MacLeod and D'Amico 2006).

Site Fidelity

Site fidelity has been reported for Cuvier's beaked whales in the Ligurian Sea (Ballardini et al. 2005); around the Hawaiian Islands (McSweeney et al. 2007), near San Clemente Island, California (Falcone et al. 2009); and off the Canary Islands (Aguilar de Soto and Hammond 2014).

Lifetime Reproductive Potential

Taylor et al. (2007) did not include interbirth intervals for Ziphiids. Interbirth intervals for other odontocetes (not including phocoenidae or highly matrilineal species) range between 2-4.7 years (Taylor et al. 2007). In Hawaii, one photo-identified female had a calving interval of over 6 years (Baird 2018). In the Canary Islands, Aguilar de Soto and Hammond (2014) estimated a calving interval of approximately 4 years using photo-identification data from two females associated with calves.

Cuvier's beaked whales reach sexual maturity at approximately 6.2 m in length (Jefferson et al. 2015). While Ziphiid age of first reproduction is not reported, odontocetes (not including phocoenids or highly matrilineal species) range between 7-14 years (Taylor et al. 2007). Taylor et al. (2007) reported the age of last reproduction for Cuvier's beaked whales as 46 years and for mesoplodon species as ranging between 21–44 years with most around 40 years. Other studies suggest a maximum age of females at 30 years and males at 36 years (Mitchell 1975; Mead 1984; Houston 1990; Baird 2018).

Research on Blainville's beaked whales in the Bahamas suggests that males and females reach sexual maturity at 9 years, and maximum age is greater than 23 years (Claridge 2013).

Generation Length

Taylor et al. (2007) did not report Ziphiid generation length, but other odontocetes (not including phocoenids or highly matrilineal species) range between 11–27 years.

Reproductive Plasticity

Peaks in calving are not known for this species (Jefferson et al. 2015).

Migration

No migratory information was found in the literature for Cuvier's beaked whales in the Caribbean.

Home Range

Cuvier's beaked whales are documented throughout the Caribbean (e.g., Caldwell et al. 1971a, 1971b; van Bree 1975; Debrot and Barros 1994; Debrot et al. 1998; Gordon et al. 1998; Romero et al. 2001;

Jérémie et al. 2006; MacLeod et al. 2006; Rinaldi et al. 2006; Whitt et al. 2011). Sightings and strandings of this species have been documented off Puerto Rico and the Virgin Islands (Mignucci-Giannoni 1996, 1998; Mignucci-Giannoni et al. 1999).

Because of their wide distribution throughout the Caribbean Sea, Cuvier's beaked whales of the Puerto Rico and U.S. Virgin Islands stock are likely trans-boundary with waters near adjacent Caribbean islands at a minimum, and are not likely to occur exclusively within the bounds of the U.S. EEZ (Waring et al. 2012).

Stock Abundance

An abundance estimate for the Puerto Rico and U.S. Virgin Islands stock of Cuvier's beaked whales is unavailable due to few sightings during surveys (Waring et al. 2012). Surveys in 1995 (Roden and Mullin 2000) and 2000 (Swartz and Burks 2000) reported no Cuvier's beaked whale sightings in U.S. waters although three Cuvier's beaked whales were sighted south of Martinique (Swartz and Burks 2000). A 2001 survey resulted in one sighting of three Cuvier's beaked whales in U.S. waters north of Puerto Rico and two additional sightings of unidentified beaked whales in U.S. waters (Swartz et al. 2002). This species has been observed off Ramey in Aguadilla, near Isla de Caja de Muertos, south of Bahía de Guánica, in the vicinity of La Parguera, and between St. Thomas and St. Croix (Mignucci-Giannoni 1998).

Stock Abundance Trend

A trend analysis has not been conducted for this stock due to insufficient data (Waring et al. 2012).

Cumulative Stressors

At the present time, no whaling or dolphin fishery occurs in the U.S. Virgin Islands or Puerto Rico; however, this is not the case throughout the Caribbean. As summarized in Waring et al. (2012), local whalers conduct small-scale whaling (artisanal) in the eastern Caribbean nations of St. Lucia, Dominica, and St. Vincent and the Grenadines (e.g., Rathjen and Sullivan 1970; Caldwell et al. 1971a; Adams 1975; Caldwell and Caldwell 1975; Price 1985; Reeves 1988; Hoyt and Hvenegaard 2002; Romero et al. 2002; Mohammed et al. 2003; World Council of Whalers 2008; Waring et al. 2012). While not the target of a standard hunt, on occasion artisanal whalers in the Lesser Antillean islands will kill Cuvier's beaked whales (Reeves et al. 2003; Waring et al. 2012). Cuvier's beaked whales have been taken in the St. Vincent fishery (Caldwell et al. 1971a; Caldwell and Caldwell 1975), but catches of small whale or dolphin fisheries have very limited monitoring (Price 1985; Waring et al. 2012).

The Cuvier's beaked whale stock may interact with longline fisheries (Waring et al. 2012). However, during the period 2001–2015, no fishing-related mortality or serious injury was reported in Puerto Rico or the U.S. Virgin Islands waters (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010; 2012a; 2012b; 2013; 2014; 2016; 2017). This may represent an underestimation because there was no observer coverage within the Caribbean region for six of those years (Fairfield-Walsh and Garrison 2007; Garrison et al. 2009; Garrison and Stokes 2010; 2012b; 2013; 2016).

Cuvier's beaked whales commonly strand in waters of Puerto Rico and the Virgin Islands, as well as other areas of the northeastern Caribbean (Mignucci-Giannoni et al. 1999; Pérez-Zayas et al. 2002). However, during the period 2005–2017, no Cuvier's beaked whales were reported stranded in Puerto Rico or the U.S. Virgin Islands (NOAA National Marine Mammal Health and Stranding Response Database unpublished data).

Impacts on beaked whales associated with naval activities (e.g., sonar) include skin lesions (Jepson et al. 2003; Fernández et al. 2005) and mass strandings (Simmonds and Lopez-Jurado 1991), Frantzis 1998). Legacy impacts on Cuvier's beaked whales from naval operations at Roosevelt Roads in Puerto Rico that ceased in 2004 are unknown (Waring et al. 2012).

Coastal pollution may be an issue for the Cuvier's beaked whale Puerto Rico and U.S. Virgin Islands stock. Parts of Vieques Island, Puerto Rico are listed on the U.S. Environmental Protection Agency's (EPA) Superfund National Priorities List due to unexploded ordnance and associated hazardous materials (Whitall et al. 2016; EPA 2018).

Cuvier's beaked whale predators include tiger sharks, white sharks, and cookiecutter sharks (Pérez-Zayas et al. 2002; Cárdenas Hinojosa et al. 2015; Baird 2018).

Other relevant information

In his review of global climate change, range changes and potential implications for the conservation of marine cetaceans, MacLeod (2009) categorized the Cuvier's beaked whale as a warmer water-limited (WWL) species and speculated that as a WWL species, the range of Cuvier's beaked whale is likely to expand polewards in all oceans.

Learmonth et al. (2006) in their table for potential effects of climate change on species range had a question mark for Cuvier's beaked whales and how they would be affected.

Studies of deep-water currents and their potential role in increasing deep-water productivity as well as other proximal factors need to be considered for deepwater species in the Gulf of Mexico, as well as the dynamic nature of the warm- and cold-core rings.

Distribution and Sightings

Density model results for Cuvier's beaked whale in the Gulf of Mexico are presented by Mannocci et al. (2017).

Further Reading

Allen, B.M., R.L. Brownell, and J.G. Mead. 2012. Species review of Cuvier's beaked whale, *Ziphius cavirostris*. Reports of the International Whaling Commission. https://swfsc.noaa.gov/publications/CR/2011/2011Allen2.pdf

Baird, R.W. 2018. Cuvier's beaked whale: *Ziphius cavirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 234–237. doi: 10.1016/B978-0-12-804327-1.00100-X

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine Mammals of the World (Second Edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Ziphius cavirostris*. The IUCN Red List of Threatened Species 2008: e.T23211A9429826. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T23211A9429826.en

Valdivia, A. 2017. Petition to list the Gulf of Mexico Cuvier's beaked whale (*Ziphius cavirostris*) as endangered under the Endangered Species Act. Center for Biological Diversity, 57 pp. http://sero.nmfs.noaa.gov/protected_resources/listing_petitions/documents/cbd_petition_to_list_the_gulf_of_mexico_cuvier_s_beaked_whale_under_the_esa_final.pdf

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

References

Adams, J.E. 1975. Primitive whaling in the West Indies. Sea Frontiers 21:303–313.

Aguilar de Soto, N. and P. Hammond. 2014. Population parameters of Blainville´s and Cuvier´s beaked whales. Report to Office of Naval Research for Award No. N00014-12-1-0626. 8 p.

Baird, R.W. 2018. Cuvier's beaked whale: *Ziphius cavirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 234–237. doi: 10.1016/B978-0-12-804327-1.00100-X

Baird, R.W., D.J. McSweeney, A.D. Ligon, and D.L. Webster. 2004. Tagging feasibility and diving of Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's beaked whales (*Mesoplodon densirostris*) in Hawai'i. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Order No. AB133F-03-SE-0986. 15 p.

Ballardini, M., T. Pusser, and B. Nani. 2005. Photo-identification of Cuvier's beaked whales (*Ziphius cavirostris*) in the northern Ligurian Sea. Proceedings of the 14th annual conference of the European Cetacean Society, La Rochelle. pp. 4–7.

Caldwell, D.K. and M.C. Caldwell. 1975. Dolphin and small whale fisheries of the Caribbean and West Indies: Occurrence, history, and catch statistics — with special reference to the Lesser Antillean island of St. Vincent. Journal of the Fisheries Research Board of Canada 32(7):1105–1110. doi: 10.1139/f75-132

Caldwell, D.K., M.C. Caldwell, W.F. Rathjen, and J.R. Sullivan. 1971a. Cetaceans from the Lesser Antillean island of St. Vincent. Fishery Bulletin 69:303–312.

Caldwell, D.K., W.F. Rathjen, and M.C. Caldwell. 1971b. Cuvier's beaked whale, *Ziphius cavirostris*, from Barbados. Bulletin of the Southern California Academy of Sciences 70(52-53).

Cárdenas-Hinojosa, G., M. Hoyos-Padilla, and L. Rojas-Bracho. 2015. Occurrence of Cuvier's beaked whales (*Ziphius cavirostris*) at Guadalupe Island, Mexico, from 2006 to 2009. Latin American Journal of Aquatic Mammals 10(1):38–47. doi: 10.5597/lajam00192

Claridge, D.E. 2006. Fine-scale distribution and habitat selection of beaked whales. Aberdeen University. Dissertation. 119 p.

Claridge, D.E. 2013. Population ecology of Blainville's beaked whales (*Mesoplodon densirostris*). University of St Andrews. 296 p.

Debrot, A.O. and N.B. Barros. 1994. Additional cetacean records for the Leeward Dutch Antilles. Marine Mammal Science 10(3):359–368. doi: 10.1111/j.1748-7692.1994.tb00491.x

Debrot, A.O., J.A. De Meyer, and P.J.E. Dezentjé. 1998. Additional records and a review of the cetacean fauna of the Leeward Dutch Antilles. Caribbean Journal of Science 34(3-4):204–210.

Environmental Protection Agency (EPA). 2018. Atlantic Fleet Weapons Training Area, Vieques, PR. 28 August 2018, https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Falcone, E.A., G.S. Schorr, A.B. Douglas, J. Calambokidis, E. Henderson, M.F. McKenna, J. Hildebrand, and D. Moretti. 2009. Sighting characteristics and photo-identification of Cuvier’s beaked whales (*Ziphius cavirostris*) near San Clemente Island, California: a key area for beaked whales and the military? Marine Biology 156(12):2631–2640. doi: 10.1007/s00227-009-1289-8

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Fernandez, A., J.F. Edwards, F. Rodriguez, A. Espinosa de los Monteros, P. Herraez, P. Castro, J.R. Jaber, V. Martin, and M. Arbelo. 2005. "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. Veterinary Pathology 42(4):446–457. doi: 10.1354/vp.42-4-446

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Gannier, A. 2000. Distribution of cetaceans off the Society Islands (French Polynesia) as obtained from dedicated surveys. Aquatic Mammals 26(2):111–126.

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.

Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-607. 64 p.

Garrison, L.P. and L. Stokes. 2012a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-632. 61 p.

Garrison, L.P. and L. Stokes. 2012b. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.
Garrison, L.P. and L. Stokes. 2013. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-655. 62 p.
Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.
Gordon, J., A. Moscrop, C. Carlson, S. Ingram, R. Leaper, J. Matthews, and K. Young. 1998. Distribution, movements and residency of sperm whales off the Commonwealth of Dominica, eastern Caribbean: Implications for the development and regulation of the local whalewatching industry. Reports of the International Whaling Commission 48:551–557.
Houston, J. 1990. Status of Blainville’s beaked whale, *Mesoplodon densirostris*, in Canada. Canadian Field-Naturalist 104(1):117–120.
Hoyt, E. and G.T. Hvenegaard. 2002. A review of whale-watching and whaling with applications for the Caribbean. Coastal Management 30(4):381–399. doi: 10.1080/089207502900273
Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0
Jepson, P.D., M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martin, A.A. Cunningham, and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. Nature 425(6958):575–576. doi: 10.1038/425575a
Jérémie, S., A. Gannier, S. Bourreau, and J.-C. Nicolas. 2006. Cetaceans of Martinique Island (Lesser Antilles): Occurrence and distribution obtained from a small boat dedicated survey. Paper SC/58/SM23. 58th Annual Meeting of the International Whaling Commission, June 2006, St. Kitts and Nevis, West Indies.
Learmonth, J.A., C.D. MacLeod, M.B. Santos, G.J. Pierce, H.Q.P. Crick, and R.A. Robinson. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology - an Annual Review, Vol 44 44:431–464. doi: 10.1201/9781420006391
MacLeod, C., W.F. Perrin, R. Pitman, J. Barlow, L. Ballance, A. D'Amico, T. Gerrodette, G. Joyce, K.D. Mullin, D.L. Palka, and G.T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). Journal of Cetacean Research and Management 7(3):271–286.

MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. Endangered Species Research 7:125–136. doi: 10.3354/esr00197

MacLeod, C.D. and A. D'Amico. 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. Journal of Cetacean Research and Management 7(3):211–221.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

McSweeney, D.J., R.W. Baird, and S.D. Mahaffy. 2007. Site fidelity, associations, and movements of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales off the island of Hawai'i. Marine Mammal Science 23(3):666–687. doi: 10.1111/j.1748-7692.2007.00135.x

Mead, J.G. 1984. Survey of reproductive data for the beaked whales (Ziphiidae). Reports of the International Whaling Commission (Special Issue) 6:91–96.

Mignucci-Giannoni, A.A. 1996. Marine mammal strandings in Puerto Rico and the United States and British Virgin Islands. University of Puerto Rico. Dissertation. 247 p.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mignucci-Giannoni, A.A., B. Pinto-Rodríguez, M. Velasco-Escudero, R.A. Montoya-Ospina, N.M. Jiménez, M.A. Rodríguez-López, J.E.H. Williams, and D.K. Odell. 1999. Cetacean strandings in Puerto Rico and the Virgin Islands. Journal of Cetacean Research and Management 1(2):191–198. doi: 10.47536/jcrm.v1i2.466

Mitchell, E. 1975. Report of the meeting on smaller cetaceans, Montreal, April 1-11, 1974. Subcommittee on smaller cetaceans, International Whaling Commission. Journal of the Fisheries Research Board of Canada 32(7):889–983. doi: 10.1139/f75-117

Mohammed, E., L.E. Straker, and C. Jardine. 2003. St. Vincent and the Grenadines: Reconstructed fisheries catches and fishing effort, 1942-2001. Fisheries Centre Research Reports 11(6):95–116.

Pérez-Zayas, J.J., A.A. Mignucci-Giannoni, G.M. Toyos-González, R.J. Rosario-Delestre, and J. Williams, E. H. 2002. Incidental predation by a largetooth cookiecutter shark on a Cuvier’s beaked whale in Puerto Rico. Aquatic Mammals 28(3):308–311.

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Rathjen, W.F. and J.R. Sullivan. 1970. West-Indies whaling. Sea Frontiers 16(3):130–137.

Reeves, R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. Reports of the International Whaling Commission 38(445-447).

Reeves, R.R., B.D. Smith, E.A. Crespo, and G. Notarbartolo di Sciara. 2003. Dolphins, whales and porpoises. 2002-2010 Conservation Action Plan for the world’s cetaceans. IUCN/SSC Cetacean Specialist Group: Gland, Switzerland and Cambridge, UK. 139 p. doi: 10.2305/IUCN.CH.2003.SSC-AP.2.en

Rinaldi, C., R. Rinaldi, and P. Sahagian. 2006. Report of surveys conducted on small cetaceans off Guadeloupe 1998 to 2005. SC/58/SM17. Reports of the International Whaling Commission:1–4.

Ritter, F. and B. Brederlau. 1999. Behavioural observations of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). Aquatic Mammals 25(2):55–61.

Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.

Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo di Sciara. 2001. Cetaceans of Venezuela: Their distribution and conservation status. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS 151. 60 p.

Romero, A., R. Baker, and J.E. Creswell. 2002. Environmental history of marine mammal exploitation in Trinidad and Tobago, W.I., and its ecological impact. Environment and History 8:255–274.

Simmonds, M.P. and L.F. Lopez-Jurado. 1991. Whales and the military. Nature 351(6326):448–448. doi: 10.1038/351448a0

Swartz, S.L. and C. Burks. 2000. Cruise results, Windwards humpback (*Megaptera novaeangliae*) survey: NOAA ship Gordon Gunter cruise GU-00-01, 9 February to 3 April 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-438. 31 p.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

van Bree, P.J.H. 1975. Preliminary list of the cetaceans of the southern Caribbean. Stud. Fauna Curacao Carib. Isl 48:79–87.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

West, K.L., W.A. Walker, R.W. Baird, J.G. Mead, and P.W. Collins. 2017. Diet of Cuvier's beaked whales *Ziphius cavirostris* from the North Pacific and a comparison with their diet world-wide. Marine Ecology Progress Series 574:227–242. doi: 10.3354/meps12214

Whitall, D.R., A.L. Mason, M.H. Fulton, E.F. Wirth, D. Wehner, A. Ramos, A.S. Pait, B. West, E. Pisarski, B. Shaddrix, and L.A. Reed. 2016. Chemical contaminants in the marine resources of Vieques, Puerto Rico. National Oceanic Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Silver Spring, MD. NOAA Technical Memorandum NOS-NCCOS-223. 70 p. doi: 10.7289/V5/TM-NOS-NCCOS-223

Whitt, A.D., T.A. Jefferson, M. Blanco, D. Fertl, and D. Rees. 2011. A review of marine mammal records of Cuba. Latin American Journal of Aquatic Mammals 9(2):65–122. doi: 10.5597/lajam00175

World Council of Whalers. 2008. World whaling – Caribbean. http://www.worldwhalers.com/whaling_around_the_world/caribbean.htm

Cuvier's beaked whale − *Ziphius cavirostris*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 41% of scores ≥ 2

	Ziphius cavirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	1.4	
	Habitat Specificity	2.2	1.4	
	Site Fidelity	2.8	1.0	
	Lifetime Reproductive Potential	2.2	0.4	
	Generation Length	2.3	0.8	
	Reproductive Plasticity	2.0	0.4	
	Migration	2.8	1.4	
	Home Range	2.3	1.2	
	Stock Abundance	2.1	1.8	
	Stock Abundance Trend	2.5	0.6	
	Cumulative Stressors	2.4	1.6	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.2	
	Sea Surface Temperature (Change in variability)	1.4	2.4	
	Air Temperature (Change in mean)	3.4	2.0	
	Air Temperature (Change in variability)	1.0	2.0	
	Precipitation (Change in mean)	1.6	2.2	
	Precipitation (Change in variability)	1.5	1.8	
	Sea Surface Salinity (Change in mean)	2.9	1.8	
	Sea Surface Salinity (Change in variability)	2.0	1.8	
	Ocean pH (Change in mean)	3.6	2.0	
	Ocean pH (Change in variability)	1.4	1.8	
	Sea ice coverage (Change in mean)	1.1	2.2	
	Sea ice coverage (Change in variability)	1.0	2.2	
	Dissolved oxygen (Change in mean)	3.4	2.2	
	Dissolved oxygen (Change in variability)	1.2	2.0	
	Circulation	2.2	1.6	
	Sea level rise	1.5	2.2	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Cuvier's beaked whale (Western North Atlantic Stock)

Ziphius cavirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (64% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Ocean pH (Standard anomaly) (3.60), Sea Surface Temperature (Standard anomaly) (3.52), Air Temperature (Standard anomaly) (3.40), Dissolved oxygen (Standard anomaly) (3.40).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (2.84), Site Fidelity (2.76), and Species Abundance Trend (2.52).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 41% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The Cuvier's beaked whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020). This stock is considered separately from the Gulf of Mexico and Puerto Rico/U.S. Virgin Islands stocks.

Prey/Diet Specificity

West et al. (2017) compiled Cuvier's beaked whale diet information from 18 studies, which included 45 stomach analyses. World-wide, the most important cephalopod families in the diet are Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuthidae, Ommastrephidae, Onychoteuthidae, Pholidoteuthidae, and Mastigoteuthidae, all within the order Oegopsida (West et al. 2017). Cranchiidae is common prey in all locations (West et al. 2017). Histioteuthidae and Cranchiidae are the most common prey in the North Atlantic (West et al. 2017). Results of stomach and fecal analysis show that dietary components from Bahamian Cuvier's beaked whales are consistent with those from stomach content studies from elsewhere in the Atlantic (Hickmott 2005).

Habitat Specificity

Generally, little is known about beaked whale habitat preferences due to their elusive nature (Barlow et al. 2006). Beaked whales are typically found in continental slope and oceanic waters deeper than 200 m (Ritter and Brederlau 1999; Gannier 2000; Waring et al. 2001; Cañadas et al. 2002; MacLeod et al. 2004;

Ferguson 2005; MacLeod and Zuur 2005; Ferguson et al. 2006; MacLeod and Mitchell 2006). Beaked whales are only occasionally reported in waters over the continental shelf (Pitman 2002). Cuvier's beaked whales have been found associated with physical features such as the continental slope, canyons, escarpments, and oceanic islands (Baird et al. 2004; MacLeod et al. 2004; MacLeod and D'Amico 2006).

Beaked whales off the eastern U.S. are often found near the Gulf Stream and associated warm-core rings (Waring et al. 1992). Beaked whales south of Georges Bank were located in waters with a mean SST of 20.7° to 24.9°C and a bottom depth of 500 to 2,000 m (Waring et al. 2003).

Site Fidelity

Site fidelity has been reported for Cuvier's beaked whales in waters off Cape Hatteras, NC (Forney et al. 2017), the Ligurian Sea (Ballardini et al. 2005), Hawaii (McSweeney et al. 2007), and Canary Islands (Aguilar de Soto and Hammond 2014).

Lifetime Reproductive Potential

Taylor et al. (2007) did not include interbirth intervals for ziphiids. Interbirth intervals for other odontocetes (not including phocoenids or highly matrilineal species) range between 2-4.7 years (Taylor et al. 2007). In Hawaii, one photo-identified female had a calving interval of over 6 years (Baird 2018). In the Canary Islands, Aguilar de Soto and Hammond (2014) estimated calving interval of approximately 4 years using photo ID of two females associated with calves.

Taylor et al. (2007) reported age of last reproduction for Cuvier's beaked whale as 46 and for Mesoplodont species as ranging between 21-44, with most around 40. While Ziphiid age of first reproduction is not reported, odontocetes (not including phocoenids or highly matrilineal species) range between 7-14 years (Taylor et al. 2007). Other studies suggest a maximum age of females at 30 years and males at 36 years, based on growth layer groups that may be annual layers (Mitchell 1975; Mead 1984; Houston 1990; Baird 2018).

Research on related Blainville's beaked whales in the Bahamas suggests males and females reach sexual maturity at age nine and maximum age is greater than 23 years (Claridge 2013).

Generation Length

Taylor et al. (2007) did not report Ziphiid generation length, but other odontocetes (not including phocoenids or highly matrilineal species) range between 11-27 years.

Reproductive Plasticity

Information regarding Cuvier's beaked whale reproductive seasonality, location, and habitat in the western North Atlantic was not found in the literature.

Migration

No migratory information was found in the literature for Cuvier's beaked whales in the western North Atlantic, although most sightings occur in late spring or summer (Waring et al. 2014) and there is evidence that Cuvier's beaked whales are present year-round off Cape Hatteras based on aerial surveys (McLellan et al. 2018) and acoustic detections (Stanistreet et al. 2017). During a three-year monitoring period following the Deepwater Horizon oil spill, Cuvier’s beaked whales were present only seasonally in the western Gulf of Mexico (Green Canyon and Mississippi Canyon), with periods of low density during the summer and higher density in the winter, while Cuvier’s beaked whales maintained a high density at an eastern Gulf of Mexico site (Dry Tortugas; Hildebrand et al. 2015).

Home Range

In a satellite tagging study to examine Cuvier’s beaked whale diving behavior, Shearer et al. (2019) found individuals tagged off the coast of Cape Hatteras, NC, generally remained within the offshore waters south of Virginia and north of Cape Hatteras.

Stock Abundance

Cuvier’s beaked whales are difficult to identify and distinguish from other beaked whales. Estimated abundance of Cuvier’s beaked whales is typically negatively biased when sightings of beaked whales which could be positively identified to species were used.

The most recent NOAA Fisheries Stock Assessment Report (Hayes et al. 2020) estimated Cuvier’s beaked whales in the Western North Atlantic at 5,744 (CV=0.36), based on 2016 shipboard and aerial surveys from Florida to the lower Bay of Fundy (Garrison 2020; Palka 2020).

Earlier estimates from 2002, 2004, 2006, and 2011 surveys estimated the abundance of undifferentiated beaked whales rather than Cuvier’s beaked whales specifically. The 2002 aerial survey resulted in an abundance estimate of 822 (CV=0.81) undifferentiated beaked whales (Palka 2006). The 2004 survey north of Maryland resulted in an abundance estimate of 2,839 (CV=0.78) undifferentiated beaked whales. The 2004 shipboard survey between Florida and Maryland resulted in an abundance estimate of 674 (CV =0.36) undifferentiated beaked whales. The 2006 aerial survey from the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence resulted in an abundance estimate of 922 (CV=1.47) undifferentiated beaked whales Waring et al. (2014).

Waring et al. (2014) noted that estimates are not dive-time correct and are therefore likely negatively biased.

Survey Period	Area	Cuvier’s beaked whale		Unidentified Ziphiidae		Reference
		NBest	CV	NBest	CV	
2002	S. Gulf of Maine to Maine			822	0.81	Palka 2006
2004	Maryland to Bay of Fundy			2839	0.78	Palka 2006
2004	Florida to Maryland			674	0.36	

2004	Florida to Bay of Fundy (COMBINED)			3513	0.63	
2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence			922	1.47	Waring et al. 2014
2011	North Carolina to lower Bay of Fundy	4,962	0.37			Palka 2012
2016	Florida to Bay of Fundy (COMBINED)	5,744	0.36			Garrison 2020; Palka 2020

Stock Abundance Trend

A trend analysis has not been conducted for this stock due to imprecise abundance estimates (Hayes et al. 2020).

Cumulative Stressors

Seven Cuvier's beaked whales stranded along the U.S. Atlantic coast between 2013 and 2017, with one showing evidence of human interaction (Hayes et al. 2020). Impacts on beaked whales associated with naval activities (e.g., sonar) include skin lesions and mass strandings (Simmonds and Lopez-Jurado 1991; Frantzis 1998; Jepson et al. 2003; Fernández et al. 2005; Bernaldo de Quiros et al. 2019). In March 2000, 14 beaked whales live-stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died and necropsies performed on 5 of the whales showed evidence of tissue trauma associated with an acoustic or impulse injury (Evans and England 2001; Balcomb and Claridge 2001; Cox et al. 2006).

Other relevant information

In his review of global climate change, range changes and potential implications for the conservation of marine cetaceans, MacLeod (2009) categorized the Cuvier's beaked whale as a warmer water-limited (WWL) species and speculated that as a WWL species, the range of Cuvier's beaked whale is likely to expand polewards in all oceans.

Learmonth et al. (2006) in their table for potential effects of climate change on species range had a question mark for Cuvier's beaked whale and how they would be affected.

Studies of deep-water currents and their potential role in increasing deep-water productivity as well as other proximal factors need to be considered for deepwater species in the Gulf, as well as the dynamic nature of the warm- and cold-core rings.

Distribution and Sightings

Density model results for Cuvier's beaked whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017) and Mannocci et al. (2017).

Further Reading

Allen, B.M., R.L. Brownell, and J.G. Mead. 2012. Species review of Cuvier's beaked whale, *Ziphius cavirostris*. Reports of the International Whaling Commission. https://swfsc.noaa.gov/publications/CR/2011/2011Allen2.pdf

Baird, R.W. 2018. Cuvier's beaked whale *Ziphius cavirostris*. Encyclopedia of marine mammals. Third edition. B. Würsig, J. G. M. Thewissen and K. M. Kovacs. San Diego, California, Elsevier/Academic Press: 254-257.

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Ziphius cavirostris*. The IUCN Red List of Threatened Species 2008: e.T23211A9429826. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T23211A9429826.en

Valdivia, A (2017) Petition to list the Gulf of Mexico Cuvier's beaked whale (*Ziphius cavirostris*) as endangered under the Endangered Species Act. Center for Biological Diversity, 57 pp. http://sero.nmfs.noaa.gov/protected_resources/listing_petitions/documents/cbd_petition_to_list_the_gulf_of_mexico_cuvier_s_beaked_whale_under_the_esa_final.pdf

References

Aguilar de Soto, N. and P. Hammond. 2014. Population parameters of Blainville´s and Cuvier´s beaked whales. Report to Office of Naval Research for Award No. N00014-12-1-0626. 8 p.

Baird, R.W. 2018. Cuvier's beaked whale: *Ziphius cavirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 234–237. doi: 10.1016/B978-0-12-804327-1.00100-X

Baird, R.W., D.J. McSweeney, A.D. Ligon, and D.L. Webster. 2004. Tagging feasibility and diving of Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's beaked whales (*Mesoplodon densirostris*) in Hawai'i. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Order No. AB133F-03-SE-0986. 15 p.

Balcomb, K.C.I. and D.E. Claridge. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. Bahamas Journal of Science 2:2–12.

Ballardini, M., T. Pusser, and B. Nani. 2005. Photo-identification of Cuvier's beaked whales (*Ziphius cavirostris*) in the northern Ligurian Sea. Proceedings of the 14th annual conference of the European Cetacean Society, La Rochelle. pp. 4–7.

Barlow, J., M.C. Ferguson, W.F. Perrin, L. Ballance, T. Gerrodette, G. Joyce, C.D. MacLeod, K. Mullin, D.L. Palka, and G. Waring. 2006. Abundance and densities of beaked and bottlenose whales (family Ziphiidae). Journal of Cetacean Research and Management 7:263–270.

Bernaldo de Quirós, Y., A. Fernandez, R.W. Baird, R.L. Brownell, N. Aguilar de Soto, D. Allen, M. Arbelo, M. Arregui, A. Costidis, A. Fahlman, A. Frantzis, F.M.D. Gulland, M. Iñíguez, M. Johnson, A. Komnenou, H. Koopman, D.A. Pabst, W.D. Roe, E. Sierra, M. Tejedor, and G. Schorr. 2019. Advances in research on the impacts of anti-submarine sonar on beaked whales. Proceedings of the Royal Society B: Biological Sciences 286(1895):20182533. doi: 10.1098/rspb.2018.2533

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

Claridge, D.E. 2013. Population ecology of Blainville's beaked whales (*Mesoplodon densirostris*). University of St Andrews. 296 p.

Cox, T.M., T.J. Ragen, A.J. Read, E. Vos, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G.D. Spain, A. Fernandez, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J.

Hilderbrand, D. Houser, T. Hullar, P.D. Jepson, D. Ketten, C.D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. Journal of Cetacean Research and Management 7(3):177–187.

Evans, D.L. and G.R. England. 2001. Joint interim report - Bahamas marine mammal stranding - event of 15-16 March 2000. 59 p.

Ferguson, M.C. 2005. Cetacean population density in the eastern Pacific Ocean: Analyzing patterns with predictive spatial models. University of California, San Diego. 203 p.

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Fernandez, A., J.F. Edwards, F. Rodriguez, A. Espinosa de los Monteros, P. Herraez, P. Castro, J.R. Jaber, V. Martin, and M. Arbelo. 2005. "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. Veterinary Pathology 42(4):446–457. doi: 10.1354/vp.42-4-446

Forney, K.A., B.L. Southall, E. Slooten, S. Dawson, A.J. Read, R.W. Baird, and R.L. Brownell. 2017. Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity. Endangered Species Research 32:391–413. doi: 10.3354/esr00820

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Gannier, A. 2000. Distribution of cetaceans off the Society Islands (French Polynesia) as obtained from dedicated surveys. Aquatic Mammals 26(2):111–126.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hickmott, L.S. 2005. Diving behaviour and foraging ecology of Blainville's and Cuvier's beaked whales in the northern Bahamas. University of Aberdeen. Thesis. 102 p.

Hildebrand, J.A., S. Baumann-Pickering, K.E. Frasier, J.S. Trickey, K.P. Merkens, S.M. Wiggins, M.A. McDonald, L.P. Garrison, D. Harris, T.A. Marques, and L. Thomas. 2015. Passive acoustic monitoring of beaked whale densities in the Gulf of Mexico. Scientific Reports 5(1):16343. doi: 10.1038/srep16343

Houston, J. 1990. Status of Blainville's beaked whale, *Mesoplodon densirostris*, in Canada. Canadian Field-Naturalist 104(1):117–120.

Jepson, P.D., M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martin, A.A. Cunningham, and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. Nature 425(6958):575–576. doi: 10.1038/425575a

Learmonth, J.A., C.D. MacLeod, M.B. Santos, G.J. Pierce, H.Q.P. Crick, and R.A. Robinson. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology - an Annual Review, Vol 44 44:431–464. doi: 10.1201/9781420006391

MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. Endangered Species Research 7:125–136. doi: 10.3354/esr00197

MacLeod, C.D. and A. D'Amico. 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. Journal of Cetacean Research and Management 7(3):211–221.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

MacLeod, C.D. and A.F. Zuur. 2005. Habitat utilization by Blainville's beaked whales off Great Abaco, northern Bahamas, in relation to seabed topography. Marine Biology 147(1):1–11. doi: 10.1007/s00227-004-1546-9

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

McLellan, W.A., R.J. McAlarney, E.W. Cummings, A.J. Read, C.G.M. Paxton, J.T. Bell, and D.A. Pabst. 2018. Distribution and abundance of beaked whales (Family Ziphiidae) Off Cape Hatteras, North Carolina, U.S.A. Marine Mammal Science 34(4):997–1017. doi: 10.1111/mms.12500

McSweeney, D.J., R.W. Baird, and S.D. Mahaffy. 2007. Site fidelity, associations, and movements of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales off the island of Hawai'i. Marine Mammal Science 23(3):666–687. doi: 10.1111/j.1748-7692.2007.00135.x

Mead, J.G. 1984. Survey of reproductive data for the beaked whales (Ziphiidae). Reports of the International Whaling Commission (Special Issue) 6:91–96.

Mitchell, E. 1975. Report of the meeting on smaller cetaceans, Montreal, April 1-11, 1974. Subcommittee on smaller cetaceans, International Whaling Commission. Journal of the Fisheries Research Board of Canada 32(7):889–983. doi: 10.1139/f75-117

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D.L. 2006. Summer abundance estimates of cetaceans in US North Atlantic Navy Operating Areas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 06-03. 41 p.

Pitman, R.L. 2002. Mesoplodont whales *Mesoplodon* spp. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals. Academic Press, San Diego, CA. pp. 738–742.

Ritter, F. and B. Brederlau. 1999. Behavioural observations of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). Aquatic Mammals 25(2):55–61.

Shearer, J.M., N.J. Quick, W.R. Cioffi, R.W. Baird, D.L. Webster, H.J. Foley, Z.T. Swaim, D.M. Waples, J.T. Bell, and A.J. Read. 2019. Diving behaviour of Cuvier's beaked whales (*Ziphius cavirostris*) off

Cape Hatteras, North Carolina. Royal Society Open Science 6(2):181728. doi: 10.1098/rsos.181728
Simmonds, M.P. and L.F. Lopez-Jurado. 1991. Whales and the military. Nature 351(6326):448–448. doi: 10.1038/351448a0
Stanistreet, J.E., D.P. Nowacek, S. Baumann-Pickering, J.T. Bell, D.M. Cholewiak, J.A. Hildebrand, L.E.W. Hodge, H.B. Moors-Murphy, S.M. Van Parijs, and A.J. Read. 2017. Using passive acoustic monitoring to document the distribution of beaked whale species in the western North Atlantic Ocean. Canadian Journal of Fisheries and Aquatic Sciences 74(12):2098–2109. doi: 10.1139/cjfas-2016-0503
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.
Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70
Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.
Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x
West, K.L., W.A. Walker, R.W. Baird, J.G. Mead, and P.W. Collins. 2017. Diet of Cuvier's beaked whales *Ziphius cavirostris* from the North Pacific and a comparison with their diet world-wide. Marine Ecology Progress Series 574:227–242. doi: 10.3354/meps12214

False killer whale − *Pseudorca crassidens*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 59% of scores ≥ 2

	Pseudorca crassidens	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	1.7	
	Habitat Specificity	1.6	1.3	
	Site Fidelity	1.5	1.3	
	Lifetime Reproductive Potential	2.1	0.7	
	Generation Length	2.6	0.7	
	Reproductive Plasticity	1.3	0.7	
	Migration	2.8	1.3	
	Home Range	1.7	1.3	
	Stock Abundance	2.7	1.7	
	Stock Abundance Trend	2.3	1.0	
	Cumulative Stressors	2.3	1.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	2.2	2.7	
	Sea Surface Salinity (Change in variability)	1.3	2.7	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.0	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.0	2.7	
	Circulation	1.5	2.0	
	Sea level rise	2.0	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low

Moderate

High

Very High

False killer whale (Northern Gulf of Mexico Stock)

Pseudorca crassidens

CVA Results Summary

Overall Climate Vulnerability Rank: High (93% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (2.80), Species Abundance (2.67), and Generation Time (2.60).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 59% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The false killer whale Gulf of Mexico stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico and adjacent offshore and Mexican waters (Hayes et al. 2021).

Prey/Diet Specificity

False killer whales' diet consists primarily of cephalopods and fish (Stacey et al. 1994; Odell and McClune 1999).

Habitat Specificity

False killer whales are found primarily in oceanic and offshore areas, but have been known to approach shore (Baird et al. 1989; Rudolph et al. 1997; Gannier 2002; Baird 2018). False killer whales are found in oceanic waters in the northern Gulf of Mexico (Davis and Fargion 1996; Mullin and Fulling 2004; Maze-Foley and Mullin 2006).

Site Fidelity

Information regarding false killer whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Kasuya (1986) reported an inter-birth interval of 6.9 years in Japan. Ferreira (2008) calculated inter-birth interval from annual pregnancy rate and reported an interval of 8.8 years and 4.5 years in Japan and South Africa, respectively.

Leatherwood et al. (1989) reported age at sexual maturation of 8 to 14 years. Ferreira et al. (2014) estimated that females in populations in Japan and South Africa reach sexual maturity at 8–10.5 years. Taylor et al. (2007) reported age at first reproduction of 12 years and age at last reproduction of 41 years (estimated). False killer whales are among the few species in which senescence has been recorded, with ovulation ceased in 50% of whales over 45 years, and whales over 55 years old being classified as post-reproductive (Photopoulou et al. 2017). These values suggest a reproductive lifespan of 27-37 years.

Generation Length

Oleson et al. (2010) estimated a generation length for false killer whales of 25 years, based on short-finned pilot whales.

Reproductive Plasticity

Information regarding false killer whale reproductive seasonality, location, and habitat in the Gulf of Mexico was not found in the literature.

Migration

False killer whales were only seen in the northern Gulf of Mexico during the spring and summer surveys (Hansen et al. 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004), although the Navy expects no seasonal differences in their occurrence patterns within their operating areas (DoN 2007).

Home Range

In the northern Gulf of Mexico, false killer whales are mostly seen in the deep waters seaward of the shelf break but are occasionally found over shelf waters (Davis and Fargion 1996; Jefferson and Schiro 1997; Mullin and Fulling 2004). The species is assumed to occur in other regions of the Gulf of Mexico beyond U.S. waters (Jefferson and Schiro 1997; Ortega Ortiz 2002; Jefferson et al. 2008).

Stock Abundance

The most recent abundance estimate for false killer whales in the northern Gulf of Mexico is 494 individuals (CV=0.79), based on 2017 and 2018 oceanic surveys (Garrison et al. 2020; Hayes et al. 2021). Previously, the stock abundance was estimated to be 777 individuals (CV=0.56) based on data pooled from 2003 and 2004 surveys (Mullin 2007). For 1996 to 2001 the estimate was 1038 individuals (CV=0.71; Mullin and Fulling 2004). For 1991 to 1994, the estimate was 381 individuals (CV=0.62; Hansen et al. 1995).

Stock Abundance Trend

Five point estimates of false killer whale abundance have been made based on data from surveys in 2003 (1,293; CV=0.64), 2004 (0), 2009 (0), 2017 (1,069; CV=0.97), and 2018 (162; CV=0.74). Pairwise comparisons of the log-transformed means were conducted between years, and found significant differences between the 2003 and 2018 estimates and the 2017 and 2018 estimates (see Garrison et al. 2020 and Hayes et al. 2021). The DWH NRDA Trustees estimated that for the northern Gulf of Mexico stock of false killer whales, 18% of the population was exposed to oil, 6% was killed, 8% of females sustained reproductive failure, and 7% of the population sustained adverse health effects (Table 4.9-12 of DWH NRDA 2016).

Cumulative Stressors

The false killer whale may interact with longline fisheries in the northern Gulf of Mexico, however no fishing-related mortality or serious injury of a false killer whale was reported during 2014–2018 (Hayes et al. 2021). A mass stranding of 99 false killer whales occurred in Florida in 2017.

The oil, dispersant and burn residue compounds from the Deepwater Horizon (DWH) incident present persistent ecological concerns along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011; DWH MMIQT 2015).

Distribution and Sightings

Density model results for false killer whales in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Baird, R.W. 2018. False killer whale: *Pseudorca crassidens*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 347–349. doi: 10.1016/B978-0-12-804327-1.00006-6

Baird, R.W. 2018. *Pseudorca crassidens* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T18596A145357488. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T18596A145357488.en

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

References

Baird, R.W. 2018. False killer whale: *Pseudorca crassidens*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 347–349. doi: 10.1016/B978-0-12-804327-1.00006-6

Baird, R.W., K.M. Langelier, and P.J. Stacey. 1989. First records of false killer whales, *Pseudorca crassidens*, in Canada. Canadian Field-Naturalist 103:368–371.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western

Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x
Deepwater Horizon Marine Mammai Injury Quantification Team (DWH MMIQT). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. 64 p.
Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.
Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.
Ferreira, I.M. 2008. Growth and reproduction in false killer whales (*Pseudorca crassidens* Owen, 1846). University of Pretoria. Thesis. 152 p.
Ferreira, I.M., T. Kasuya, H. Marsh, and P.B. Best. 2014. False killer whales (*Pseudorca crassidens*) from Japan and South Africa: Differences in growth and reproduction. Marine Mammal Science 30(1):64–84. doi: 10.1111/mms.12021
Gannier, A. 2002. Cetaceans of the Marquesas Islands (French Polynesia): Distribution and relative abundance as obtained from a small boat dedicated survey. Aquatic Mammals 28(2):198–210.
Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48
Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.
Hansen, L.J., K.D. Mullin, and C.L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. MIA-94/95-25. 9 p.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.
Jefferson, T.A. and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review 27(1):27–50. doi: 10.1111/j.1365-2907.1997.tb00371.x
Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.
Kasuya, T. 1986. False killer whales. In: Tamura, T., S. Ohsumi, and S. Arai (Eds.), Report of investigation in search of solution for dolphin-fishery conflict in the Iki Island area. Report prepared for the Japan Fisheries Agency. English translation by N. Inagaki. pp. 178–187.
Leatherwood, S., D. McDonald, R.W. Baird, and M.D. Scott. 1989. The false killer whale, *Pseudorca crassidens* (Owen, 1846); A summary of information available through 1988. Oceans Unlimited Technical Report 89-001:1–114.
Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mullin, K.D. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 26 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996-2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Odell, D.K. and K.M. McClune. 1999. False killer whale *Pseudorca crassidens* (Owen, 1846). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 213–243.

Oleson, E.M., C.H. Boggs, K.A. Forney, M.B. Hanson, D.R. Kobayashi, B.L. Taylor, P.R. Wade, and G.M. Ylitalo. 2010. Status review of Hawaiian insular false killer whales (*Pseudorca crassidens*) under the Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Fisheries Science Center: Honolulu, HI. NOAA Technical Memorandum NMFS-PIFSC-22. 140 p.

Ortega Ortiz, J.G. 2002. Multiscale analysis of cetacean distribution in the Gulf of Mexico. Texas A&M University, College Station. 170 p.

Photopoulou, T., I.M. Ferreira, P.B. Best, T. Kasuya, and H. Marsh. 2017. Evidence for a postreproductive phase in female false killer whales *Pseudorca crassidens*. Frontiers in Zoology 14(1):30. doi: 10.1186/s12983-017-0208-y

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for false killer whale (*Pseudorca crassidens*) for the U.S. Gulf of Mexico version 1.3, 2015-09-30, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 35 p.

Rudolph, P., C. Smeenk, and S. Leatherwood. 1997. Preliminary checklist of Cetacea in the Indonesian Archipelago and adjacent waters. Zoologische Verhandelingen 312:1–48.

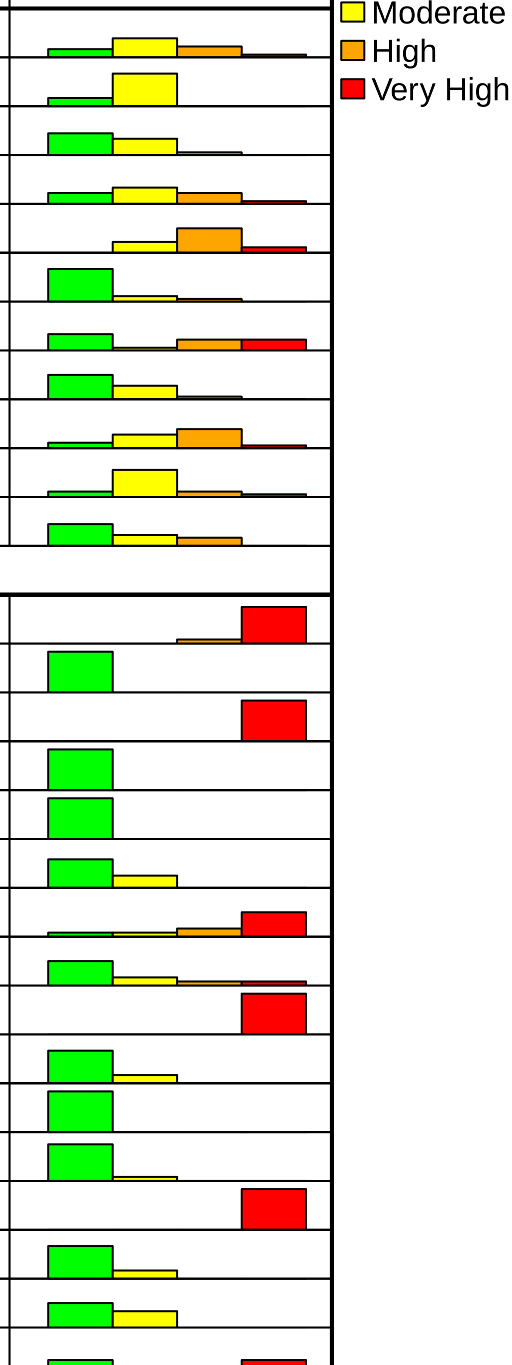
Stacey, P.J., S. Leatherwood, and R.W. Baird. 1994. *Pseudorca crassidens*. Mammalian Species 456:1–6. doi: 10.2307/3504208

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

False killer whale − *Pseudorca crassidens*
Western North Atlantic Stock

Overall Vulnerability Rank = Moderate
Biological Sensitivity = Low
Climate Exposure = Very High
Data Quality = 59% of scores ≥ 2

	Pseudorca crassidens	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	2.0	
	Habitat Specificity	1.8	1.3	
	Site Fidelity	1.5	1.0	
	Lifetime Reproductive Potential	2.1	0.7	
	Generation Length	2.9	0.7	
	Reproductive Plasticity	1.3	0.3	
	Migration	2.4	0.3	
	Home Range	1.5	1.0	
	Stock Abundance	2.5	1.3	
	Stock Abundance Trend	2.1	0.3	
	Cumulative Stressors	1.7	0.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.0	
	Sea Surface Temperature (Change in variability)	1.0	2.0	
	Air Temperature (Change in mean)	4.0	2.0	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.0	
	Precipitation (Change in variability)	1.3	2.0	
	Sea Surface Salinity (Change in mean)	3.3	2.0	
	Sea Surface Salinity (Change in variability)	1.7	2.0	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.2	2.0	
	Sea ice coverage (Change in mean)	1.0	2.0	
	Sea ice coverage (Change in variability)	1.1	2.0	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.2	2.0	
	Circulation	1.4	1.5	
	Sea level rise	2.5	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		



False killer whale (Western North Atlantic Stock)

Pseudorca crassidens

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (30% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), and Sea Surface Temperature (Standard anomaly) (3.9).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Generation Time (2.87).

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 59% of the data quality scores were 2 or greater, 9% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The false killer whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

False killer whales' diet consists primarily of cephalopods and fish (Stacey et al. 1994; Odell and McClune 1999).

Habitat Specificity

False killer whales are found primarily in oceanic and offshore areas, but have been known to approach shore (Baird et al. 1989; Rudolph et al. 1997; Gannier 2002; Baird 2018). False killer whales have been sighted in U.S. Atlantic waters from southern Florida to Maine (Schmidly 1981).

Site Fidelity

Information regarding false killer whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Kasuya (1986) reported an inter-birth interval of 6.9 years in Japan. Ferreira (2008) calculated inter-birth interval from annual pregnancy rate and reported an interval of 8.8 years and 4.5 years in Japan and South Africa, respectively.

Leatherwood et al. (1989) reported age at sexual maturation of 8 to 14 years. Ferreira et al. (2014) estimated that females in populations in Japan and South Africa reach sexual maturity at 8–10.5 years. Taylor et al. (2007) reported age at first reproduction of 12 years and age at last reproduction of 41 years (estimated). False killer whales are among the few species in which senescence has been recorded, with ovulation ceased in 50% of whales over 45 years, and whales over 55 years old being classified as post-reproductive (Photopoulou et al. 2017). These values suggest a reproductive lifespan of 27-37 years.

Generation Length

Oleson et al. (2010) estimated a generation length for false killer whales of 25 years, based on short-finned pilot whales.

Reproductive Plasticity

Information regarding false killer whale reproductive seasonality, location, and habitat in the western North Atlantic was not found in the literature.

Migration

Information regarding false killer whale migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Information regarding false killer whale home range in the western North Atlantic was not found in the literature.

Stock Abundance

The most recent abundance estimate for western North Atlantic false killer whales is 1,791 individuals (CV=0.56), based on summer 2016 surveys from Florida to the lower Bay of Fundy (Garrison 2020; Palka 2020). Summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy estimated the population at 442 individuals (CV=1.06; Waring et al. 2015).

Stock Abundance Trend

There are insufficient data to determine population trends for this stock (Hayes et al. 2020).

Cumulative Stressors

The false killer whale stock in the western North Atlantic may interact with pelagic longline fisheries, however no fishery-related mortality or serious injury was reported during 2013–2017 (Hayes et al.

2020). One false killer whale stranding was reported in the U.S. Atlantic Ocean during 2013–2017 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Distribution and Sightings

Density model results for false killer whales in the western North Atlantic are presented by Roberts et al. (2015, 2016).

Further Reading

Baird, R.W. 2018. False killer whale: *Pseudorca crassidens*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 347–349. doi: 10.1016/B978-0-12-804327-1.00006-6

Baird, R.W. 2018. *Pseudorca crassidens* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T18596A145357488. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T18596A145357488.en

Department of the Navy. 2009. Marine Resources Assessment for the Chesapeake Bay. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0127. Prepared by Geo-Marine, Inc., Hampton, VA. 393 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

References

Baird, R.W. 2018. False killer whale: *Pseudorca crassidens*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 347–349. doi: 10.1016/B978-0-12-804327-1.00006-6

Baird, R.W., K.M. Langelier, and P.J. Stacey. 1989. First records of false killer whales, *Pseudorca crassidens*, in Canada. Canadian Field-Naturalist 103:368–371.

Ferreira, I.M. 2008. Growth and reproduction in false killer whales (*Pseudorca crassidens* Owen, 1846). University of Pretoria. Thesis. 152 p.

Ferreira, I.M., T. Kasuya, H. Marsh, and P.B. Best. 2014. False killer whales (*Pseudorca crassidens*) from Japan and South Africa: Differences in growth and reproduction. Marine Mammal Science 30(1):64–84. doi: 10.1111/mms.12021

Gannier, A. 2002. Cetaceans of the Marquesas Islands (French Polynesia): Distribution and relative abundance as obtained from a small boat dedicated survey. Aquatic Mammals 28(2):198–210.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Kasuya, T. 1986. False killer whales. In: Tamura, T., S. Ohsumi, and S. Arai (Eds.), Report of investigation in search of solution for dolphin-fishery conflict in the Iki Island area. Report prepared for the Japan Fisheries Agency. English translation by N. Inagaki. pp. 178–187.

Leatherwood, S., D. McDonald, R.W. Baird, and M.D. Scott. 1989. The false killer whale, *Pseudorca crassidens* (Owen, 1846); A summary of information available through 1988. Oceans Unlimited Technical Report 89-001:1–114.

Odell, D.K. and K.M. McClune. 1999. False killer whale *Pseudorca crassidens* (Owen, 1846). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 213–243.

Oleson, E.M., C.H. Boggs, K.A. Forney, M.B. Hanson, D.R. Kobayashi, B.L. Taylor, P.R. Wade, and G.M. Ylitalo. 2010. Status review of Hawaiian insular false killer whales (*Pseudorca crassidens*) under the Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Fisheries Science Center: Honolulu, HI. NOAA Technical Memorandum NMFS-PIFSC-22. 140 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Photopoulou, T., I.M. Ferreira, P.B. Best, T. Kasuya, and H. Marsh. 2017. Evidence for a postreproductive phase in female false killer whales *Pseudorca crassidens*. Frontiers in Zoology 14(1):30. doi: 10.1186/s12983-017-0208-y

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for false killer whale (*Pseudorca crassidens*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 140 p.

Rudolph, P., C. Smeenk, and S. Leatherwood. 1997. Preliminary checklist of Cetacea in the Indonesian Archipelago and adjacent waters. Zoologische Verhandelingen 312:1–48.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States coast and Gulf of Mexico. Washington, DC. FWS/OBS-80/41. 163 p.

Stacey, P.J., S. Leatherwood, and R.W. Baird. 1994. *Pseudorca crassidens*. Mammalian Species 456:1–6. doi: 10.2307/3504208

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-231. 361 p. doi: 10.7289/V5TQ5ZH0

Fin whale − *Balaenoptera physalus*

Western North Atlantic Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Balaenoptera physalus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	2.8	
	Habitat Specificity	1.5	2.5	
	Site Fidelity	2.8	2.0	
	Lifetime Reproductive Potential	1.1	2.0	
	Generation Length	3.1	1.7	
	Reproductive Plasticity	2.9	1.3	
	Migration	1.3	2.3	
	Home Range	1.7	2.2	
	Stock Abundance	2.0	2.5	
	Stock Abundance Trend	1.8	1.3	
	Cumulative Stressors	2.2	2.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	2.9	
	Sea Surface Temperature (Change in variability)	1.0	2.9	
	Air Temperature (Change in mean)	3.8	2.9	
	Air Temperature (Change in variability)	1.0	2.9	
	Precipitation (Change in mean)	1.2	2.9	
	Precipitation (Change in variability)	1.6	2.9	
	Sea Surface Salinity (Change in mean)	2.1	2.9	
	Sea Surface Salinity (Change in variability)	1.6	2.9	
	Ocean pH (Change in mean)	4.0	2.9	
	Ocean pH (Change in variability)	1.2	2.9	
	Sea ice coverage (Change in mean)	1.6	2.9	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	4.0	2.9	
	Dissolved oxygen (Change in variability)	1.2	2.9	
	Circulation	2.7	2.5	
	Sea level rise	1.8	2.9	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Fin whale (Western North Atlantic Stock)

Balaenoptera physalus

CVA Results Summary

Overall Climate Vulnerability Rank: High (47% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Air Temperature (Standard anomaly) (3.75).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Generation Time (3.07), Reproductive Plasticity (2.93), and Site Fidelity (2.80).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Low

Data Quality: 89% of the data quality scores were 2 or greater. 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The western North Atlantic stock of fin whales includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone (EEZ) in the western North Atlantic and adjacent offshore and Canadian waters (Donovan 1991; Hayes et al. 2022).

Prey/Diet Specificity

The fin whale diet includes a wide variety of small, schooling prey (e.g., herring [*Clupea harengus*], capelin [*Mallotus villosus*], sand lance [*Ammodytes* spp.]), squid, krill, and copepods (see review in Kenney et al. 1985; NMFS 2010). Pauly et al. (1998) reported species-level diet of 80% large zooplankton, 5% small squids, 5% small pelagic fishes, 5% mesopelagic fishes, and 5% miscellaneous fishes, however those results are biased by krill-dominated diets in the Southern Ocean and high latitudes in the Northern Hemisphere.

Habitat Specificity

Fin whales in the western North Atlantic forage in shallow areas of high relief (Kenney and Winn 1986; Hain et al. 1992; Waring et al. 1992; Woodley and Gaskin 1996). Fin whales have been found associated with features that aggregate prey, such as warm core rings and thermal fronts (Waring et al. 1992; Clark and Gagnon 2004; Johnston et al. 2005; Doniol-Valcroze et al. 2007).

Site Fidelity

Females of this population show evidence of site fidelity (Seipt et al. 1990; Clapham and Seipt 1991; Agler et al. 1993).

Lifetime Reproductive Potential

Calving intervals in northeastern U.S. waters range from 2 to 6 years (Agler et al. 1990) while Taylor et al. (2007) reported interbirth interval of 2.24 years for the species in general.

Female fin whales in the North Atlantic mature at 8 to 11 years of age (Boyd et al. 1999) while Taylor et al. (2007) reported age at first reproduction of 10 years for the species in general. Taylor et al. (2007) estimated age at last reproduction to be 62 years.

Generation Length

Taylor et al. (2007) reported generation length of 19.6 years at r=0.04 and 25.9 years at r=0.0 for the species in general.

Reproductive Plasticity

Hain et al. (1992) suggested that calving takes place during October to January in the latitudes of the U.S. mid-Atlantic. Calving, mating, and wintering locations remain mostly unknown (Aguilar 2018; Hayes et al. 2022).

Migration

Fin whales that are found in U.S. Atlantic EEZ waters likely migrate into Canadian waters, open-ocean areas, and subtropical or tropical regions (Hayes et al. 2022). Passive acoustic monitoring suggests fin whales move southward in the fall and northward in spring (Clark 1995). However, a portion of the population is found within U.S. waters throughout the year, suggesting the population does not undergo distinct annual migrations like other mysticetes in the region (CETAP 1982; Hain et al. 1992; Edwards et al. 2015; Hayes et al. 2022).

Home Range

Fin whales are common in waters of the U. S. Atlantic EEZ, principally from Cape Hatteras northward (CETAP 1982; Hain et al. 1992). In a recent globally-scaled review of sightings data, Edwards et al. (2015) found evidence to confirm the presence of fin whales in every season throughout much of the US EEZ north of 35°N. Clark (1995) suggested a substantial deep-ocean distribution of fin whales.

Stock Abundance

The western North Atlantic fin whale stock abundance is estimated at 7,418 individuals (CV=0.25) based on the sum of the estimates from the 2016 NOAA shipboard and aerial surveys and the 2016 Canadian Northwest Atlantic International Sightings Survey (Hayes et al. 2022).

Stock Abundance Trend

A trend analysis has not been conducted for this stock due to poor statistical power to detect a trend (Hayes et al. 2022).

Cumulative Stressors

Threats to fin whales in the western North Atlantic include ship strikes, pollution, and entanglement in fishing gear (Hayes et al. 2022). During the period 2014−2018, a minimum annual rate of 1.55 western North Atlantic fin whales suffered serious injury or mortality from incidental fishery interactions and a minimum annual rate of 0.8 fin whales suffered serious injury or mortality from vessel collisions (Henry et al. 2021).

Distribution and Sightings

Density model results for fin whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Aguilar, A. and R. García-Vernet. 2018. Fin Whale: *Balaenoptera physalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 368–371. doi: 10.1016/B978-0-12-804327-1.00128-X

Cooke, J.G. 2018. *Balaenoptera physalus*. The IUCN Red List of Threatened Species 2018: e.T2478A50349982. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2478A50349982.en

Department of the Navy. 2009. Marine Resources Assessment for the Chesapeake Bay. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0127. Prepared by Geo-Marine, Inc., Hampton, VA. 393 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

National Marine Fisheries Service (NMFS). 2019. Fin whale (*Balaenoptera physalus*) 5-year review: Summary and evaluation. Silver Spring, MD. 40 p.

References

Agler, B.A., J.A. Beard, R.S. Bowman, H.D. Corbett, S.E. Frohock, M.P. Hawvermale, S.K. Katona, S.S. Sadove, and I.E. Seipt. 1990. Fin whale (*Balaenoptera physalus*) photographic identification: Methodology and preliminary results from the western North Atlantic. Reports of the International Whaling Commission (Special Issue) 12:349–356.

Agler, B.A., R.L. Schooley, S.E. Frohock, S.K. Katona, and I.E. Seipt. 1993. Reproduction of photographically identified fin whales, *Balaenoptera physalus*, from the Gulf of Maine. Journal of Mammalogy 74(3):577–587. doi: 10.2307/1382276

Aguilar, A. and R. García-Vernet. 2018. Fin Whale: *Balaenoptera physalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 368–371. doi: 10.1016/B978-0-12-804327-1.00128-X

Boyd, I.L., C. Lockyer, and H.D. Marsh. 1999. Reproduction in marine mammals. In: Reynolds III, J.E. and S.A. Rommel (Eds.), Biology of marine mammals. Smithsonian Institution Press, Washington, DC. pp. 218–286.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Clapham, P.J. and I.E. Seipt. 1991. Resightings of independent fin whales, *Balaenoptera-physalus*, on maternal summer ranges. Journal of Mammalogy 72(4):788–790. doi: 10.2307/1381844

Clark, C.W. 1995. Annex M. Matters arising out of the discussion of blue whales: Annex M1. Application of US Navy underwater hydrophone arrays for scientific research on whales. Reports of the International Whaling Commission 45:210–212.

Clark, C.W. and G.J. Gagnon. 2002. Low-frequency vocal behaviors of baleen whales in the North Atlantic: Insights from Integrated Undersea Surveillance System detections, locations, and tracking from 1992 to 1996. Journal of Underwater Acoustics (US Navy) 52(3):609–640.

Doniol-Valcroze, T., D. Berteaux, P. Larouche, and R. Sears. 2007. Influence of thermal fronts on habitat selection by four rorqual whale species in the Gulf of St. Lawrence. Marine Ecology Progress Series 335:207–216. doi: 10.3354/meps335207

Donovan, G.P. 1991. A review of IWC stock boundaries. Reports of the International Whaling Commission (Special Issue) 13:39–68.

Edwards, E.F., C. Hall, T.J. Moore, C. Sheredy, and J.V. Redfern. 2015. Global distribution of fin whales *Balaenoptera physalus* in the post-whaling era (1980-2012). Mammal Review 45(4):197–214. doi: 10.1111/mam.12048

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. Reports of the International Whaling Commission 42:653–669.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henry, A.G., M. Garron, D. Morin, A. Smith, A. Reid, W. Ledwell, and T.V.N. Cole. 2021. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2014-2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 21-07. 14 p. doi: 10.25923/ey0b-fw22

Johnston, D.W., L.H. Thorne, and A.J. Read. 2005. Fin whales *Balaentoptera physalus* and minke whales *Balaentoptera acutorostrata* exploit a tidally driven island wake ecosystem in the Bay of Fundy. Marine Ecology Progress Series 305:287–295. doi: 10.3354/meps305287

Kenney, R.D., M.A.M. Hyman, and H.E. Winn. 1985. Calculation of standing stocks and energetic requirements of the cetaceans of the northeast United States outer continental shelf. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-F/NEC-41. 99 p.

Kenney, R.D. and H.E. Winn. 1986. Cetacean high-use habitats of the Northeast United-States continental-shelf. Fishery Bulletin 84(2):345–357.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

NMFS (National Marine Fisheries Service). 2010. Final recovery plan for the fin whale (*Balaenoptera physalus*). National Marine Fisheries Service, Office of Protected Resources: Silver Spring, MD. 109 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Seipt, I.E., P.J. Clapham, C.A. Mayo, and M.P. Hawvermale. 1990. Population characteristics of Individually identified fin whales *Balaenoptera-physalus* in Massachusetts Bay. Fishery Bulletin 88(2):271–278.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Woodley, T.H. and D.E. Gaskin. 1996. Environmental characteristics of North Atlantic right and fin whale habitat in the lower Bay of Fundy, Canada. Canadian Journal of Zoology 74(1):75–84. doi: 10.1139/z96-010

Fraser's dolphin − *Lagenodelphis hosei*

Gulf of Mexico Stock

Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 78% of scores ≥ 2

	Lagenodelphis hosei	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	2.0	
	Habitat Specificity	1.6	2.0	
	Site Fidelity	1.7	1.3	
	Lifetime Reproductive Potential	2.1	2.3	
	Generation Length	2.2	2.3	
	Reproductive Plasticity	1.7	1.7	
	Migration	2.8	1.3	
	Home Range	1.7	1.3	
	Stock Abundance	3.3	2.7	
	Stock Abundance Trend	3.0	1.3	
	Cumulative Stressors	2.0	1.7	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	3.0	
	Sea Surface Temperature (Change in variability)	1.5	3.0	
	Air Temperature (Change in mean)	3.9	3.0	
	Air Temperature (Change in variability)	2.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	2.8	2.7	
	Sea Surface Salinity (Change in variability)	1.8	3.0	
	Ocean pH (Change in mean)	3.4	3.0	
	Ocean pH (Change in variability)	1.5	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.4	3.0	
	Dissolved oxygen (Change in variability)	1.5	3.0	
	Circulation	2.1	2.3	
	Sea level rise	1.1	2.0	
	Exposure Score	High		
	Overall Vulnerability Rank	High		

Low

Moderate

High

Very High

Fraser’s dolphin (Gulf of Mexico Stock)

Lagenodelphis hosei

CVA Results Summary

Overall Climate Vulnerability Rank: High (56% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0:Air Temperature (Standard anomaly) (3.87), Dissolved oxygen (Standard anomaly) (3.40), Ocean pH (Standard anomaly) (3.40), and Sea Surface Temperature (Standard anomaly) (3.40).

Biological Sensitivity: High. Two sensitivity attributes scored greater than or equal to 3.0: Species Abundance (3.27) and Species Abundance Trend (3.00).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 78% of the data quality scores were 2 or greater. 45% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The Fraser’s dolphin Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Fraser's dolphins are generally known to feed on mesopelagic fishes, mesopelagic cephalopods, and shrimps (Robison and Craddock 1983; Jefferson and Leatherwood 1994; Perrin et al. 1994; Dos Santos and Haimovici 2001; Dolar et al. 2003). In the Sulu Sea near the Phillipines, mesopelagic myctophids (55% by volume), mesopelagic cephalopods (30% by volume), and crustaceans (15% by volume) comprised the diet of Fraser’s dolphins (Dolar et al. 2003). Watkins et al. (1994) reported on Fraser’s dolphins feeding cooperatively on ‘rainbow runner’ (*Elagatis bipinnulatus*) off Dominica in the southeast Caribbean. Squid beaks and shrimp were found in stomach contents of a Fraser’s dolphin that stranded in Puerto Rico (Mignucci-Giannoni et al. 1999).

Habitat Specificity

Fraser’s dolphin is typically oceanic, except in places where deep water is found near shore (Ballance and Pitman 1998; Dolar et al. 2006; Jefferson et al. 2015; Louella and Dolar 2018). This species is often associated with upwelling-modified waters in the Eastern Tropical Pacific (Au and Perryman 1985).

Stable isotope analyses support that this species is predominantly oceanic (Botta et al. 2012; Bisi et al. 2013; Kiszka et al. 2011).

In the northern Gulf of Mexico, Fraser's dolphins are sighted in oceanic waters deeper than 200m (Maze-Foley and Mullin 2006). Fraser's dolphins are sighted over the abyssal plain in the southern Gulf of Mexico (Leatherwood et al. 1993)

Site Fidelity

Information regarding Fraser's dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported Fraser's dolphins have an interbirth interval of 2.00 years based on values reported by Amano et al. (1996).

Jefferson and Leatherwood (1994) reported age at sexual maturation for both sexes to occur around 7 years of age. Taylor et al. (2007) reported age at first reproduction of 8 years. Amano et al. (1996) reported females to reach sexual maturity at 5-8 years of age. Taylor et al. (2007) reported age at last reproduction of 18 years (observed) to 33 years (estimated), while Amano et al. (1996) reported an individual to be up to 17.5 years old captured in Japan, and Siciliano et al. (2007) reported an individual to be up to 19 years old in Brazil. These values result in a reproductive lifespan ranging from 10-28 years.

Generation Length

Taylor et al. (2007) estimated generation length of 11.0 years at r = 0.01 and 11.1 years at r = 0.0 based on values reported by Amano et al. (1996).

Reproductive Plasticity

Little information regarding Fraser's dolphin reproduction is presented in the literature. Of the information available, there is no strong evidence of calving seasonality (DoN 2007).

Migration

Fraser's dolphins have been observed in the northern Gulf of Mexico year-round (Leatherwood et al. 1993; Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Fraser's dolphins are found in the deep waters of the U.S. Gulf of Mexico and are assumed to occur throughout the oceanic Gulf of Mexico (Maze-Foley and Mullin 2006; Jefferson et al. 2008; Garrison and Aichinger Dias 2020).

Stock Abundance

The most recent abundance estimate for the Northern Gulf of Mexico Fraser's dolphin stock is 213 individuals (CV=1.03), based on 2017 and 2018 surveys (Garrison et al. 2020). Previously, the stock was estimated at 726 individuals (CV=0.70), based on pooled data from 1996 through 2001 (Mullin and

Fulling 2004). For 1991 to 1994, the estimate was 127 (CV=0.90; Hansen et al. 1995). No Fraser's dolphins were encountered during summer 2003 and spring 2004 surveys (Mullin 2007), or during a summer 2009 survey (Waring et al. 2012).

Stock Abundance Trend

Data are insufficient to determine the population trends for this species (Hayes et al. 2021). The Deepwater Horizon (DWH) Natural Resource Damage Assessment (NRDA) Trustees did not estimate impacts to the northern Gulf of Mexico stock of Fraser's dolphins due to lack of data (DWH NRDA 2016).

Cumulative Stressors

Fraser's dolphin may interact with longline fisheries in the Gulf of Mexico. No fishing-related mortalities of Fraser's dolphin were reported during the 2014–2018 period (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b).

Five Fraser's dolphins were reported stranded during a mass stranding event in Florida during 2017 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The oil, dispersant and burn residue compounds from the DWH incident present persistent ecological concerns along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011; Litz et al. 2014; DWH MMIQT 2015).

Other relevant information

Gomes-Pereira et al. (2013) characterized Fraser's dolphins as potential bio-indicators of climate change based on sightings made in temperate waters of the Azores (Aug 2008) and the Madeira Archipelago (Aug 2010) during a period of increased seawater temperature in the region.

Distribution and Sightings

Density model results for Fraser's dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Kiszka, J. and G. Braulik. 2018. *Lagenodelphis hosei*. The IUCN Red List of Threatened Species 2018: e.T11140A50360282. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T11140A50360282.en

Louella, M. and L. Dolar. 2018. Fraser's Dolphin: *Lagenodelphis hosei*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 392-395. doi: 10.1016/B978-0-12-804327-1.00134-5

References

Amano, M., N. Miyazaki, and F. Yanagisawa. 1996. Life history of Fraser's dolphin, *Lagenodelphis hosei*, based on a school captured off the pacific coast of Japan. Marine Mammal Science 12(2):199–214. doi: 10.1111/j.1748-7692.1996.tb00571.x

Au, D.W.K. and W.L. Perryman. 1985. Dolphin habitats in the Eastern Tropical Pacific. Fishery Bulletin 83(4):623–643.

Ballance, L.T. and R.L. Pitman. 1998. Cetaceans of the western tropical Indian Ocean: Distribution, relative abundance, and comparisons with cetacean communities of two other tropical ecosystems. Marine Mammal Science 14(3):429–459. doi: 10.1111/j.1748-7692.1998.tb00736.x

Bisi, T.L., P.R. Dorneles, J. Lailson-Brito, G. Lepoint, A.d.F. Azevedo, L. Flach, O. Malm, and K. Das. 2013. Trophic relationships and habitat preferences of delphinids from the southeastern Brazilian coast determined by carbon and nitrogen stable isotope composition. PLoS ONE 8(12):e82205. doi: 10.1371/journal.pone.0082205

Botta, S., A.A. Hohn, S.A. Macko, and E.R. Secchi. 2011. Isotopic variation in delphinids from the subtropical western South Atlantic. Journal of the Marine Biological Association of the United Kingdom 92(8):1689–1698. doi: 10.1017/s0025315411000610

Deepwater Horizon Marine Mammai Injury Quantification Team (DWH MMIQT). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. 64 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Dolar, M.L.L., W.F. Perrin, B.L. Taylor, G.L. Kooyman, and M.N.R. Alava. 2006. Abundance and distributional ecology of cetaceans in the central Philippines. Journal of Cetacean Research and Management 8(1):93–111.

Dolar, M.L.L., W.A. Walker, G.L. Kooyman, and W.F. Perrin. 2003. Comparative feeding ecology of spinner dolphins (*Stenella longirostris*) and Fraser's dolphins (*Lagenodelphis hosei*) in the Sulu Sea. Marine Mammal Science 19(1):1–19. doi: 10.1111/j.1748-7692.2003.tb01089.x

dos Santos, R.A. and M. Haimovici. 2001. Cephalopods in the diet of marine mammals stranded or incidentally caught along southeastern and southern Brazil (21–34°S). Fisheries Research 52(1-2):99–112. doi: 10.1016/s0165-7836(01)00234-x

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Gomes-Pereira, J.N., R. Marques, M.J. Cruz, and A. Martins. 2013. The little-known Fraser's dolphin *Lagenodelphis hosei* in the North Atlantic: New records and a review of distribution. Marine Biodiversity 43:321–332. doi: 10.1007/s12526-013-0159-2

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hansen, L.J., K.D. Mullin, and C.L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. MIA-94/95-25. 9 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Jefferson, T.A. and S. Leatherwood. 1994. *Lagenodelphis hosei*. Mammalian Species 470:1–5. doi: 10.2307/3504207

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Kiszka, J., B. Simon-Bouhet, L. Martinez, C. Pusineri, P. Richard, and V. Ridoux. 2011. Ecological niche segregation within a community of sympatric dolphins around a tropical island. Marine Ecology Progress Series 433:273–288. doi: 10.3354/meps09165

Leatherwood, S., T.A. Jefferson, J.C. Norris, W.E. Stevens, L.J. Hansen, and K.D. Mullin. 1993. Occurrence and sounds of Fraser's dolphin in the Gulf of Mexico. Texas Journal of Science 45(4):349–354.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Louella, M. and L. Dolar. 2018. Fraser's dolphin: *Lagenodelphis hosei*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 392–395. doi: 10.1016/B978-0-12-804327-1.00134-5

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A., B. Pinto-Rodríguez, M. Velasco-Escudero, R.A. Montoya-Ospina, N.M. Jiménez, M.A. Rodríguez-López, J.E.H. Williams, and D.K. Odell. 1999. Cetacean strandings in Puerto Rico and the Virgin Islands. Journal of Cetacean Research and Management 1(2):191–198. doi: 10.47536/jcrm.v1i2.466

Mullin, K.D. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 26 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F., S. Leatherwood, and A. Collett. 1994. Fraser's dolphin-*Lagenodelphis hosei* (Fraser, 1956). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 225–240.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for Fraser's dolphin (*Lagenodelphis hosei*) for the U.S. Gulf of Mexico version 1.3, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 35 p.

Robison, B.H. and J.E. Craddock. 1983. Mesopelagic fishes eaten by Fraser dolphin, *Lagenodelphis-hosei*. Fishery Bulletin 81(2):283–289.

Siciliano, S., R.M.A. Ramos, A.P.M. Di Beneditto, M.C.O. Santos, A.B. Fragoso, J.L. Brito, A.F. Azevedo, A.F.C. Vicente, E. Zampirolli, F.S. Alvarenga, L. Barbosa, and N.R.W. Lima. 2007. Age and growth of some delphinids in south-eastern Brazil. Journal of the Marine Biological Association of the United Kingdom 87(1):293–303. doi: 10.1017/s0025315407053398

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Watkins, W.A., M.A. Daher, K. Fristrup, and G. Notarbartolo di Sciara. 1994. Fishing and acoustic behavior of Fraser's dolphin (*Lagenodelphis hosei*) near Dominica, Southeast Caribbean. Caribbean Journal of Science 30:76–82.

Fraser's dolphin − *Lagenodelphis hosei*

Western North Atlantic Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = Moderate

Data Quality = 26% of scores ≥ 2

	Lagenodelphis hosei	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.7	
	Habitat Specificity	2.0	2.3	
	Site Fidelity	1.5	1.0	
	Lifetime Reproductive Potential	1.7	1.0	
	Generation Length	2.1	1.0	
	Reproductive Plasticity	1.5	0.3	
	Migration	2.0	0.0	
	Home Range	1.7	1.0	
	Stock Abundance	1.7	1.0	
	Stock Abundance Trend	1.9	0.0	
	Cumulative Stressors	2.5	0.0	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	2.9	2.5	
	Sea Surface Temperature (Change in variability)	1.1	2.5	
	Air Temperature (Change in mean)	2.5	1.5	
	Air Temperature (Change in variability)	1.0	1.5	
	Precipitation (Change in mean)	1.0	1.5	
	Precipitation (Change in variability)	1.2	1.5	
	Sea Surface Salinity (Change in mean)	2.0	1.5	
	Sea Surface Salinity (Change in variability)	1.1	1.5	
	Ocean pH (Change in mean)	2.5	1.5	
	Ocean pH (Change in variability)	1.1	1.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	1.0	1.5	
	Dissolved oxygen (Change in variability)	1.1	1.5	
	Circulation	1.4	1.5	
	Sea level rise	1.2	2.5	
	Exposure Score	Moderate		
Overall Vulnerability Rank		Low		

Low
Moderate
High
Very High

Fraser’s dolphin (Western North Atlantic Stock)

Lagenodelphis hosei

CVA Results Summary

Overall Climate Vulnerability Rank: Low (94% certainty from bootstrap analysis).

Climate Exposure: Moderate. Three exposure factors scored greater than or equal to 2.5: Sea Surface Temperature (Standard anomaly) (2.9), Air Temperature (Standard anomaly) (2.5), and Ocean pH (Standard anomaly) (2.5).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5.

Distributional Response: High

Abundance Response: Low

Phenology Response: High

Data Quality: 26% of the data quality scores were 2 or greater. 18% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Fraser’s dolphin western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Fraser's dolphins are generally known to feed on mesopelagic fishes, mesopelagic cephalopods, and shrimps (Robison and Craddock 1983; Jefferson and Leatherwood 1994; Perrin et al. 1994; Dos Santos and Haimovici 2001; Dolar et al. 2003). Pauly et al. (1998) reported the diet composition of Fraser’s dolphins consisting of 5% benthic invertebrates, 30% small squids, 5% large squids, 5% small pelagic fishes, 35% mesopelagic fishes, and 20% miscellaneous fishes. In the Sulu Sea near the Phillipines, mesopelagic myctophids (55% by volume), mesopelagic cephalopods (30% by volume), and crustaceans (15% by volume) comprised the diet of Fraser’s dolphins (Dolar et al. 2003). Watkins et al. (1994) reported on Fraser’s dolphins feeding cooperatively on ‘rainbow runner’ (*Elagatis bipinnulatus*) off Dominica in the southeast Caribbean. Squid beaks and shrimp were found in stomach contents of a Fraser’s dolphin that stranded in Puerto Rico (Mignucci-Giannoni et al. 1999).

Habitat Specificity

Fraser’s dolphin is typically oceanic, except in places where deep water is found near shore (Ballance and Pitman 1998; Dolar et al. 2006; Jefferson et al. 2015; Louella and Dolar 2018). This species is often associated with upwelling-modified waters in the Eastern Tropical Pacific (Au and Perryman 1985).

Stable isotope analyses suggest that this species is predominantly oceanic (Botta et al. 2012; Bisi et al. 2013; Kiszka et al. 2011).

Site Fidelity

Information regarding Fraser's dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported Fraser's dolphins have an interbirth interval of 2.00 years based on values reported by Amano et al. (1996).

Jefferson and Leatherwood (1994) reported age at sexual maturation for both sexes to occur around 7 years of age. Taylor et al. (2007) reported age at first reproduction of 8 years. Amano et al. (1996) reported females to reach sexual maturity at 5-8 years of age. Taylor et al. (2007) reported age at last reproduction of 18 years (observed) to 33 years (estimated), while Amano et al. (1996) reported an individual to be up to 17.5 years old captured in Japan, and Siciliano et al. (2007) reported an individual to be up to 19 years old in Brazil. These values result in a reproductive lifespan ranging from 10-28 years.

Generation Length

Taylor et al. (2007) estimated generation length of 11.0 years at r = 0.01 and 11.1 years at r = 0.0 based on values reported by Amano et al. (1996).

Reproductive Plasticity

Little information regarding Fraser's dolphin reproduction is presented in the literature. Of the information available, there is no strong evidence of calving seasonality (DoN 2008)

Migration

No stock-specific migratory information was in the published literature. In the Gulf of Mexico, Fraser's dolphins have been observed year-round (Leatherwood et al. 1993; Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

No stock-specific migratory information was in the published literature. In the Gulf of Mexico, Fraser's dolphin are found in deep waters (Maze-Foley and Mullin 2006) and are assumed to occur throughout the oceanic Gulf of Mexico (Jefferson et al. 2008).

Stock Abundance

Abundance has not been estimated for the Western North Atlantic Fraser's dolphin stock due to a lack of sightings during surveys (Hayes et al. 2020). The only information regarding abundance comes from a 1999 sighting of a group of an estimated 250 Fraser's dolphins in waters 3300 m deep off Cape Hatteras, North Carolina (NMFS 1999).

Stock Abundance Trend

There are insufficient data to determine the population trends for this stock (Hayes et al. 2020).

Cumulative Stressors

Fraser's dolphin may interact with longline fisheries; however, there were no reports of fishery-related mortality or serious injury to Fraser's dolphins in the western North Atlantic during 2013–2017 (Hayes et al. 2020). During the same period, no Fraser's dolphins were reported stranded along the U.S. Atlantic coast (Hayes et al. 2020).

Other relevant information

Gomes-Pereira et al. (2013) characterized Fraser's dolphins as potential bio-indicators of climate change based on sightings made in temperate waters of the Azores (Aug 2008) and the Madeira Archipelago (Aug 2010) during a period of increased seawater temperature in the region.

Distribution and Sightings

Density model results for Fraser's dolphin in the western North Atlantic are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Kiszka, J. and G. Braulik. 2018. *Lagenodelphis hosei*. The IUCN Red List of Threatened Species 2018: e.T11140A50360282. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T11140A50360282.en

Louella, M. and L. Dolar. 2018. Fraser's dolphin: *Lagenodelphis hosei*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 392-395. doi: 10.1016/B978-0-12-804327-1.00134-5

References

Amano, M., N. Miyazaki, and F. Yanagisawa. 1996. Life history of Fraser's dolphin, *Lagenodelphis hosei*, based on a school captured off the pacific coast of Japan. Marine Mammal Science 12(2):199–214. doi: 10.1111/j.1748-7692.1996.tb00571.x

Au, D.W.K. and W.L. Perryman. 1985. Dolphin habitats in the Eastern Tropical Pacific. Fishery Bulletin 83(4):623–643.

Ballance, L.T. and R.L. Pitman. 1998. Cetaceans of the western tropical Indian Ocean: Distribution, relative abundance, and comparisons with cetacean communities of two other tropical ecosystems. Marine Mammal Science 14(3):429–459. doi: 10.1111/j.1748-7692.1998.tb00736.x

Bisi, T.L., P.R. Dorneles, J. Lailson-Brito, G. Lepoint, A.d.F. Azevedo, L. Flach, O. Malm, and K. Das. 2013. Trophic relationships and habitat preferences of delphinids from the southeastern Brazilian coast determined by carbon and nitrogen stable isotope composition. PLoS ONE 8(12):e82205. doi: 10.1371/journal.pone.0082205

Botta, S., A.A. Hohn, S.A. Macko, and E.R. Secchi. 2011. Isotopic variation in delphinids from the subtropical western South Atlantic. Journal of the Marine Biological Association of the United Kingdom 92(8):1689–1698. doi: 10.1017/s0025315411000610

Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Dolar, M.L.L., W.F. Perrin, B.L. Taylor, G.L. Kooyman, and M.N.R. Alava. 2006. Abundance and distributional ecology of cetaceans in the central Philippines. Journal of Cetacean Research and Management 8(1):93–111.

Dolar, M.L.L., W.A. Walker, G.L. Kooyman, and W.F. Perrin. 2003. Comparative feeding ecology of spinner dolphins (*Stenella longirostris*) and Fraser's dolphins (*Lagenodelphis hosei*) in the Sulu Sea. Marine Mammal Science 19(1):1–19. doi: 10.1111/j.1748-7692.2003.tb01089.x

dos Santos, R.A. and M. Haimovici. 2001. Cephalopods in the diet of marine mammals stranded or incidentally caught along southeastern and southern Brazil (21–34°S). Fisheries Research 52(1-2):99–112. doi: 10.1016/s0165-7836(01)00234-x

Gomes-Pereira, J.N., R. Marques, M.J. Cruz, and A. Martins. 2013. The little-known Fraser's dolphin *Lagenodelphis hosei* in the North Atlantic: New records and a review of distribution. Marine Biodiversity 43:321–332. doi: 10.1007/s12526-013-0159-2

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Jefferson, T.A. and S. Leatherwood. 1994. *Lagenodelphis hosei*. Mammalian Species 470:1–5. doi: 10.2307/3504207

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Kiszka, J., B. Simon-Bouhet, L. Martinez, C. Pusineri, P. Richard, and V. Ridoux. 2011. Ecological niche segregation within a community of sympatric dolphins around a tropical island. Marine Ecology Progress Series 433:273–288. doi: 10.3354/meps09165

Leatherwood, S., T.A. Jefferson, J.C. Norris, W.E. Stevens, L.J. Hansen, and K.D. Mullin. 1993. Occurrence and sounds of Fraser's dolphin in the Gulf of Mexico. Texas Journal of Science 45(4):349–354.

Louella, M. and L. Dolar. 2018. Fraser's dolphin: *Lagenodelphis hosei*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 392–395. doi: 10.1016/B978-0-12-804327-1.00134-5

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A., B. Pinto-Rodríguez, M. Velasco-Escudero, R.A. Montoya-Ospina, N.M. Jiménez, M.A. Rodríguez-López, J.E.H. Williams, and D.K. Odell. 1999. Cetacean strandings in Puerto Rico

and the Virgin Islands. Journal of Cetacean Research and Management 1(2):191–198. doi: 10.47536/jcrm.v1i2.466
Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.
National Marine Fisheries Service (NMFS). 1999. Cruise results. Summer Atlantic Ocean marine mammal survey. NOAA Ship Oregon II cruise 236 (99- 05), 4 August - 30 September 1999. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 11 p.
Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280
Perrin, W.F., S. Leatherwood, and A. Collett. 1994. Fraser's dolphin-*Lagenodelphis hosei* (Fraser, 1956). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 225–240.
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for Fraser's dolphin (*Lagenodelphis hosei*) for the U.S. East Coast version 1.2, 2015-10-05, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 139 p.
Robison, B.H. and J.E. Craddock. 1983. Mesopelagic fishes eaten by Fraser dolphin, *Lagenodelphis-hosei*. Fishery Bulletin 81(2):283–289.
Siciliano, S., R.M.A. Ramos, A.P.M. Di Beneditto, M.C.O. Santos, A.B. Fragoso, J.L. Brito, A.F. Azevedo, A.F.C. Vicente, E. Zampirolli, F.S. Alvarenga, L. Barbosa, and N.R.W. Lima. 2007. Age and growth of some delphinids in south-eastern Brazil. Journal of the Marine Biological Association of the United Kingdom 87(1):293–303. doi: 10.1017/s0025315407053398
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Watkins, W.A., M.A. Daher, K. Fristrup, and G. Notarbartolo di Sciara. 1994. Fishing and acoustic behavior of Fraser's dolphin (*Lagenodelphis hosei*) near Dominica, Southeast Caribbean. Caribbean Journal of Science 30:76–82.

Gervais beaked whale − *Mesoplodon europaeus*

Western North Atlantic Stock

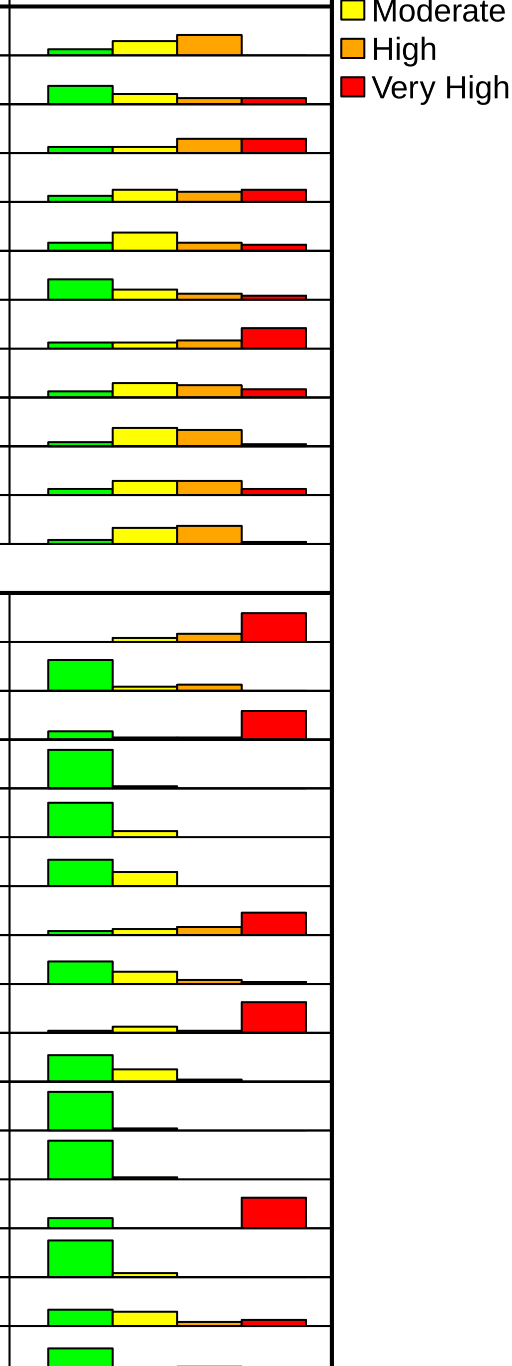
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 26% of scores ≥ 2

	Mesoplodon europaeus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	1.0	
	Habitat Specificity	2.0	1.5	
	Site Fidelity	2.9	1.0	
	Lifetime Reproductive Potential	2.7	0.2	
	Generation Length	2.3	0.8	
	Reproductive Plasticity	1.8	0.5	
	Migration	3.0	1.0	
	Home Range	2.5	1.0	
	Stock Abundance	2.4	1.0	
	Stock Abundance Trend	2.5	0.0	
	Cumulative Stressors	2.4	1.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	2.0	
	Sea Surface Temperature (Change in variability)	1.4	2.2	
	Air Temperature (Change in mean)	3.2	1.8	
	Air Temperature (Change in variability)	1.0	1.8	
	Precipitation (Change in mean)	1.1	2.0	
	Precipitation (Change in variability)	1.4	1.5	
	Sea Surface Salinity (Change in mean)	3.2	1.5	
	Sea Surface Salinity (Change in variability)	1.6	1.5	
	Ocean pH (Change in mean)	3.5	1.8	
	Ocean pH (Change in variability)	1.4	1.5	
	Sea ice coverage (Change in mean)	1.0	2.0	
	Sea ice coverage (Change in variability)	1.0	2.0	
	Dissolved oxygen (Change in mean)	3.2	2.0	
	Dissolved oxygen (Change in variability)	1.1	1.8	
	Circulation	2.0	1.5	
	Sea level rise	1.6	2.2	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Gervais beaked whale (Western North Atlantic Stock)

Mesoplodon europaeus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (52% certainty from bootstrap analysis).

Climate Exposure: High. Five exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.60), Ocean pH (Standard anomaly) (3.50), Air Temperature (Standard anomaly) (3.25), Dissolved oxygen (Standard anomaly) (3.25), and Sea Surface Salinity (Standard anomaly) (3.20).

Biological Sensitivity: Moderate. Five sensitivity attributes scored greater than or equal to 2.5:Migration (3.05), Site Fidelity (2.90), Lifetime Reproductive Potential (2.70), Home Range (2.55), and Species Abundance Trend (2.50).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 26% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Gervais' beaked whale western North Atlantic stock group includes individuals found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic (Hayes et al. 2020).

Prey/Diet Specificity

Information regarding prey comes primarily from stranded animals. Those animals were found to consume meso-pelagic squids (e.g., histioteuthids, cranchiids, chiroteuthids, octopoteuthids), fish such as viperfish (*Chauliodus* sp.), gempylids (*Nesiarchus* sp.), and mysids (Debrot and Barros 1992; Santos et al. 2007; Fernández et al. 2009).

Habitat Specificity

Gervais' beaked whales occur in warmer southern waters of the North Atlantic (MacLeod 2000).

Beaked whales are found along the continental shelf break off the northeastern U.S. and with the Gulf Stream and the associated warm-core rings off the eastern U.S. (Waring et al. 1992; Waring et al. 2001). A survey off George's Bank found beaked whales in waters with a mean SST of 20.7° to 24.9°C and a bottom depth of 500 to 2,000 m (Waring et al. 2003). World-wide, beaked whales are found in continental slope and oceanic waters deeper than 200 m (Waring et al. 2001; Cañadas et al. 2002; Pitman 2002; MacLeod et al. 2004; Ferguson et al. 2006; MacLeod and Mitchell 2006).

Site Fidelity

Information regarding Gervais' beaked whale site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Information regarding Gervais beaked whale reproductive interval in the western North Atlantic was not found in the literature. Taylor et al. (2007) estimated age at last reproduction of 42 years.

Generation Length

Information regarding Gervais' beaked whale generation length in the western North Atlantic was not found in the literature.

Reproductive Plasticity

Information regarding Gervais' beaked whale reproductive season, habitat, and/or location in the western North Atlantic was not found in the literature.

Migration

Information regarding Gervais' beaked whale migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Satellite track data and photo identification studies were not found for this stock of Gervais' beaked whales, though they are believed to be principally oceanic and, based on strandings, range from Cape Cod to Florida, into the Caribbean and the Gulf of Mexico (Leatherwood et al. 1976; Mead 1989; MacLeod et al. 2006; Jefferson et al. 2008; McLellan et al. 2018; Hayes et al. 2020).

Stock Abundance

Abundance estimates for Gervais' beaked whales off the eastern U.S. and Canadian Atlantic coast are unavailable due to difficulty differentiating beaked whales during surveys. The best abundance estimate for *Mesoplodon spp.* beaked whales is 10,107 individuals (CV=0.27), based on 2016 survey estimates (Garrison 2020; Palka 2020; Hayes et al. 2020).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2020).

Cumulative Stressors

The 2013-2017 total average estimated annual mortality of Gervais' beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero (Hayes et al. 2020).

During the period 2007–2011, 21 Gervais' beaked whales stranded along the U.S. Atlantic coast, with none of these animals showing signs of human interaction (NOAA National Marine Mammal Health and Stranding Response Database, as cited in Hayes et al. 2020).

Distribution and Sightings

Density model results for beaked whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017a), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

MacLeod, C.D. 2018. Beaked Whales, Overview. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 80–83. doi: 10.1016/B978-0-12-804327-1.00062-5

Pitman, R. 2018. *Mesoplodon* Beaked Whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Mesoplodon europaeus*. The IUCN Red List of Threatened Species 2008: e.T13245A3427527. doi: 10.2305/IUCN.UK.2008.RLTS.T13245A3427527.en

References

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

Debrot, A.O. and N.B. Barros. 1992. Notes on a Gervais' beaked whale, *Mesoplodon europaeus*, and a dwarf sperm whale, *Kogia simus*, stranded in Curacao, Netherlands Antilles. Marine Mammal Science 8(2):172–178. doi: 10.1111/j.1748-7692.1992.tb00379.x

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Fernandez, A., J.F. Edwards, F. Rodriguez, A. Espinosa de los Monteros, P. Herraez, P. Castro, J.R. Jaber, V. Martin, and M. Arbelo. 2005. "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. Veterinary Pathology 42(4):446–457. doi: 10.1354/vp.42-4-446

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic: A guide to their identification. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS CIRC-396. 176 p.

MacLeod, C., W.F. Perrin, R. Pitman, J. Barlow, L. Ballance, A. D'Amico, T. Gerrodette, G. Joyce, K.D. Mullin, D.L. Palka, and G.T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). Journal of Cetacean Research and Management 7(3):271–286.

Macleod, C.D. 2000. Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. Mammal Review 30(1):1–8. doi: 10.1046/j.1365-2907.2000.00057.x

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

McLellan, W.A., R.J. McAlarney, E.W. Cummings, A.J. Read, C.G.M. Paxton, J.T. Bell, and D.A. Pabst. 2018. Distribution and abundance of beaked whales (Family Ziphiidae) Off Cape Hatteras, North Carolina, U.S.A. Marine Mammal Science 34(4):997–1017. doi: 10.1111/mms.12500

Mead, J.G. 1989. Beaked whales of the genus *Mesoplodon*. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic press, San Diego, CA. pp. 349–430.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pitman, R.L. 2002. Mesoplodont whales *Mesoplodon* spp. In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals. Academic Press, San Diego, CA. pp. 738–742.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Santos, M.B., G.J. Pierce, J. Herman, A. López, A. Guerra, E. Mente, and M.R. Clarke. 2001. Feeding ecology of Cuvier's beaked whale (*Ziphius cavirostris*): a review with new information on the diet of this species. Journal of the Marine Biological Association of the United Kingdom 81(04):687–694. doi: 10.1017/s0025315401004386

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Gray seal − *Halichoerus grypus grypus*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 100% of scores≥ 2

Halichoerus grypus grypus		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	2.8	
	Habitat Specificity	2.8	3.0	
	Site Fidelity	2.8	3.0	
	Lifetime Reproductive Potential	1.3	3.0	
	Generation Length	1.0	3.0	
	Reproductive Plasticity	1.9	3.0	
	Migration	2.5	3.0	
	Home Range	2.0	3.0	
	Stock Abundance	1.0	3.0	
	Stock Abundance Trend	1.3	2.2	
	Cumulative Stressors	2.5	2.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	2.8	3.0	
	Sea Surface Temperature (Change in variability)	1.4	3.0	
	Air Temperature (Change in mean)	3.0	3.0	
	Air Temperature (Change in variability)	1.6	3.0	
	Precipitation (Change in mean)	1.1	2.8	
	Precipitation (Change in variability)	1.6	2.8	
	Sea Surface Salinity (Change in mean)	1.4	2.8	
	Sea Surface Salinity (Change in variability)	1.6	2.8	
	Ocean pH (Change in mean)	2.0	2.0	
	Ocean pH (Change in variability)	1.5	2.0	
	Sea ice coverage (Change in mean)	1.5	2.8	
	Sea ice coverage (Change in variability)	1.8	2.8	
	Dissolved oxygen (Change in mean)	3.2	2.5	
	Dissolved oxygen (Change in variability)	1.2	2.2	
	Circulation	2.2	2.5	
	Sea level rise	3.0	2.5	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Gray seal (Western North Atlantic Stock)

Halichoerus grypus grypus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (88% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than 3.0: Dissolved oxygen (Standard anomaly) (3.25), Air Temperature (Standard anomaly) (3.05), and Sea level rise (3.05).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than 2.5: Site Fidelity (2.85), Habitat Specificity (2.75), Cumulative Stressors (2.55), and Migration (2.55).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 100 % of the data quality scores were 2 or greater, 100 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The gray seal western North Atlantic stock includes individuals found in waters off the U.S. and Canadian coasts in the western North Atlantic (Bonner 1981; Boskovic et al. 1996; Lesage and Hammill 2001; Klimova et al. 2014; Hayes et al. 2022).

Prey/Diet Specificity

Gray seals are known to target prey in the orders Pleuronectiformes, Gadiformes, Trachiniformes, and Rajiformes. In the western North Atlantic, a large proportion of their diet is sand eels or sand lance (Ammodytidae), which can make up over 70% of the diet (Flanders et al. 2020). Other prey include herring (*Clupea harengus*), whiting (*Merlangius merlangus*), cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), saithe (*Pollachius virens*), and flatfish (plaice and flounder; Bonner 1981; D. Thompson et al. 1991; P.M. Thompson et al. 1991; Lesage and Hammill 2001; Hall and Russell 2018). Gray seals at Muskeget Island, Massachusetts consumed windowpane flounder (*Scophthalmus aquosus*), silver hake (*Merluccius bilinearis*), sand lance (*Ammodytes* sp.), skates (Rajidae), and gadids (Rough 1995). Elsewhere in the North Atlantic, gray seals feed on a variety of fish species and cephalopods (Hammond et al. 1994).

Foraging strategies vary with sex and season, and animals generally fast during the pupping and molting periods (Breed et al. 2006, 2009, 2011; Russell et al. 2015). At Anticosti Island, (Quebec, Canada), gray seals in August and September feed primarily on cod, herring and mackerel (*Scomber scombrus*; Bowen et al. 1993). On the Scotian Shelf, gray seals feed essentially on sand lance during January to March (Bowen et al. 1993; Bowen and Harrison 1994).

Habitat Specificity

Gray seals are generally coastal and are often found within continental shelf waters while foraging (Lesage and Hammill 2001). Gray seals require terrestrial habitat (e.g. rock shore, beaches) or ice to haul out (Hall and Russell 2018). Haul out site suitability may be affected by ocean conditions, weather conditions, topography, bathymetry, and human presence (Reeves et al. 1992; Katona et al. 1993; Barlas 1999; Sjöberg and Ball 2000; Wood et al. 2020). Gray seals haul out for pupping and breeding from December to February at various sites throughout Maine and Massachusetts, Nova Scotia, Sable Island, and Gulf of St Lawrence (den Heyer et al. 2020) and in April and May to molt (Rough 1995).

Site Fidelity

Gray seals show a high degree of site fidelity and generally return to their natal site to breed (D. Thompson et al. 1991; McConnell et al. 1992; Sjöberg and Ball 2000). Return visits may come within meters of previous pupping sites (Pomeroy et al. 1994). However, gray seals also recruit into non-natal colonies (Wood et al. 2011; Wood et al. 2020) and some populations use alternative haul-out sites (Goulet et al. 2001).

Lifetime Reproductive Potential

Female gray seals typically reproduce every year, meaning the reproductive interval is around 1 year. (Hammill et al. 2014.)

Female gray seals reach sexual maturity around 4 or 5 years, with a mean age of first birth of 5.6 years (Hammill and Gosselin 1995; Hammill et al. 2014). Females can live to around 40 years (Mellish et al. 1999), allowing a reproductive lifespan of greater than 30 years.

Generation Length

Gray seal generation length is estimated at 14 years (Magera et al. 2013).

Reproductive Plasticity

In the western North Atlantic population, gray seals primarily pup from early December to late January at nine established colonies in U.S. waters and at colonies in eastern Canada (Sable Island, Gulf of St. Lawrence, coast of Nova Scotia; Wood et al. 2020; den Heyer et al. 2020). These colonies are found on remote beaches and uninhabited islands.

Females give birth to a single pup on land or on shifting pack ice (Lesage and Hammill 2001). Gray seals breed from January to February generally after the pups are born (Barlas 1999). Breeding adult gray seals of both sexes fast during pupping.

Migration

After breeding, gray seals disperse widely and remain offshore until they molt in the spring (Rough 1995; Lesage and Hammill 2001). After they molt, there is a second dispersal.

Home Range

Gray seals in the Baltic Sea were found to spend 75% of their time within 50km of the haulout site (Sjöberg and Ball 2000). In the United Kingdom, gray seals generally remain within 40 km of a haulout site during foraging trips (McConnell et al. 1999).

Stock Abundance

The gray seal population in U.S. waters during the pupping season in 2021 was estimated to be 27,911 (Wood et al. 2022) while the total Canadian gray seal population in 2021 was estimated to be 366,400 (95% CI=317,800 to 409,400; DFO 2022).

Stock Abundance Trend

In the U.S., the mean rate of increase in the number of pups born differs across the pupping colonies over various time periods. The estimated mean rate of increase in the minimum number of pups born was 20.9% on Muskeget Island from 1988-2021, 19.0% on Monomoy Island from 2009-2021, 11.5% on Seal Island from 2000-2021, and 44.1% on Nomans Island from 2011-2021 (Wood et al. 2022).

Based on the most recent assessment of herds in Canada, the population increased at a rate of 1.5% per year between 2016 and 2021 (DFO 2022). .

Cumulative Stressors

Threats to gray seals in the western North Atlantic include fisheries interactions, vessel strikes, direct take, pollution, storms, disease, and predation (Katona et al. 1993; Bowen et al. 2003; Bowen 2016; Hayes et al. 2022).

Gray seals in the western North Atlantic interact with gillnet, seine, and trawl fisheries (Precoda and Orphanides 2022; Lyssikatos and Chavez-Rosales 2022; Josephson et al. 2019; Hayes et al. 2022). During the time period 2014–2018, annual average human-caused mortality or serious injury was 4,729 individuals, based on catch data from Canada and Greenland (which includes subsistence catch, and licensed removals of nuisance animals), reports from U.S. fisheries observers, and strandings (Hayes et al. 2021).

Distribution and Sightings

Density model results for a combined guild phocid seals (primarily gray seals and harbor seals [*Phoca vitulina*]) in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018).

Further Reading

Bowen, D. 2016. *Halichoerus grypus*. The IUCN Red List of Threatened Species 2016: e.T9660A45226042. doi: 10.2305/IUCN.UK.2016-1.RLTS.T9660A45226042.en

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hall, A.J. and D.J.F. Russell. 2018. Gray Seal: *Halichoerus grypus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 420–422. doi: 10.1016/B978-0-12-804327-1.00139-4

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

References

Barlas, M.E. 1999. The distribution and abundance of harbor seals (*Phoca vitulina concolor*) and gray seals (*Halichoerus grypus*) in southern New England, Winter 1998-Summer 1999. Boston University. Thesis. 52 p.

Bonner, W.N. 1981. Grey seal *Halichoerus grypus* Fabricius, 1791. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 2: Seals. Academic Press. pp. 111–144.

Boskovic, R., K.M. Kovacs, M.O. Hammill, and B.N. White. 1996. Geographic distribution of mitochondrial DNA haplotypes in grey seals (*Halichoerus grypus*). Canadian Journal of Zoology 74(10):1787–1796. doi: 10.1139/z96-199

Bowen, D. 2016. *Halichoerus grypus.* The IUCN Red List of Threatened Species 2016: e.T9660A45226042. doi: 10.2305/IUCN.UK.2016-1.RLTS.T9660A45226042.en

Bowen, W.D. and G.D. Harrison. 1994. Offshore diet of grey seals *Halichoerus grypus* near Sable Island, Canada. Marine Ecology Progress Series 112(1-2):1–11. doi: 10.3354/meps112001

Bowen, W.D., J.W. Lawson, and B. Beck. 1993. Seasonal and geographic variation in the species composition and size of prey consumed by grey seals (*Halichoerus grypus*) on the Scotian Shelf. Canadian Journal of Fisheries and Aquatic Sciences 50:1768–1778. doi: 10.1139/f93-198

Bowen, W.D., J. McMillan, and R. Mohn. 2003. Sustained exponential population growth of grey seals at Sable Island, Nova Scotia. ICES Journal of Marine Science 60(6):1265–1274. doi: 10.1016/s1054-3139(03)00147-4

Breed, G.A., W.D. Bowen, and M.L. Leonard. 2011. Development of foraging strategies with age in a long-lived marine predator. Marine Ecology Progress Series 431:267–279. doi: 10.3354/meps09134

Breed, G.A., W.D. Bowen, J.I. McMillan, and M.L. Leonard. 2006. Sexual segregation of seasonal foraging habitats in a non-migratory marine mammal. Proceedings of the Royal Society B: Biological Sciences 273(1599):2319–2326. doi: 10.1098/rspb.2006.3581

Breed, G.A., I.D. Jonsen, R.A. Myers, W.D. Bowen, and M.L. Leonard. 2009. Sex-specific, seasonal foraging tactics of adult grey seals (*Halichoerus grypus*) revealed by state–space analysis. Ecology 90(11):3209–3221. doi: 10.1890/07-1483.1

den Heyer, C.E., W.D. Bowen, J. Dale, J.F. Gosselin, M.O. Hammill, D.W. Johnston, S.L.C. Lang, K.T. Murray, G.B. Stenson, and S.A. Wood. 2020. Contrasting trends in gray seal (*Halichoerus grypus*) pup production throughout the increasing northwest Atlantic metapopulation. Marine Mammal Science 37(2):611–630. doi: 10.1111/mms.12773

Department of Fisheries and Oceans (DFO). 2022. Stock assessment of northwest Atlantic grey seals (*Halichoerus grypus*) in Canada in 2021. Fisheries and Oceans Canada: Ottawa, Ontario, Canada. Canadian Science Advisory Secretariat Science Advisory Report 2022/018. 13 p.

Flanders, K.R., Z.H. Olson, and K.A. Ono. 2020. Utilizing next-generation sequencing to identify prey DNA in western North Atlantic grey seal *Halichoerus grypus* diet. Marine Ecology Progress Series 655:227–240. doi: 10.3354/meps13520

Goulet, A.-M., M. Hammill, and C. Barrette. 2001. Movements and diving of grey seal females (*Halichoerus grypus*) in the Gulf of St. Lawrence, Canada. Polar Biology 24(6):432–439. doi: 10.1007/s003000100237

Hall, A.J. and D.J.F. Russell. 2018. Gray Seal: *Halichoerus grypus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 420–422. doi: 10.1016/B978-0-12-804327-1.00139-4

Hammill, M.O. and J.F. Gosselin. 1995. Grey seal (*Halichoerus grypus*) from the Northwest Atlantic: female reproductive rates, age at first birth, and age of maturity in males. Canadian Journal of Fisheries and Aquatic Sciences 52(12):2757–2761. doi: 10.1139/f95-864

Hammill, M.O., G.B. Stenson, D.P. Swain, and H.P. Benoît. 2014. Feeding by grey seals on endangered stocks of Atlantic cod and white hake. ICES Journal of Marine Science 71(6):1332–1341. doi: 10.1093/icesjms/fsu123

Hammond, P.S., A.J. Hall, and J.H. Prime. 1994. The diet of grey seals in the Inner and Outer Hebrides. Journal of Applied Ecology 31(4):737–746. doi: 10.2307/2404164

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Josephson, E., F.W. Wenzel, and M.C. Lyssikatos. 2019. Serious injury determinations for small cetaceans and pinnipeds caught in commercial fisheries off the northeast US Coast, 2013-2017.29. doi: 10.25923/a1b7-6673

Katona, S.K., V. Rough, and D.T. Richardson. 1993. A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland. Smithsonian Institution Press, Washington, DC. p.

Klimova, A., C.D. Phillips, K. Fietz, M.T. Olsen, J. Harwood, W. Amos, and J.I. Hoffman. 2014. Global population structure and demographic history of the grey seal. Molecular Ecology 23(16):3999–4017. doi: 10.1111/mec.12850

Lesage, V. and M.O. Hammill. 2001. The status of the grey seal, *Halichoerus grypus*, in the Northwest Atlantic. Canadian Field-Naturalist 115(4):653–662.

Magera, A.M., J.E. Mills Flemming, K. Kaschner, L.B. Christensen, and H.K. Lotze. 2013. Recovery trends in marine mammal populations. PLoS ONE 8(10):e77908. doi: 10.1371/journal.pone.0077908

McConnell, B.J., C. Chambers, K.S. Nicholas, and M.A. Fedak. 1992. Satellite tracking of grey seals (*Halichoerus grypus*). Journal of Zoology 226(2):271–282. doi: 10.1111/j.1469-7998.1992.tb03839.x

McConnell, B.J., M.A. Fedak, P. Lovell, and P.S. Hammond. 1999. Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology 36(4):573–590. doi: 10.1046/j.1365-2664.1999.00429.x

Mellish, J.Ann E., Sara J. Iverson, and W.D. Bowen. 1999. Variation in milk production and lactation performance in grey seals and consequences for pup growth and weaning characteristics. Physiological and Biochemical Zoology 72(6):677–690. doi: 10.1086/316708

Pomeroy, P.P., S.S. Anderson, S.D. Twiss, and B.J. McConnell. 1994. Dispersion and site fidelity of breeding female grey seals (*Halichoerus grypus*) on North Rona, Scotland. Journal of Zoology 233(3):429–447. doi: 10.1111/j.1469-7998.1994.tb05275.x

Precoda, K. and C.D. Orphanides. 2022. Estimates of cetacean and pinniped bycatch in the 2019 New England sink and Mid-Atlantic gillnet fisheries, in: Northeast Fisheries Science, C. (Ed.). doi: 10.25923/vv44-jc03

Reeves, R.R., B.S. Stewart, and S. Leatherwood. 1992. The Sierra Club handbook of seals and sirenians. Sierra Club Books, San Francisco, CA. p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Rough, V. 1995. Gray seals in Nantucket Sound, Massachusetts, winter and spring, 1994. Final report to Marine Mammal Commission. Contract T10155615. NTIS Pub. PB95-191391. 28 p.

Russell, D.J.F., B.T. McClintock, J. Matthiopoulos, P.M. Thompson, D. Thompson, P.S. Hammond, E.L. Jones, M.L. MacKenzie, S. Moss, and B.J. McConnell. 2015. Intrinsic and extrinsic drivers of activity budgets in sympatric grey and harbour seals. Oikos 124(11):1462–1472. doi: 10.1111/oik.01810

Sjöberg, M. and J.P. Ball. 2000. Grey seal, *Halichoerus grypus*, habitat selection around haulout sites in the Baltic Sea: bathymetry or central-place foraging? Canadian Journal of Zoology 78(9):1661–1667. doi: 10.1139/z00-108

Thompson, D., P.S. Hammond, K.S. Nicholas, and M.A. Fedak. 1991. Movements, diving and foraging behaviour of grey seals (*Halichoerus grypus*). Journal of Zoology 224(2):223–232. doi: 10.1111/j.1469-7998.1991.tb04801.x

Thompson, P.M., G.J. Pierce, J.R.G. Hislop, D. Miller, and J. Diack. 1991. Winter foraging by common seals (*Phoca vitulina*) in relation to food availability in the Inner Moray Firth, N.E. Scotland. Journal of Animal Ecology 60(1):283–294. doi: 10.2307/5460

Wood, S.A., T.R. Frasier, B.A. McLeod, J.R. Gilbert, B.N. White, W.D. Bowen, M.O. Hammill, G.T. Waring, and S. Brault. 2011. The genetics of recolonization: an analysis of the stock structure of grey seals (*Halichoerus grypus*) in the northwest Atlantic. Canadian Journal of Zoology 89(6):490–497. doi: 10.1139/z11-012

Wood, S.A., E. Josephson, K. Precoda, and K.T. Murray. 2022. Gray seal (*Halichoerus grypus*) pupping trends and 2021 population estimates in U.S. waters. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 22-14. 16 p. doi: 10.25923/9hjq-gb82

Wood, S.A., K.T. Murray, E. Josephson, and J. Gilbert. 2020. Rates of increase in gray seal (*Halichoerus grypus atlantica*) pupping at recolonized sites in the United States, 1988–2019. Journal of Mammalogy 101(1):121–128. doi: 10.1093/jmammal/gyz184

Harbor porpoise − *Phocoena phocoena phocoena*

Gulf of Maine/Bay of Fundy Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = Moderate

Data Quality = 93% of scores ≥ 2

	Phocoena phocoena phocoena	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.6	
	Habitat Specificity	2.2	2.8	
	Site Fidelity	2.3	2.4	
	Lifetime Reproductive Potential	1.5	3.0	
	Generation Length	1.4	2.4	
	Reproductive Plasticity	1.6	2.4	
	Migration	2.1	2.8	
	Home Range	1.8	2.6	
	Stock Abundance	1.4	3.0	
	Stock Abundance Trend	1.8	1.0	
	Cumulative Stressors	2.2	2.2	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.1	2.8	
	Sea Surface Temperature (Change in variability)	1.9	2.2	
	Air Temperature (Change in mean)	2.6	2.0	
	Air Temperature (Change in variability)	1.4	2.0	
	Precipitation (Change in mean)	1.3	2.4	
	Precipitation (Change in variability)	1.5	2.4	
	Sea Surface Salinity (Change in mean)	1.6	2.4	
	Sea Surface Salinity (Change in variability)	2.0	2.4	
	Ocean pH (Change in mean)	2.7	2.0	
	Ocean pH (Change in variability)	1.6	2.0	
	Sea ice coverage (Change in mean)	1.2	2.6	
	Sea ice coverage (Change in variability)	1.1	2.6	
	Dissolved oxygen (Change in mean)	3.0	2.0	
	Dissolved oxygen (Change in variability)	1.9	1.8	
	Circulation	2.2	2.4	
	Sea level rise	1.8	2.8	
	Exposure Score	Moderate		
Overall Vulnerability Rank		Low		

Low
Moderate
High
Very High

Harbor porpoise (Gulf of Maine/Bay of Fundy Stock)

Phocoena phocoena phocoena

CVA Results Summary

Overall Climate Vulnerability Rank: Low (96% certainty from bootstrap analysis).

Climate Exposure: Moderate. Four exposure factors scored greater than 2.5: Sea Surface Temperature (Standard anomaly) (3.12), Dissolved oxygen (Standard anomaly) (2.96), Ocean pH (Standard anomaly) (2.68), and Air Temperature (Standard anomaly) (2.56).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5.

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater. 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The harbor porpoise Gulf of Maine/Bay of Fundy stock includes individuals that are found in the Gulf of Maine and Bay of Fundy (Gaskin 1984, 1992; Hayes et al. 2022). This stock is considered separately from the harbor porpoise stocks in the Gulf of St. Lawrence, Newfoundland, and Greenland.

Prey/Diet Specificity

In the Gulf of Maine and Bay of Fundy, harbor porpoise diet consists of small clupeoid and gadid fish such as Atlantic herring (*Clupea harengus*) and silver hake (*Merluccius bilinearis*; Recchia and Read 1989; Gaskin 1992; Gannon et al. 1998; Read 1999), while south of New England harbor porpoise diet diversifies and includes a longfin squid (*Doryteuthis (Amerigo) pealeii*) as a primary prey item Orphanides et al. 2020). Diet varies by age, sex, and season (Smith and Read 1992; Read and Hohn 1995; Gannon et al. 1998; Orphanides et al. 2020).

Habitat Specificity

Harbor porpoises in the Gulf of Maine and Bay of Fundy are typically found in continental shelf waters but have been recorded in offshore waters (Palka 1995; Read et al. 1996; Read 1999; Westgate et al. 1998; Jefferson et al. 2008). They are generally found in cooler waters and often associated with oceanographic features such as fronts (Watts and Gaskin 1985; Gaskin 1992; Skov et al. 2003)

Site Fidelity

Information regarding harbor porpoise site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 1.00 year, which is supported by findings from Read and Hohn (1995).

Taylor et al. (2007) reported harbor porpoise age at first reproduction of 5 years and age at last reproduction of 24 years (observed) to 27 years (estimated). In the Gulf of Maine, female harbor porpoises reach sexual maturity at three years of age and few individuals live beyond 10 years of age, with the oldest known individuals living to 17 years (Read 1990a; Read and Gaskin 1990; Read and Hohn 1995).

Generation Length

Taylor et al. (2007) estimated harbor porpoise generation length at 8.3 years (r=0.11) and 11.9 year (r=0).

Reproductive Plasticity

Harbor porpoises in the Gulf of Maine and Bay of Fundy calf and mate in late spring and early summer, with a peak in calving in May (Fisher and Harrison 1970; Gaskin and Blair 1977; Gaskin et al. 1984; Read 1990b; Read and Hohn 1995). Specific mating location and habitat are not reported in the literature.

Migration

Bycatch records and sighting data suggest an onshore-offshore migration with the stock moving to a more offshore distribution during the winter and spring and a more nearshore distribution during summer and fall (CETAP 1982; Kraus et al. 1983; Palka 1995; IWC 1996; Read et al. 1996; Read 1999; Palka 2000; Westgate et al. 1998). Members of the Gulf of Maine and Bay of Fundy stock may also move south to mid-Atlantic waters during the winter where they mix with individuals from other stocks (Westgate et al. 1998; Rosel et al. 1999; Wingfield et al. 2017).

Home Range

A harbor porpoise that was rehabilitated, satellite tagged, and released off the coast of Maine followed the continental slope south to near Cape Hatteras over the course of 63 days (Schofield et al. 2008). Movements of satellite tagged harbor porpoises in the Bay of Fundy and Gulf of Maine showed a high degree of variation that included restricted movement over the course of days or weeks and longer distance excursions to points elsewhere within the Bay of Fundy and Gulf of Maine (Read and Westgate 1997).

Stock Abundance

The abundance of the Gulf of Maine and Bay of Fundy harbor porpoise stock is estimated to be 95,543 individuals (CV=0.3), based on 2016 survey data from central Virginia to the Gulf of St. Lawrence, Bay of Fundy, and Scotian Shelf (Palka 2020; Hayes et al. 2022).

Stock Abundance Trend

Insufficient data exist to calculate a stock abundance trend (Hayes et al. 2022).

Cumulative Stressors

Harbor porpoises in the Gulf of Maine and Bay of Fundy stock interact with gillnet and trawl fisheries. During the time period 2014–2018, annual average human-caused mortality or serious injury was 150 individuals (CV=0.14), based on bycatch data from U.S. fisheries observers in the Northeast and Mid-Atlantic (Lyssikatos et al. 2021; Orphanides 2021; Hayes et al. 2021). During the same period, 229 harbor porpoises were reported stranded along the U.S. Atlantic coast and 86 along the Canadian coast of Nova Scotia, Prince Edward Island, Newfoundland, and New Brunswick (Ledwell and Huntington 2014, 2015, 2017, 2018, as cited by Hayes et al. 2021).

Other stressors include pollution (Hall et al. 2006), vessel traffic (Oakley et al. 2017; Terhune 2015), anthropogenic noise (Lucke et al. 2009), and offshore wind development (Carstensen et al. 2006; Brandt et al. 2011; Teilmann and Carstensen 2012; Dähne et al. 2013; Benjamins et al. 2017; Hayes et al. 2022).

Distribution and Sightings

Density model results for harbor porpoises in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017), Mannocci et al. (2017), Chavez-Rosales et al. (2019), Palka et al. (2021a, 2021b).

Further Reading

Bjørge, A. and K.A. Tolley. 2018. Harbor Porpoise: *Phocoena phocoena*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 448-451. doi: 10.1016/B978-0-12-804327-1.00144-8

Braulik, G., G. Minton, M. Amano, and A. Bjørge. 2020. *Phocoena phocoena*. The IUCN Red List of Threatened Species 2020: e.T17027A50369903. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T17027A50369903.en.

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

References

Benjamins, S., N. van Geel, G. Hastie, J. Elliott, and B. Wilson. 2017. Harbour porpoise distribution can vary at small spatiotemporal scales in energetic habitats. Deep Sea Research Part II: Topical Studies in Oceanography 141:191–202. doi: 10.1016/j.dsr2.2016.07.002

Brandt, M.J., A. Diederichs, K. Betke, and G. Nehls. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Marine Ecology Progress Series 421:205–216. doi: 10.3354/meps08888

Carstensen, J., O.D. Henriksen, and J. Teilmann. 2006. Impacts of offshore wind farm construction on harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs). Marine Ecology Progress Series 321:295–308. doi: 10.3354/meps321295

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Dähne, M., A. Gilles, K. Lucke, V. Peschko, S. Adler, K. Krügel, J. Sundermeyer, and U. Siebert. 2013. Effects of pile-driving on harbour porpoises (*Phocoena phocoena*) at the first offshore wind farm in Germany. Environmental Research Letters 8(2):025002. doi: 10.1088/1748-9326/8/2/025002

Fisher, H.D. and R.J. Harrison. 2009. Reproduction in the common porpoise (*Phocoena phocoena*) of the North Atlantic. Journal of Zoology 161(2):471–486. doi: 10.1111/j.1469-7998.1970.tb02050.x

Gannon, D.P., J.E. Craddock, and A.J. Read. 1998. Autumn food habits of harbor porpoises, *Phocoena phocoena*, in the Gulf of Maine. Fishery Bulletin 96(3):428–437.

Gaskin, D.E. 1984. The harbor porpoise *Phocoena phocoena* (L.): Regional populations, status, and information on direct and indirect catches. Reports of the International Whaling Commission 34:569–586.

Gaskin, D.E. 1992. Status of the harbor porpoise, *Phocoena phocoena*, in Canada. Canadian Field-Naturalist 106(1):36–54.

Gaskin, D.E. and B.A. Blair. 1977. Age determination of harbour porpoise, *Phocoena phocoena* (L.), in the western North Atlantic. Canadian Journal of Zoology 55(1):18–30. doi: 10.1139/z77-002

Gaskin, D.E., G.J.D. Smith, A.P. Watson, Y. Yasui, and D.B. Yurick. 1984. Reproduction in the porpoises (Phocoenidae): implications for management. Reports of the International Whaling Commission (Special Issue) 6:135–148.

Hall, A.J., K. Hugunin, R. Deaville, R.J. Law, C.R. Allchin, and P.D. Jepson. 2006. The risk of infection from polychlorinated biphenyl exposure in the harbor porpoise (*Phocoena phocoena*): A case–control approach. Environmental Health Perspectives 114(5):704–711. doi: 10.1289/ehp.8222

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

International Whaling Commission (IWC). 1996. Annex H. Report of the Sub-Committee on Small Cetaceans. Reports of the International Whaling Commission 46:160–179.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.
Kraus, S.D., J.H. Prescott, and G.S. Stone. 1983. Harbor porpoise, *Phocoena phocoena*, in the U.S. coastal waters off the Gulf of Maine: A survey to determine seasonal distribution and abundance. NMFS. NA82FAC00027 22 p.
Ledwell, W. and J. Huntington. 2014. Incidental entrapments and entanglements of cetaceans and leatherback sea turtles, strandings, ice entrapments reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2014. Report to the Department of Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 23 p.
Ledwell, W. and J. Huntington. 2015. Incidental entrapments and entanglements of cetaceans and leatherback sea turtles, strandings, ice entrapments reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2015. Report to the Department of Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 22 p.
Ledwell, W. and J. Huntington. 2017. Incidental entrapments and entanglements of cetaceans and leatherback sea turtles and strandings and harassments reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2016. Report to the Department of Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 23 p.
Ledwell, W. and J. Huntington. 2018. Incidental entrapments and entanglements of cetaceans and leatherback sea turtles, strandings, ice entrapments reported to the Whale Release and Strandings Group in Newfoundland and Labrador and a summary of the Whale Release and Strandings program during 2017. Report to the Department of Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 24 p.
Lucke, K., U. Siebert, P.A. Lepper, and M.-A. Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. Journal of the Acoustical Society of America 125(6):4060–4070. doi: 10.1121/1.3117443
Lyssikatos, M.C., S. Chavez-Rosales, and J. Hatch. 2021. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2014-2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 21-02. 12 p.
Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856
Oakley, J.A., A.T. Williams, and T. Thomas. 2017. Reactions of harbour porpoise (*Phocoena phocoena*) to vessel traffic in the coastal waters of South West Wales, UK. Ocean & Coastal Management 138:158–169. doi: 10.1016/j.ocecoaman.2017.01.003
Orphanides, C. 2021. Estimates of cetacean and pinniped bycatch in the 2018 New England sink and Mid-Atlantic gillnet fisheries, in: Northeast Fisheries Science, C. (Ed.). doi: 10.25923/aqrw-mp47
Orphanides, C.D., F.W. Wenzel, and J.S. Collie. 2020. Diet of harbor porpoises (*Phocoena phocoena*) on the continental shelf off southern New England. Fishery Bulletin 118(2):184–197. doi: 10.7755/fb.118.2.7
Palka, D. 1995. Influences on spatial patterns of Gulf of Maine harbor porpoises. In: Blix, A.S., L. Walløe, and Ø. Ulltang (Eds.), Whales, seals, fish and man. Elsevier Science B.V., New York, NY. pp. 69–75.
Palka, D. 2000. Abundance of the Gulf of Maine/Bay of Fundy harbor porpoise based on shipboard and aerial surveys during 1999. National Oceanic and Atmospheric Administration, National Marine

Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 00-07. 29 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Read, A.J. 1990a. Age at sexual maturity and pregnancy rates of harbor porpoises *Phocoena-phocoena* from the Bay of Fundy. Canadian Journal of Fisheries and Aquatic Sciences 47(3):561–565. doi: 10.1139/f90-064

Read, A.J. 1990b. Reproductive seasonality in harbor porpoises, *Phocoena-phocoena*, from the Bay of Fundy. Canadian Journal of Zoology 68(2):284–288. doi: 10.1139/z90-042

Read, A.J. 1999. Harbour porpoise *Phocoena phocoena* (Linnaeus, 1758). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 323–355.

Read, A.J. and D.E. Gaskin. 1990. Changes in growth and reproduction of harbour porpoises, *Phocoena phocoena*, from the Bay of Fundy. Canadian Journal of Fisheries and Aquatic Sciences 47(11):2158–2163. doi: 10.1139/f90-240

Read, A.J. and A.A. Hohn. 1995. Life in the fast lane - the life-history of harbor porpoises from the Gulf of Maine. Marine Mammal Science 11(4):423–440. doi: 10.1111/j.1748-7692.1995.tb00667.x

Read, A.J., J.R. Nicolas, and J.E. Craddock. 1996. Winter capture of a harbor porpoise in a pelagic drift net off North Carolina. Fishery Bulletin 94(2):381–383.

Read, A.J. and A.J. Westgate. 1997. Monitoring the movements of harbour porpoises (*Phocoena phocoena*) with satellite telemetry. Marine Biology 130(2):315–322. doi: 10.1007/s002270050251

Recchia, C.A. and A.J. Read. 1989. Stomach contents of harbor porpoises, *Phocoena-phocoena* (L), from the Bay of Fundy. Canadian Journal of Zoology 67(9):2140–2146. doi: 10.1139/z89-304

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Rosel, P.E., J.Y. Wang, and J.J. Pella. 1999. Seasonal changes in northwest Atlantic harbor porpoise populations: Summer isolation and winter mixing. Abstracts, Thirteenth Biennial Conference on the Biology of Marine Mammals. 28 November-3 December 1999. Wailea, Hawaii. pp. 162–163.

Schofield, D.T., G. Early, F.W. Wenzel, K. Matassa, C. Perry, G. Beekman, B. Whitaker, E. Gebhard, W. Walton, and M. Swingle. 2008. Rehabilitation and homing behavior of a satellite-tracked harbor porpoise (*Phocoena phocoena*). Aquatic Mammals 34(1):1–8. doi: 10.1578/am.34.1.2008.1

Skov, H., J. Durinck, and D. Bloch. 2003. Habitat characteristics of the shelf distribution of the harbour porpoise (*Phocoena phocoena*) in the waters around the Faroe Islands during summer. NAMMCO Scientific Publications 5:31–40.

Smith, R.J. and A.J. Read. 1992. Consumption of euphausiids by harbor porpoise (*Phocoena-phocoena*) calves in the Bay of Fundy. Canadian Journal of Zoology 70(8):1629–1632. doi: 10.1139/z92-225

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Teilmann, J. and J. Carstensen. 2012. Negative long term effects on harbour porpoises from a large scale offshore wind farm in the Baltic—evidence of slow recovery. Environmental Research Letters 7(4). doi: 10.1088/1748-9326/7/4/045101

Terhune, J., M. 2015. Harbour porpoise presence near oil tankers. Canadian Acoustics 43(3):1–2.

Watts, P. and D.E. Gaskin. 1985. Habitat index analysis of the harbor porpoise (*Phocoena-phocoena*) in the southern coastal Bay of Fundy, Canada. Journal of Mammalogy 66(4):733–744. doi: 10.2307/1380800

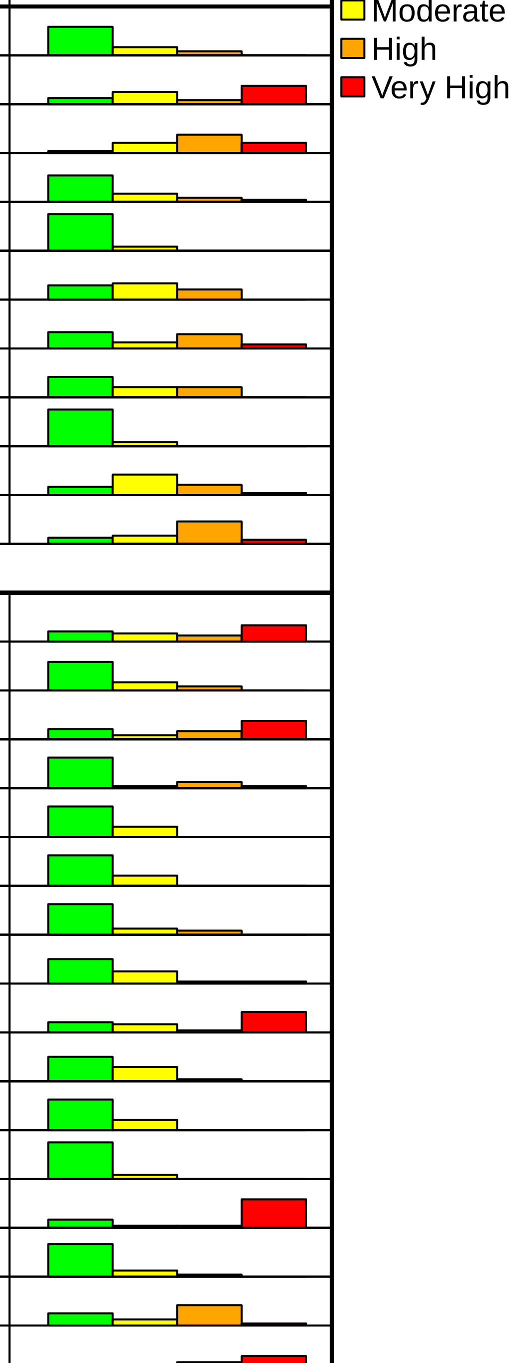
Westgate, A.J. and A.J. Read. 1998. Applications of new technology to the conservation of porpoises. Marine Technology Society Journal 32(1):70–81.

Wingfield, J.E., M. O'Brien, V. Lyubchich, J.J. Roberts, P.N. Halpin, A.N. Rice, and H. Bailey. 2017. Year-round spatiotemporal distribution of harbour porpoises within and around the Maryland wind energy area. PLoS ONE 12(5):e0176653. doi: 10.1371/journal.pone.0176653

Harbor seal – *Phoca vitulina*
Western North Atlantic Stock

Overall Vulnerability Rank = Moderate
Biological Sensitivity = Moderate
Climate Exposure = Moderate
Data Quality = 96% of scores ≥ 2

	Phoca vitulina	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.4	2.8	
	Habitat Specificity	2.8	3.0	
	Site Fidelity	2.9	2.8	
	Lifetime Reproductive Potential	1.6	3.0	
	Generation Length	1.1	3.0	
	Reproductive Plasticity	1.9	3.0	
	Migration	2.1	3.0	
	Home Range	1.8	3.0	
	Stock Abundance	1.1	3.0	
	Stock Abundance Trend	2.1	1.0	
	Cumulative Stressors	2.6	2.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	2.7	3.0	
	Sea Surface Temperature (Change in variability)	1.4	3.0	
	Air Temperature (Change in mean)	2.8	3.0	
	Air Temperature (Change in variability)	1.5	2.8	
	Precipitation (Change in mean)	1.2	2.2	
	Precipitation (Change in variability)	1.2	2.2	
	Sea Surface Salinity (Change in mean)	1.4	2.5	
	Sea Surface Salinity (Change in variability)	1.6	2.8	
	Ocean pH (Change in mean)	2.8	2.0	
	Ocean pH (Change in variability)	1.4	2.0	
	Sea ice coverage (Change in mean)	1.2	2.8	
	Sea ice coverage (Change in variability)	1.1	2.5	
	Dissolved oxygen (Change in mean)	3.2	2.2	
	Dissolved oxygen (Change in variability)	1.2	2.2	
	Circulation	2.3	2.2	
	Sea level rise	3.0	2.5	
	Exposure Score	Moderate		
Overall Vulnerability Rank		Moderate		



Harbor seal (Western North Atlantic Stock)

Phoca vitulina

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (89% certainty from bootstrap analysis).

Climate Exposure: Moderate. Five exposure factors scored greater than 2.5: Dissolved oxygen (Standard anomaly) (3.25), Sea level rise (2.95), Air Temperature (Standard anomaly) (2.85), Ocean pH (Standard anomaly) (2.80), and Sea Surface Temperature (Standard anomaly) (2.70).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Site Fidelity (2.90), Habitat Specificity (2.85), and Cumulative Stressors (2.60).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 96% of the data quality scores were 2 or greater. 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The harbor seal western North Atlantic stock includes individuals that are found in waters off the U.S. and Canadian coasts in the western North Atlantic (Temte et al. 1991; Andersen and Olsen 2010; Hayes et al. 2022).

Prey/Diet Specificity

Harbor seals consume a wide variety of prey and adapt feeding patterns based on prey availability (Payne and Selzer 1989; Baird 2001; Bjørge 2002). In the western North Atlantic, harbor seal diet consists of fish, cephalopods, and crustaceans (Bigg 1981; Payne and Selzer 1989; Kenney and Vigness-Raposa 2010; Waring et al. 2010). Fish species in the harbor seal diet include sand lance (*Ammodytes* spp.), Atlantic herring (*Clupea harengus*), cod (*Gadus morhua*), hake (Phycidae and Merlucciidae), mackerel (*Scomber scombrus*), smelts (*Osmerus mordax*), shad (*Alosa* spp.), capelin (*Mallotus villosus*), and winter flounder (*Pseudopleuronectes americanus*; Boulva and McLaren 1979; Bowen et al. 1996; Kenney and Vigness-Raposa 2010; Toth et al. 2018).

Habitat Specificity

Harbor seals in the western North Atlantic use rocky outcroppings, intertidal ledges, and sandy banks as haulout habitat (Kenney 1994; Gilbert and Guldager 1998; Schroeder 2000). Tidal stage affects the availability and use of these rocky habitats (Kovacs et al. 1990; Gilbert and Guldager 1998).

Site Fidelity

Individual harbor seals are known to return to specific haulout sites within seasons and in successive years (Pauli and Terhune 1987; Goodman 1998; Guldager 2001; Harris et al. 2003; Andersen and Olsen 2010).

Lifetime Reproductive Potential

Harbor seals generally produce one pup each year (Teilmann and Galatius 2018).

Female harbor seal age of first reproduction is 3–4 years (Bigg 1981; Teilmann and Galatius 2018) and age at last reproduction is around 35 years (Härkönen and Heide-Jørgensen 1990).

Generation Length

Information regarding harbor seal generation length in the western North Atlantic was not found in the literature.

Reproductive Plasticity

The harbor seal western North Atlantic stock pups mostly in Maine and eastern Canada from mid-May through June (Richardson 1976; Wilson 1978; Whitman and Payne 1990; Temte et al. 1991; Gjertz and Borset 1992; Katona et al. 1993; DeHart 2002; Waring et al. 2006b).

Harbor seals generally pup on land, with few records of pupping in shallow water, while mating generally occurs in the water shortly after pups wean (Cassini 1999; Teilmann and Galatius 2018).

Gestation and nursing constitute large energy expenditures on the part of female harbor seals (Bowen et al. 1992; Walker and Bowen 1993). Nursing continues for 24-31 days following parturition (Muelbert and Bowen 1993; Thompson et al. 1994b).

Migration

Harbor seals in the western North Atlantic follow a general migration cycle of southward movement during fall and early winter followed by northward movement to Maine and eastern Canada during the spring prior to pupping season (Richardson 1976; Wilson 1978; Rosenfeld et al. 1988; Whitman and Payne 1990; Kenney 1994; Barlas 1999; Schroeder 2000; Jacobs and Terhune 2000; Waring et al. 2006a).

Movement of a small proportion of the stock extends to mid-Atlantic waters (Whitman and Payne 1990; Katona et al. 1993; Gilbert et al. 2005; Waring et al. 2006b).

Home Range

Telemetry and tagging studies suggest that harbor seals spend much of their time within ~ 50km of haulout sites (Thompson et al. 1989; Thompson and Miller 1990; Harkonen and Harding 2001; Bjørge et al. 2002; Dietz et al. 2003; Tougaard et al. 2006). Movement varies based on age, with juveniles undergoing long-distance dispersal (Thompson et al. 1994a; Lesage et al. 2004).

Stock Abundance

The harbor seal western North Atlantic stock is estimated at 61,336 individuals (CV=0.08; Sigourney et al. 2021). Previously, the stock abundance was estimated at 75,834 individuals (CV=0.15), based on 2012 survey data (Waring et al. 2015).

Stock Abundance Trend

Trend analysis indicated a positive abundance trend from 2001 to 2004 followed by a stable or negative trend from 2005 to 2018 (Sigourney et al. 2021; Hayes et al. 2022). Pace et al. (2019) noted a decline in harbor seal counts In southeastern Massachusetts since 2009. Johnston et al. (2015) noted a decline in bycaught and stranded harbor seals since the early 2000s.

Cumulative Stressors

Threats to harbor seals in the western North Atlantic include fisheries interactions, vessel strikes, direct take, pollution, storms, disease, and predation (Katona et al. 1993; Jacobs and Terhune 2000; Stobo and Lucas 2000; Bowen et al. 2003; Anthony et al. 2012; Härkönen et al., 2006; Andersen et al. 2014; Hayes et al. 2021).

Harbor seals in the western North Atlantic interact with groundfish gillnets, salmon gillnets, cod traps, trawl fisheries, purse seines, and herring weirs (Hayes et al. 2021). During the time period 2014–2018, annual average human-caused mortality or serious injury was 365 individuals, based on reports from U.S. fisheries observers and strandings (Hayes et al. 2021). During the period 2014–2018, 2,156 harbor seals were reported stranded along the U.S. Atlantic coast (Hayes et al. 2021). Harbor seals are part of a subsistence harvest in northern Canada (DFO 2011). Nuisance permits allow for direct shooting, which results in an unknown number of mortalities (Jacobs and Terhune 2000; Baird 2001).

Harbor seals have been the subject of several Unusual Mortality Events (UMEs) including 2003-2004 in northern Gulf of Maine waters due to an undetermined cause (MMC 2006); 2006 in the Gulf of Maine due to infectious disease; 2011-2012 in Maine, New Hampshire, and Massachusetts due to infectious disease; 2018-2019 from Virginia to Maine due to infectious disease (NMFS 2021), and most recently in 2022 in Maine due to infectious disease.

Distribution and Sightings

Density model results for a combined guild phocid seals (primarily gray seals [*Halichoerus grypus*] and harbor seals) in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Lowry, L. 2016. *Phoca vitulina*. The IUCN Red List of Threatened Species 2016: e.T17013A45229114. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T17013A45229114.en

Teilmann, J. and A. Galatius. 2018. Harbor Seal: *Phoca vitulina*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press. pp. 451-455. doi: 10.1016/B978-0-12-804327-1.00145-X

Waring, G.T., J.R. Gilbert, D. Belden, A. Van Atten, and R.A. DiGiovanni Jr. 2010. A review of the status of harbour seals (*Phoca vitulina*) in the Northeast United States of America. NAMMCO Scientific Publications 8. doi: 10.7557/3.2685

References

Andersen, S.M., J. Teilmann, R. Dietz, N.M. Schmidt, and L.A. Miller. 2014. Disturbance-induced responses of VHF and satellite tagged harbour seals. Aquatic Conservation: Marine and Freshwater Ecosystems 24(5):712–723. doi: 10.1002/aqc.2393

Anderson, L.W. and M.T. Olsen. 2010. Distribution and population structure of North Atlantic harbour seals (*Phoca vitulina*). Harbour Seals of the North Atlantic and the Baltic. NAMMCO Scientific Publications 8. pp. 173–188.

Anthony, S.J., J.A. St. Leger, K. Pugliares, H.S. Ip, J.M. Chan, Z.W. Carpenter, I. Navarrete-Macias, M. Sanchez-Leon, J.T. Saliki, J. Pedersen, W. Karesh, P. Daszak, R. Rabadan, T. Rowles, W.I. Lipkin, and A. Moscona. 2012. Emergence of fatal avian influenza in New England harbor seals. mBio 3(4):e00166-00112. doi: 10.1128/mBio.00166-12

Baird, R.W. 2001. Status of harbor seals, *Phoca vitulina*, in Canada. Canadian Field-Naturalist 115(4):663–675.

Barlas, M.E. 1999. The distribution and abundance of harbor seals (*Phoca vitulina concolor*) and gray seals (*Halichoerus grypus*) in southern New England, Winter 1998-Summer 1999. Boston University. Thesis. 52 p.

Bigg, M.A. 1981. Harbour seal *Phoca vitulina* Linnaeus, 1758 and *Phoca largha* Pallas, 1811. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 2: Seals. Academic Press, London, UK. pp. 1–27.

Bjørge, A. 2002. How persistent are marine mammal habitats in an ocean of variability. In: Evans, P.G.H. and J.A. Raga (Eds.), Marine mammals: Biology and conservation. Kluwer Academic/Plenum Publishers, New York, NY. pp. 63–91.

Bjorge, A., N. Oien, S. Hartvedt, G. Bothun, and T. Bekkby. 2002. Dispersal and bycatch mortality in gray, *Halichoerus grypus*, and harbor, *Phoca vitulina*, seals tagged at the Norwegian coast. Marine Mammal Science 18(4):963–976. doi: 10.1111/j.1748-7692.2002.tb01085.x

Boulva, J. and J.A. McLaren. 1979. Biology of the harbor seal, *Phoca vitulina*, in eastern Canada. Bulletin of the Fisheries Research Board of Canada. Vol. 200, Ottawa, Canada p. 24.

Bowen, W.D., S.L. Ellis, S.J. Iverson, and D.J. Boness. 2003. Maternal and newborn life-history traits during periods of contrasting population trends: implications for explaining the decline of harbour seals (*Phoca vitulina*), on Sable Island. Journal of Zoology 261(2):155–163. doi: 10.1017/s0952836903004047

Bowen, W.D., O.T. Oftedal, and D.J. Boness. 1992. Mass and energy transfer during lactation in a small phocid, the harbor seal (*Phoca vitulina*). Physiological Zoology 65(4):844–866. doi: 10.1086/physzool.65.4.30158543

Cassini, M.H. 1999. The evolution of reproductive systems in pinnipeds. Behavioral Ecology 10(5):612–616. doi: 10.1093/beheco/10.5.612

deHart, P.A.P. 2002. The distribution and abundance of harbor seals (*Phoca vitulina concolor*) in the Woods Hole region. Boston University. Thesis. 88 p.

Department of Fisheries and Oceans (DFO). 2011. 2011–2015 Integrated fisheries management plan for Atlantic seals. Fisheries and Oceans Canada: Ottawa, Ontario, Canada. 60 p.

Dietz, R., J. Teilmann, O.D. Henriksen, and K. Laidre. 2003. Movements of seals from Rødsand seal sanctuary monitored by satellite telemetry. Relative importance of the Nysted Offshore Wind Farm area to the seals. National Environmental Research Institute: Denmark. NERI technical Report No 429. 44 p.

Gilbert, J.R. and N. Guldager. 1998. Status of harbor and gray seal populations in northern New England. Prepared for the National Marine Fisheries Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. 13 p.

Gilbert, J.R., G.T. Waring, K.M. Wynne, and N. Guldager. 2005. Changes in abundance of harbor seals in Maine, 1981–2001. Marine Mammal Science 21(3):519–535. doi: 10.1111/j.1748-7692.2005.tb01246.x

Gjertz, I. and A. Borset. 1992. Pupping in the most northerly harbor seal (*Phoca vitulina*). Marine Mammal Science 8(2):103–109. doi: 10.1111/j.1748-7692.1992.tb00369.x

Goodman, S.J. 1998. Patterns of extensive genetic differentiation and variation among European harbor seals (*Phoca vitulina vitulina*) revealed using microsatellite DNA polymorphisms. Molecular Biology and Evolution 15(2):104–118. doi: 10.1093/oxfordjournals.molbev.a025907

Guldager, N. 2001. Effect of an increasing seal population on changes in sites used for pupping. University of Maine. Thesis. 83 p.

Härkönen, T., R. Dietz, P. Reijnders, J. Teilmann, K. Harding, A. Hall, S. Brasseur, U. Siebert, S.J. Goodman, P.D. Jepson, T. Dau Rasmussen, and P. Thompson. 2006. The 1988 and 2002 phocine distemper virus epidemics in European harbour seals. Diseases of Aquatic Organisms 68:115–130. doi: 10.3354/dao068115

Härkönen, T. and K.C. Harding. 2001. Spatial structure of harbour seal populations and the implications thereof. Canadian Journal of Zoology 79(12):2115–2127. doi: 10.1139/z01-172

Harkonen, T. and M.P. Heidejorgensen. 1990. Comparative life histories of east Atlantic and other harbor seal populations. Ophelia 32(3):211–235.

Harris, D.E., B. Lelli, and S. Gupta. 2003. Long-term observations of a harbor seal haul-out site in a protected cove in Casco Bay, Gulf of Maine. Northeastern Naturalist 10(2):141–148. doi: 10.1656/1092-6194(2003)010[0141:looahs]2.0.co;2

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Jacobs, S.R. and J.M. Terhune. 2000. Harbor seal (*Phoca Vitulina*) numbers along the New Brunswick coast of the Bay of Fundy in autumn in relation to aquaculture. Northeastern Naturalist 7(3):289–296. doi: 10.1656/1092-6194(2000)007[0289:hspvna]2.0.co;2

Johnston, D.W., J. Frungillo, A. Smith, K. Moore, B. Sharp, J. Schuh, and A.J. Read. 2015. Trends in stranding and by-catch rates of gray and harbor seals along the northeastern coast of the United States: Evidence of divergence in the abundance of two sympatric phocid species? PLoS ONE 10(7):e0131660. doi: 10.1371/journal.pone.0131660

Katona, S.K., V. Rough, and D.T. Richardson. 1993. A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland. Smithsonian Institution Press, Washington, DC. p.

Kenney, M.K. 1994. Harbor seal population trends and habitat use in Maine. University of Maine. Thesis. 55 p.

Kenney, R.D. and K.J. Vigness-Raposa. 2010. Marine mammals and sea turtles of Narragansett Bay, Block Island Sound, and nearby waters: an analysis of existing data for the Rhode Island Ocean Special Area Management Plan. University of Rhode Island. Technical Report 10. 337 p.

Kovacs, K.M., K.M. Jonas, and S.E. Welke. 1990. Sex and age segregation by *Phoca vitulina concolor* at haul-out sites during the breeding season in the Passamaquoddy Bay Region, New Brunswick. Marine Mammal Science 6(3):204–214. doi: 10.1111/j.1748-7692.1990.tb00244.x

Lesage, W., M.O. Harnmill, and K.M. Kovacs. 2004. Long-distance movements of harbour seals (*Phoca vitulina*) from a seasonally ice-covered area, the St. Lawrence River estuary, Canada. Canadian Journal of Zoology 82(7):1070–1081. doi: 10.1139/Z04-084

Lucas, Z. and W.T. Stobo. 2000. Shark-inflicted mortality on a population of harbour seals (*Phoca vitulina*) at Sable Island, Nova Scotia. Journal of Zoology 252(3):405–414. doi: 10.1111/j.1469-7998.2000.tb00636.x

Muelbert, M.M.C. and W.D. Bowen. 1993. Duration of lactation and postweaning changes in mass and body composition of harbour seal, *Phoca vitulina*, pups. Canadian Journal of Zoology 71(7):1405–1414. doi: 10.1139/z93-194

National Marine Fisheries Service (NMFS). 2021. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Pace, R.M., E. Josephson, S.A. Wood, K. Murray, and G. Waring. 2019. Trends and patterns of seal abundance at haul-out sites in a gray seal recolonization zone. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-251. 17 p. doi: 10.25923/qd3s-we77

Pauli, B.D. and J.M. Terhune. 1987. Tidal and temporal interaction on harbour seal haul-out patterns. Aquatic Mammals 13(3):93–95.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Payne, P.M. and L.A. Selzer. 1989. The distribution, abundance and selected prey of the harbor seal, *Phoca vitulina concolor*, in southern New England. Marine Mammal Science 5(2):173–192. doi: 10.1111/j.1748-7692.1989.tb00331.x

Richardson, D.T. 1976. Assessment of harbor and gray seal populations in Maine. Final report to the Marine Mammal Commission. Fisheries Research Station: West Boothbay Harbor, ME. Contract Number MM4AC009.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Rosenfeld, M., M. George, and J.M. Terhune. 1988. Evidence of autumnal harbour seal, *Phoca vitulina*, movement from Canada to the United States. Canadian Field-Naturalist 102(3):527–529.

Schroeder, C.L. 2000. Population status and distribution of the harbor seal in Rhode Island waters. University of Rhode Island. Thesis. 197 p.

Teilmann, J. and A. Galatius. 2018. Harbor seal: *Phoca vitulina*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 451–455. doi: 10.1016/B978-0-12-804327-1.00145-X

Temte, J.L., M.A. Bigg, and Ø. Wiig. 1991. Clines revisited: The timing of pupping in the harbour seal (*Phoca vitulina*). Journal of Zoology 224(4):617–632. doi: 10.1111/j.1469-7998.1991.tb03790.x

Thompson, P.M., M.A. Fedak, B.J. McConnell, and K.S. Nicholas. 1989. Seasonal and sex-related variation in the activity patterns of common seals (*Phoca vitulina*). The Journal of Applied Ecology 26(2). doi: 10.2307/2404078

Thompson, P.M., K.M. Kovacs, and B.J. Mcconnell. 1994a. Natal dispersal of harbor seals (*Phoca-vitulina*) from breeding sites in Orkney, Scotland. Journal of Zoology 234:668–673. doi: 10.1111/j.1469-7998.1994.tb04873.x

Thompson, P.M. and D. Miller. 1990. Summer foraging activity and movements of radio-tagged common seals (*Phoca vitulina.* L.) in the Moray Firth, Scotland. The Journal of Applied Ecology 27(2). doi: 10.2307/2404296

Thompson, P.M., D. Miller, R. Cooper, and P.S. Hammond. 1994b. Changes in the distribution and activity of female harbor seals during the breeding-season - Implications for their lactation strategy and mating patterns. Journal of Animal Ecology 63(1):24–30. doi: 10.2307/5579

Tougaard, J., S. Tougaard, R.C. Jensen, T. Jensen, J. Teilmann, D. Adelung, N. Liebsch, and G. Müller. 2006. Harbour seals at Horns Reef before, during and after construction of Horns Rev Offshore Wind Farm. Final report to Vattenfall A/S. Fisheries and Maritime Museum: Esjberg, Denmark. Biological Papers from the Fisheries and Maritime Museum No. 5.

Walker, B.G. and W.D. Bowen. 1993. Behavioural differences among adult male harbour seals during the breeding season may provide evidence of reproductive strategies. Canadian Journal of Zoology 71(8):1585–1591. doi: 10.1139/z93-224

Waring, G.T., J.R. Gilbert, D. Belden, A. Van Atten, and R.A. DiGiovanni Jr. 2010. A review of the status of harbour seals (*Phoca vitulina*) in the Northeast United States of America. NAMMCO Scientific Publications 8:191–212. doi: 10.7557/3.2685

Waring, G.T., J.R. Gilbert, J. Loftin, and N. Cabana. 2006a. Short-term movements of radio-tagged harbor seals in New England. Northeastern Naturalist 13(1):1–14. doi: 10.1656/1092-6194(2006)13[1:smorhs]2.0.co;2

Waring, G.T., E. Josephson, C.P. Fairfield, and K. Maze-Foley. 2006b. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-194. 346 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-231. 361 p. doi: 10.7289/V5TQ5ZH0

Whitman, A.A. and P.M. Payne. 1990. Age of harbour seals, *Phoca vitulina concolor*, wintering in southern New England. Canadian Field-Naturalist 104(4):579–582.

Wilson, S.C. 1978. Social organization and behavior of harbor seals, *Phoca concolor*, in Maine. Final report to the Marine Mammal Commission: Washington, DC. Contract MM6AC013, GPO-PB-280-188. 116 p.

Harp seal − *Pagophilus groenlandicus*

Western North Atlantic Stock

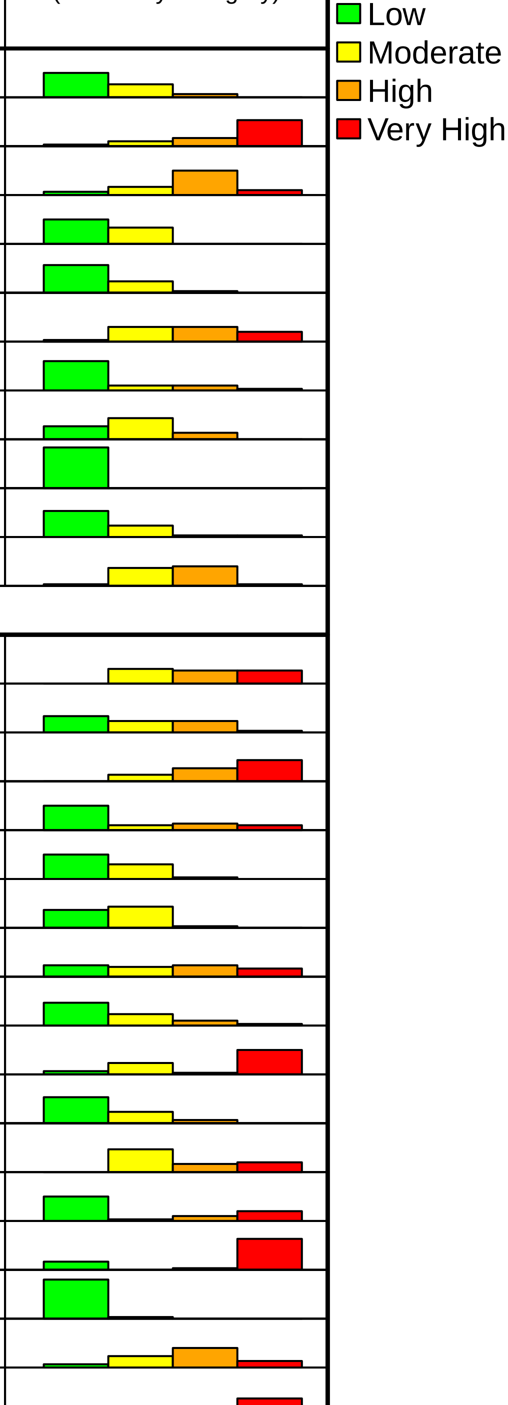
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 100% of scores≥ 2

	Pagophilus groenlandicus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.5	2.6	
	Habitat Specificity	3.4	2.8	
	Site Fidelity	2.8	2.4	
	Lifetime Reproductive Potential	1.4	2.8	
	Generation Length	1.4	2.6	
	Reproductive Plasticity	2.8	2.8	
	Migration	1.5	3.0	
	Home Range	1.8	3.0	
	Stock Abundance	1.0	3.0	
	Stock Abundance Trend	1.5	2.2	
	Cumulative Stressors	2.5	2.2	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.0	3.0	
	Sea Surface Temperature (Change in variability)	2.0	2.8	
	Air Temperature (Change in mean)	3.4	2.8	
	Air Temperature (Change in variability)	1.8	2.8	
	Precipitation (Change in mean)	1.4	2.8	
	Precipitation (Change in variability)	1.6	2.8	
	Sea Surface Salinity (Change in mean)	2.4	2.6	
	Sea Surface Salinity (Change in variability)	1.6	2.8	
	Ocean pH (Change in mean)	3.2	2.2	
	Ocean pH (Change in variability)	1.4	2.2	
	Sea ice coverage (Change in mean)	2.7	2.8	
	Sea ice coverage (Change in variability)	2.0	2.8	
	Dissolved oxygen (Change in mean)	3.4	2.4	
	Dissolved oxygen (Change in variability)	1.0	2.4	
	Circulation	2.7	2.2	
	Sea level rise	2.9	2.4	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Harp seal (Western North Atlantic Stock)

Pagophilus groenlandicus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (80% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than 3.0: Air Temperature (Standard anomaly) (3.36), Dissolved oxygen (Standard anomaly) (3.36), and Ocean pH (Standard anomaly) (3.16).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than or equal to 2.5:Habitat Specificity (3.44), Reproductive Plasticity (2.80), Site Fidelity (2.76), and Cumulative Stressors (2.52).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: High

Data Quality: 100% of the data quality scores were 2 or greater. 100% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The harp seal western North Atlantic stock includes individuals that pup off the coast of eastern Canada, generally along the coast of Newfoundland and Labrador and in the Gulf of St. Lawrence (Lavigne and Kovacs 1988; Bonner 1990; Hayes et al. 2022).

Prey/Diet Specificity

Harp seal diet varies with age, season, location, and across years (Lavigne 2018). Harp seal diet primarily consists of smaller fish such as capelin (*Mallotus villosus*), arctic cod (*Boreogadus saida*), and polar cod (*Arctogadus glacialis*), though stomach content analysis has identified more than 67 species of fish and more than 70 species of invertebrates (Lawson et al. 1995; Lawson and Stenson 1997; Wallace and Lawson 1997; Lindstrøm et al. 1998; Stenson 2012). In the northern Gulf of St. Lawrence, harp seals were found to feed on most trophic levels (Morisette et al. 2006).

Habitat Specificity

Harp seals are found with drifting pack ice, which they use to haul out for breeding and molting (Ronald and Healey 1981; Lydersen and Kovacs 1993; Moulton et al. 2000). Harp seals maintain holes in the ice to allow foraging in nearby waters (Ronald and Healey 1981). Foraging often occurs in waters less than 90m depth, but harp seals are known to dive to depths greater than 500m (Lydersen and Kovacs 1993; Folkow et al. 2004). In the northwest Atlantic, declines in sea ice condition have resulted in extensive pup mortalities.

Site Fidelity

Information regarding harp seal site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Annual pregnancy rates are highly variable, ranging from 0.204 to 0.86, suggesting an interbirth interval ranging from 1-5 years (Buren et al. 2014; Stenson and Hammill 2014).

Mean age at sexual maturity of harp seal females has been variable between years. In 2001, mean age at sexual maturity was estimated at 5.3 years (Sjare and Stenson 2010). Harp seals may live to around 30 years (Garde et al. 2010).

Generation Length

Information regarding harp seal generation length in the western North Atlantic was not found in the literature.

Reproductive Plasticity

Harp seal pupping occurs on pack ice in February and March, with mating following 2-3 weeks later (Ronald and Healey 1981; Lydersen and Kovacs 1993). Harp seals are "ice-obligates" and high rates of pup mortality have been observed in years with poor sea ice conditions (Stenson and Hammill 2014; Hammill et al. 2015). Mating generally occurs in the water (Ronald and Dougan 1982; Lavigne and Kovacs 1988; Lavigne 2018). The western North Atlantic stock has two breeding herds, one called the "Front" herd that breeds off the coast of Newfoundland and Labrador, and a second called the "Gulf" herd that breeds near the Magdalen Islands in the Gulf of St. Lawrence (Sergeant 1965; Lavigne and Kovacs 1988).

Migration

Harp seals undergo an annual migration, arriving in breeding grounds off the east coast of Newfoundland-Labrador and in the Gulf of St. Lawrence in early winter, moving north to molt around April, then continuing north to feeding grounds in May before leaving in September to return to breeding grounds (Sergeant 1965; Ronald and Dougan 1982; Stenson and Sjare 1997; Bowen and Siniff 1999).

Home Range

Harp seals are highly mobile, making extensive movements over continental shelf waters and conducting an annual migration of more than 4,000km (Bowen and Siniff 1999).

Stock Abundance

The abundance of harp seals in the western North Atlantic is 7.6 million individuals (95% CI: 6.5 – 8.8 million), based on 2017 surveys (DFO 2020; Hayes et al. 2022).

Stock Abundance Trend

Previous abundance estimates placed the population at 5.5 million individuals (95% CI= 4.5-6.4 million; Healey and Stenson 2000) in 2000, 5.9 million individuals (95% CI=4.6 - 7.2 million; DFO 2005) in 2004, 6.5 million (95% CI=5.7 to 7.3 million;) in 2008, 6.9 million individuals (95% CI=6.0 to 7.7 million; DFO 2010) in 2009, 8.6 – 9.6 million individuals (95% CI=7.8 to 10.8 million; DFO 2011) in 2010, 7.1 million individuals (95% CI 5.9-8.3 million; Hammill et al. 2012) in 2012, and 7.4 million individuals (95% CI = 6,426,000–8,354,000; DFO 2014; ICES 2014) in 2014. Differences in methodology confound direct comparisons between years.

Cumulative Stressors

Harp seals in the western North Atlantic are harvested in eastern Canada and also interact with the lumpfish and sink gillnet fisheries (Hatch and Orphanides 2014, 2015, 2016; ICES 2016; Orphanides 2019, 2020; Hayes et al. 2020; Stenson and Upward 2020; Stenson et al. 2020). During the time period 2013–2017, annual average human-caused mortality or serious injury was 232,355 individuals, based on catch data from Canada and Greenland, reports from U.S. fisheries observers, and strandings (DFO 2014; ICES 2016; Hayes et al. 2020). During the same period, 194 harp seals were reported stranded (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Kovacs, K.M. 2015. *Pagophilus groenlandicus*. The IUCN Red List of Threatened Species 2015: e.T41671A45231087. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41671A45231087.en

Lavigne, D.M. 2018. Harp seal: *Pagophilus groenlandicus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 455–457. doi: 10.1016/B978-0-12-804327-1.00146-1

References

Bonner, W.N. 1990. The natural history of seals. Facts on File, New York, NY. 196 p.

Bowen, W.D. and D.B. Siniff. 1999. Distribution, population biology, and feeding ecology of marine mammals. In: Reynolds, J.E.I. and S.A. Rommel (Eds.), Biology of Marine Mammals. Smithsonian Press, Washington, DC. pp. 423–484.

Buren, A.D., M. Koen-Alonso, P. Pepin, F. Mowbray, B. Nakashima, G. Stenson, N. Ollerhead, and W.A. Montevecchi. 2014. Bottom-up regulation of capelin, a keystone forage species. PLoS ONE 9(2):e87589. doi: 10.1371/journal.pone.0087589

Department of Fisheries and Oceans (DFO). 2005. Stock assessment of northwest Atlantic harp seals (*Pagophilus groenlandicus*). Canadian Science Advisory Secretariat Science Advisory Report 2005/037. 11 p.
Department of Fisheries and Oceans (DFO). 2010. Current status of northwest Atlantic harp seals, *Pagophilus groenlandicus*. Canadian Science Advisory Secretariat Science Advisory Report 2009/074. 14 p.
Department of Fisheries and Oceans (DFO). 2011. 2011–2015 Integrated fisheries management plan for Atlantic seals. Fisheries and Oceans Canada: Ottawa, Ontario, Canada. 60 p.
Department of Fisheries and Oceans (DFO). 2014. Updated status of northwest Atlantic harp seals, (*Pagophilus groenlandicus*). Fisheries and Oceans Canada. Canadian Science Advisory Secretariat Science Advisory Report 2014/011. 15 p.
Department of Fisheries and Oceans (DFO). 2020. 2019 status of northwest Atlantic harp seals, (*Pagophilus groenlandicus*). Fisheries and Oceans Canada. Canadian Science Advisory Secretariat Science Advisory Report 2020/020. 14 p.
Folkow, L.P., E.S. Nordøy, and A.S. Blix. 2004. Distribution and diving behaviour of harp seals (*Pagophilus groenlandicus*) from the Greenland Sea stock. Polar Biology 27(5):281–298. doi: 10.1007/s00300-004-0591-7
Garde, E., A.K. Frie, G. Dunshea, S.H. Hansen, K.M. Kovacs, and C. Lydersen. 2010. Harp seal ageing techniques—teeth, aspartic acid racemization, and telomere sequence analysis. Journal of Mammalogy 91(6):1365–1374. doi: 10.1644/10-mamm-a-080.1
Hammill, M.O., G.B. Stenson, T. Doniol-Valcroze, and A. Mosnier. 2012. Estimating carrying capacity and population trends of Northwest Atlantic harp seals, 1952–2012. Fisheries and Oceans Canada. Canadian Science Advisory Secretariat Research Document 2012/148. 31 p.
Hammill, M.O., G.B. Stenson, T. Doniol-Valcroze, and A. Mosnier. 2015. Conservation of northwest Atlantic harp seals: Past success, future uncertainty? Biological Conservation 192:181–191. doi: 10.1016/j.biocon.2015.09.016
Hatch, J.M. and C. Orphanides. 2014. Estimates of cetacean and pinniped bycatch in the 2012 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 14-02. 20 p. doi: 10.7289/V5NP22F9
Hatch, J.M. and C. Orphanides. 2015. Estimates of cetacean and pinniped bycatch in the 2013 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 15-15. 26 p. doi: 10.7289/V5HD7SNK
Hatch, J.M. and C. Orphanides. 2016. Estimates of cetacean and pinniped bycatch in the 2014 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 16-05. 22 p. doi: 10.7289/V50863BV
Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Healey, B.P. and G.B. Stenson. 2000. Estimating pup production and population size of the Northwest Atlantic harp seal (*Phoca groenlandica*). Fisheries and Oceans Canada. Research Document 2000/081. 28 p.

International Council for the Exploration of the Sea (ICES). 2014. Report of the ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP), November 17–21, 2014, Quebec City, Quebec, Canada. CM 2014/ACOM:20. 58 p.

International Council for the Exploration of the Sea (ICES). 2016. Report of the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WGHARP), 26-30 September 2016, ICES HQ, Copenhagen, Denmark. CM 2016/ACOM:21. 81 p.

Lavigne, D.M. 2018. Harp seal: *Pagophilus groenlandicus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 455–457. doi: 10.1016/B978-0-12-804327-1.00146-1

Lavigne, D.M. and K.M. Kovacs. 1988. Harps and hoods: Ice-breeding seals of the Northwest Atlantic. University of Waterloo Press, Waterloo, Ontario, Canada. 174 p.

Lawson, J.W. and G.B. Stenson. 1997. Diet of northwest Atlantic harp seals (*Phoca groenlandica*) in offshore areas. Canadian Journal of Zoology 75(12):2095–2106. doi: 10.1139/z97-844

Lawson, J.W., G.B. Stenson, and D.G. McKinnon. 1995. Diet of harp seals (*Phoca groenlandica*) in nearshore waters of the northwest Atlantic during 1990-1993. Canadian Journal of Zoology 73(10):1805–1818. doi: 10.1139/z95-213

Lindstrøm, U., A. Harbitz, T. Haug, and K.T. Nilssen. 1998. Do harp seals *Phoca groenlandica* exhibit particular prey preferences? ICES Journal of Marine Science 55(5):941–953. doi: 10.1006/jmsc.1998.0367

Lydersen, C. and K.M. Kovacs. 1993. Diving behaviour of lactating harp seal, *Phoca groenlandica*, females from the Gulf of St Lawrence, Canada. Animal Behaviour 46(6):1213–1221. doi: 10.1006/anbe.1993.1312

Morissette, L., M.O. Hammill, and C. Savenkoff. 2006. The trophic role of marine mammals in the northern Gulf of St. Lawrence. Marine Mammal Science 22(1):74–103. doi: 10.1111/j.1748-7692.2006.00007.x

Moulton, V.D., E.H. Miller, and H. Ochoa-Acuña. 2000. Haulout behaviour of captive harp seals (*Pagophilus groenlandicus*): incidence, seasonality, and relationships to weather. Applied Animal Behaviour Science 65(4):367–378. doi: 10.1016/s0168-1591(99)00062-3

Orphanides, C. 2019. Estimates of cetacean and pinniped bycatch in the 2016 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Narragansett, RI. Northeast Fisheries Science Center Reference Document 19-04. 8 p. doi: 10.25923/jp8y-sv79

Orphanides, C. 2020. Estimates of cetacean and pinniped bycatch in the 2017 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Narragansett, RI. Northeast Fisheries Science Center Reference Document 20-03. 16 p. doi: 10.25923/fkbm-jr56

Ronald, K. and J.L. Dougan. 1982. The ice lover: Biology of the harp seal (*Phoca groenlandica*). Science 215(4535):928–933. doi: 10.1126/science.215.4535.928

Ronald, K. and P.J. Healey. 1981. Harp seal. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 2: Seals. Academic Press, New York, NY. pp. 55–87.

Sergeant, D.E. 1965. Migrations of harp seals *Pagophilus groenlandicus* (Erxleben) in the Northwest Atlantic. Journal of the Fisheries Research Board of Canada 22(2):433–464. doi: 10.1139/f65-043

Sjare, B. and G.B. Stenson. 2010. Changes in the reproductive parameters of female harp seals (*Pagophilus groenlandicus*) in the northwest Atlantic. ICES Journal of Marine Science 67(2):304–315. doi: 10.1093/icesjms/fsp267

Stenson, G.B. 2012. Estimating consumption of prey by harp seals, *Pagophilus groenlandicus*, in NAFO divisions 2J3KL. Fisheries and Oceans Canada: St. John's, Newfoundland and Labrador. Canadian Stock Assessment Secretariat Research Document 2012/156. 26 p.

Stenson, G.B. and M.O. Hammill. 2014. Can ice breeding seals adapt to habitat loss in a time of climate change? ICES Journal of Marine Science 71(7):1977–1986. doi: 10.1093/icesjms/fsu074

Stenson, G.B., T. Haug, and M.O. Hammill. 2020. Harp seals: Monitors of change in differing ecosystems. Frontiers in Marine Science 7:569258. doi: 10.3389/fmars.2020.569258

Stenson, G.B. and B. Sjare. 1997. Seasonal distribution of harp seals, (*Phoca groenlandica*), in the Northwest Atlantic. International Council for the Exploration of the Sea: Copenhagen, Denmark. ICES CM 1997/CC:10. 23 p.

Stenson, G.B. and P. Upward. 2020. Updated estimates of harp seal bycatch and total removals in the Northwest Atlantic. Fisheries and Oceans Canada: Ottawa, Ontario. DFO Canadian Stock Assessment Secretariat Research Document 2020/014. 19 p.

Wallace, S.D. and J.W. Lawson. 1997. A review of stomach contents of harp seals (*Phoca groenlandica*) from the northwest Atlantic: An update. International Marine Mammal Association, Inc: Guelph, Ontario, Canada. IMMA Technical Report 97-01.

Hooded seal − *Cystophora cristata*

Western North Atlantic Stock

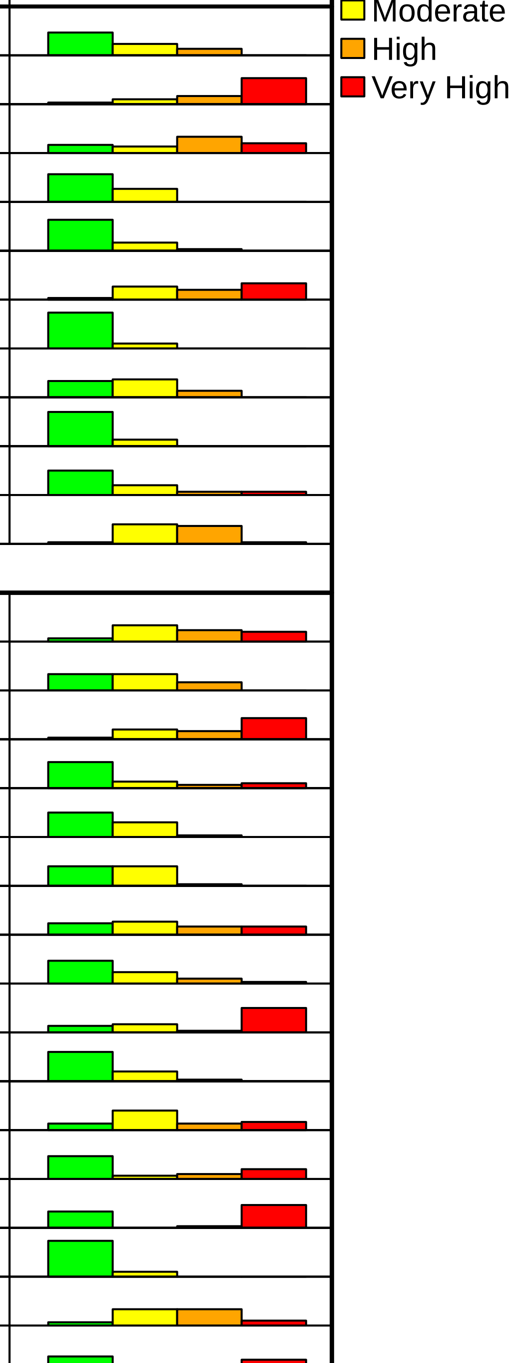
Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 89% of scores ≥ 2

Cystophora cristata		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	1.4	
	Habitat Specificity	3.4	2.6	
	Site Fidelity	2.7	1.8	
	Lifetime Reproductive Potential	1.3	2.4	
	Generation Length	1.3	2.2	
	Reproductive Plasticity	3.0	2.6	
	Migration	1.1	2.4	
	Home Range	1.8	2.6	
	Stock Abundance	1.2	3.0	
	Stock Abundance Trend	1.6	1.4	
	Cumulative Stressors	2.5	2.2	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	2.7	3.0	
	Sea Surface Temperature (Change in variability)	1.8	3.0	
	Air Temperature (Change in mean)	3.2	2.8	
	Air Temperature (Change in variability)	1.7	2.8	
	Precipitation (Change in mean)	1.4	2.8	
	Precipitation (Change in variability)	1.6	2.8	
	Sea Surface Salinity (Change in mean)	2.3	2.8	
	Sea Surface Salinity (Change in variability)	1.6	3.0	
	Ocean pH (Change in mean)	3.1	2.2	
	Ocean pH (Change in variability)	1.3	2.0	
	Sea ice coverage (Change in mean)	2.4	3.0	
	Sea ice coverage (Change in variability)	2.0	2.8	
	Dissolved oxygen (Change in mean)	2.8	2.2	
	Dissolved oxygen (Change in variability)	1.1	2.2	
	Circulation	2.6	2.4	
	Sea level rise	2.4	2.4	
	Exposure Score	High		
Overall Vulnerability Rank		High		



Hooded seal (Western North Atlantic Stock)

Cystophora cristata

CVA Results Summary

Overall Climate Vulnerability Rank: High (40% certainty from bootstrap analysis).

Climate Exposure: High. Two exposure factors scored greater than 3.0: Air Temperature (Standard anomaly) (3.20) and Ocean pH (Standard anomaly) (3.08).

Biological Sensitivity: High. Two sensitivity attributes scored greater than or equal to 3.0: Habitat Specificity (3.44) and Reproductive Plasticity (3.00).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 89% of the data quality scores were 2 or greater. 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The hooded seal western North Atlantic stock is the same as ICES Northwest Atlantic stock, which includes individuals that whelp off the coast of eastern Canada, generally along the coast of Newfoundland and Labrador, in the Gulf of St. Lawrence, and in the Davis Strait (Lavigne and Kovacs 1988; Stenson et al. 1996; Hayes et al. 2019).

Prey/Diet Specificity

Common prey items include Greenland halibut (*Reinhardtius hippoglossoides*), redfish species (*Sebastes spp.*), squid , herring (*Clupea harengus*), capelin (*Mallotus villosus*), sand eels (*Hyperoplus lanceolatus*), Atlantic cod (*Gadus morhua*), and Arctic cod (*Boreogadus saida*; Kovacs and Lavigne 1986; Ross 1993; Hauksson and Bogason 1997; Hammill and Stenson 2000; Haug et al. 2004; Haug et al. 2007). Diet varies by sex, age, season, and region (Bajzak et al. 2009; Tucker et al. 2009).

Habitat Specificity

Hooded seals spend much of the year on or around sea ice (Kovacs 2018). Hooded seals occur in deeper water and are found farther offshore than harp seals (Sergeant 1976; Campbell 1987; Lavigne and Kovacs 1988; Stenson and Kavanaugh 1993; Stenson et al. 1996). In the Northwest Atlantic, males forage in areas associated with complex seabed relief and females forage in shelf waters (Andersen et al. 2013). Hooded seals frequently dive to depths of 100-600m and are known to dive to depths greater than 1,000m (Folkow and Blix 1999; Bajzak et al. 2009).

Site Fidelity

Information regarding hooded seal site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Pregnancy rates of hooded seals in the western North Atlantic suggest a reproductive interval of 1-2 years (Frie et al. 2012).

Estimates of age at first reproduction have varied over time, with the most recent estimate (1989–1995) for the Northwest Atlantic stock at 6.1 years (Frie et al. 2012). Hooded seals are known to live to greater than 30 years of age (Frie et al. 2012).

Generation Length

Information regarding hooded seal generation length in the western North Atlantic was not found in the literature.

Reproductive Plasticity

The western North Atlantic hooded seal stock pups and whelps off the coast of eastern Canada, with primary whelping areas along the coast of Newfoundland and Labrador, in the Gulf of St. Lawrence, and in the Davis Strait (Lavigne and Kovacs 1988; Stenson et al. 1996). Breeding generally occurs in March, lasting 2–3 weeks (Bowen et al. 1985; Kovacs 2018).

Migration

Hooded seals migrate from whelping grounds following breeding in March to disperse along the edge of the pack ice to the Denmark Strait to moult in June and July (King 1983; Lavigne and Kovacs 1988; ICES 1995; Folkow et al. 1996; Stenson and Sjare 1996; Stenson et al. 1996; Andersen et al. 2009; Bajzak et al. 2009; Kovacs 2018).

Home Range

Satellite tagging efforts in the Gulf of St. Lawrence suggest large home ranges that include much of the Gulf of St. Lawrence prior to migration (Bajzak et al. 2009). Hooded seals have been found along the U.S. Atlantic Coast and as far south as Puerto Rico (McAlpine et al. 1999; Harris et al. 2001; Mignucci-Giannoni and Odell 2001; Harris and Gupta 2006). Hooded seals that stranded in the U.S. were satellite tagged and released then traveled to the eastern edge of the Scotian Shelf, Gulf of St. Lawrence, and as far as the southeast tip of Greenland (WHALENET http://whale.wheelock.edu).

Stock Abundance

The best estimate for hooded seals in the western North Atlantic is 592,100 individuals (SE=94,800; 95% C.I.= 404,400-779,800), based on 2005 pup production estimates from all three western North Atlantic whelping areas (Hammill and Stenson 2006).

Stock Abundance Trend

Stenson et al. (1996) estimated pup production increased at 5% per year during the period 1984–1990, but acknowledged stable or declining pup production may also be possible.

A previous abundance estimate of 400,000–450,000 hooded individuals was based on an estimate of pup production from a 1990 survey (Hammill et al. 1992). Pup production estimates in 2000 were similar to pup population estimates in 1990 (ICES 2001).

Cumulative Stressors

Hooded seals in the western North Atlantic are harvested in eastern Canada and also interact with gillnet fisheries (ICES 2006; Hayes et al. 2019). During the time period 2012–2016, annual average human-caused mortality or serious injury was 1,680 individuals, based on catch data from Canada and Greenland, reports from U.S. fisheries observers, and strandings (ICES 2006; Hayes et al. 2019).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2018. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Kovacs, K.M. 2016. *Cystophora cristata*. The IUCN Red List of Threatened Species 2016: e.T6204A45225150. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T6204A45225150.en

Kovacs, K.M. 2018. Hooded seal: *Cystophora cristata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 477–480. doi: 10.1016/B978-0-12-804327-1.00151-5

References

Andersen, J.M., Y.F. Wierma, G. Stenson, M.O. Hammill, and A. Rosing-Asvid. 2009. Movement patterns of hooded seals (*Cystophora cristata*) in the Northwest Atlantic ocean during the post-moult and pre-breed seasons. Journal of Northwest Atlantic Fishery Science 42:1–11. doi: 10.2960/J.v42.m649

Andersen, J.M., Y.F. Wiersma, G.B. Stenson, M.O. Hammill, A. Rosing-Asvid, and M. Skern-Maurizen. 2013. Habitat selection by hooded seals (*Cystophora cristata*) in the Northwest Atlantic Ocean. ICES Journal of Marine Science 70(1):173–185. doi: 10.1093/icesjms/fss133

Bajzak, C.E., S.D. Côté, M.O. Hammill, and G. Stenson. 2009. Intersexual differences in the postbreeding foraging behaviour of the Northwest Atlantic hooded seal. Marine Ecology Progress Series 385:285–294. doi: 10.3354/meps08015

Bowen, W.D., O.T. Oftedal, and D.J. Boness. 1985. Birth to weaning in 4 days: remarkable growth in the hooded seal, *Cystophora cristata*. Canadian Journal of Zoology 63(12):2841–2846. doi: 10.1139/z85-424

Campbell, R.R. 1987. Status of the hooded seal, *Cystophora cristata*, in Canada. Canadian Field-Naturalist 101(2):253–265.

Folkow, L.P. and A.S. Blix. 1999. Diving behaviour of hooded seals (*Cystophora cristata*) in the Greenland and Norwegian Seas. Polar Biology 22(1):61–74. doi: 10.1007/s003000050391

Folkow, L.P., P.-E. Mårtensson, and A.S. Blix. 1996. Annual distribution of hooded seals (*Cystophora cristata*) in the Greenland and Norwegian seas. Polar Biology 16(3):179–189. doi: 10.1007/bf02329206

Frie, A.K., G.B. Stenson, and T. Haug. 2012. Long-term trends in reproductive and demographic parameters of female Northwest Atlantic hooded seals (*Cystophora cristata*): Population responses to ecosystem change? Canadian Journal of Zoology 90(3):376–392. doi: 10.1139/z11-140

Hammill, M.O. and G. Stenson. 2006. Abundance of Northwest Atlantic hooded seals (1960–2005), 2006 DFO Canada. Fisheries and Oceans Canada. Canadian Science Advisory Secretariat Research Document 2006/068. 19 p.

Hammill, M.O. and G.B. Stenson. 2000. Estimated prey consumption by harp seals (*Phoca groenlandica*), hooded seals (*Cystophora cristata*), grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) in Atlantic Canada. Journal of Northwest Atlantic Fishery Science 26:1–23. doi: 10.2960/J.v26.a1

Hammill, M.O., G.B. Stenson, and R.A. Myers. 1992. Hooded seal (*Cystophora cristata*) pup production in the Gulf of St. Lawrence. Canadian Journal of Fisheries and Aquatic Sciences 49(12):2546–2550. doi: 10.1139/f92-281

Harris, D.E. and S. Gupta. 2006. GIS-based analysis of ice-breeding seal strandings in the Gulf of Maine. Northeastern Naturalist 13(3):403–420. doi: 10.1656/1092-6194(2006)13[403:Gaoiss]2.0.Co;2

Harris, D.E., B. Lelli, G. Jakush, and G. Early. 2001. Hooded seal (*Cystophora cristata*) records from the southern Gulf of Maine. Northeastern Naturalist 8(4):427–434. doi: 10.1656/1092-6194(2001)008[0427:hsccrf]2.0.co;2

Haug, T., K.T. Nilssen, and L. Lindblom. 2016. Feeding habits of harp and hooded seals in drift ice waters along the east coast of Greenland in summer and winter. Polar Research 23(1):35–42. doi: 10.3402/polar.v23i1.6264

Haug, T., K. Tormod Nilssen, L. Lindblom, and U. Lindstrøm. 2007. Diets of hooded seals (*Cystophora cristata*) in coastal waters and drift ice waters along the east coast of Greenland. Marine Biology Research 3(3):123–133. doi: 10.1080/17451000701358531

Hauksson, E. and V. Bogason. 1997. Comparative feeding of grey (*Halichoerus grypus*) and common seals (*Phoca vitulina*) in coastal waters of Iceland, with a note on the diet of hooded (*Cystophora cristata*) and harp seals (*Phoca groenlandica*). Journal of Northwest Atlantic Fishery Science 22:125–135. doi: 10.2960/J.v22.a11

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

International Council for the Exploration of the Sea (ICES). 1995. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. 5-9 June 1995, Dartmouth, Nova Scotia Canada. NAFO SCS Doc. 95/16. Serial No. N2569. 40 p.

International Council for the Exploration of the Sea (ICES). 2001. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. 2-6 October 2000, Copenhagen, Denmark. CM 2001/ACFM:08. 40 p.

International Council for the Exploration of the Sea (ICES). 2006. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. 12-16 June 2006, Copenhagen, Denmark. CM 2006/ACFM:32. 28 p.

King, J.E. 1983. Seals of the world. Cornell University Press, Ithaca, NY. p.

Kovacs, K.M. 2018. Hooded seal: *Cystophora cristata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 477–480. doi: 10.1016/B978-0-12-804327-1.00151-5

Kovacs, K.M. and D.M. Lavigne. 1986. *Cystophora cristata*. Mammalian Species(258):1–9. doi: 10.2307/3503888

Lavigne, D.M. and K.M. Kovacs. 1988. Harps and hoods: Ice-breeding seals of the Northwest Atlantic. University of Waterloo Press, Waterloo, Ontario, Canada. 174 p.

McAlpine, D.F., P.T. Stevick, L.D. Murison, and S.D. Turnbull. 1999. Extralimital records of hooded seals (*Cystophora cristata*) from the Bay of Fundy and northern Gulf of Maine. Northeastern Naturalist 6(3):225–230. doi: 10.2307/3858597

Mignucci-Giannoni, A.A. and D.K. Odell. 2001. Tropical and subtropical records of hooded seals (*Cystophora cristata*) dispel the myth of extant Caribbean monk seals (*Monachus tropicalis*). Bulletin of Marine Science 68(1):47–58.

Ross, S.-A. 1992. Food and feeding in the hooded seal (*Cystophora cristata*) in Newfoundland. Memorial University of Newfoundland. Thesis. 164 p.

Sergeant, D.E. 1976. History and present status of populations of harp and hooded seals. Biological Conservation 10(2):95–118. doi: 10.1016/0006-3207(76)90055-0

Stenson, G.B. and D.J. Kavanagh. 1993. Distribution of harp and hooded seals in offshore waters of Newfoundland. Northwest Atlantic Fisheries Organization: Dartmouth, NS. NAFO SRC- Doc. 93/45. Ser. No. N2226. 13 p.

Stenson, G.B., R.A. Myers, W.G. Warren, and I.H. Ni. 1996. Pup production of hooded seals (*Cystophora cristata*) in the Northwest Atlantic. Oceanographic Literature Review 44(7):741–742.

Stenson, G.B. and B. Sjare. 1996. Newfoundland hooded seal tag returns in the Northeast Atlantic. NAFO Scientific Council Studies 26:115–118.

Tucker, S., W.D. Bowen, S.J. Iverson, W. Blanchard, and G.B. Stenson. 2009. Sources of variation in diets of harp and hooded seals estimated from quantitative fatty acid signature analysis (QFASA). Marine Ecology Progress Series 384:287–302. doi: 10.3354/meps08000

Humpback whale − *Megaptera novaeangliae*

Gulf of Maine Stock

Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 100% of scores≥ 2

	Megaptera novaeangliae	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	3.0	
	Habitat Specificity	2.2	3.0	
	Site Fidelity	2.8	3.0	
	Lifetime Reproductive Potential	1.0	2.9	
	Generation Length	2.4	2.5	
	Reproductive Plasticity	3.2	3.0	
	Migration	1.4	2.4	
	Home Range	1.6	3.0	
	Stock Abundance	2.2	2.9	
	Stock Abundance Trend	1.1	2.8	
	Cumulative Stressors	3.0	3.0	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	3.0	
	Sea Surface Temperature (Change in variability)	1.2	3.0	
	Air Temperature (Change in mean)	3.4	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.2	2.6	
	Precipitation (Change in variability)	1.4	2.6	
	Sea Surface Salinity (Change in mean)	1.9	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	3.4	3.0	
	Ocean pH (Change in variability)	1.2	3.0	
	Sea ice coverage (Change in mean)	1.1	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.5	2.6	
	Dissolved oxygen (Change in variability)	1.2	2.6	
	Circulation	2.1	3.0	
	Sea level rise	1.9	3.0	
	Exposure Score	High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Humpback whale (Gulf of Maine Stock)

Megaptera novaeangliae

CVA Results Summary

Overall Climate Vulnerability Rank: High (53% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.60), Dissolved oxygen (Standard anomaly) (3.52), Air Temperature (Standard anomaly) (3.40), and Ocean pH (Standard anomaly) (3.40).

Biological Sensitivity: High. Two sensitivity attributes scored greater than or equal to 3.0: Reproductive Plasticity (3.24) and Cumulative Stressors (3.05).

Distributional Response: High

Abundance Response: High

Phenology Response: High

Data Quality: 100% of the data quality scores were 2 or greater, 100% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The humpback whale Gulf of Maine stock includes individuals that feed in Gulf of Maine and adjacent waters (Waring et al. 2000; Hayes et al. 2020).

Prey/Diet Specificity

Humpback whales in Gulf of Maine waters feed generally on fish — herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), mackerel (*Scomber scombrus*), and other small fishes — and euphausiids (Kenney and Winn 1986; Payne et al. 1986; Payne et al. 1990; Hain et al. 1995; Kenney et al. 1996; Paquet et al. 1997).

Habitat Specificity

Humpback whales in the Gulf of Maine feed in shallow coastal waters associated with ledges and high relief (Payne et al. 1986, 1990; Hamazaki 2002). Elsewhere it has been demonstrated that they also use oceanographic features such as thermal fronts (Doniol-Valcroze et al. 2007). In a worldwide analysis, Rasmussen (2012) found that humpback wintering grounds were found in warm waters of 21.1°–28.38°C. The West Indies wintering grounds were found to average 26.11°C (SD=0.27) during February, the month of peak calving occurrence (Winn et al. 1975; Whitehead and Moore 1982; Rasmussen 2012).

Site Fidelity

Humpback whales show maternally-directed site fidelity to feeding grounds in the western North Atlantic (Martin et al. 1984; Clapham and Mayo 1987b).

Lifetime Reproductive Potential

The average calving interval is in the range of two to three years (Clapham and Mayo 1990; Barlow and Clapham 1997; Robbins 2007). Consecutive year calving can occur (Clapham and Mayo 1987b; Weinrich et al. 1993; Robbins 2007).

Females of this stock can produce their first calf as early as age 5 (Clapham and Mayo 1987a; Clapham 1992, Robbins 2007) but the average is closer to 9 years (Robbins 2007). In 2021, the oldest reproducing female was known to be at least 44 years old (Center for Coastal Studies, unpublished data).

Generation Length

Taylor et al. (2007) estimated the generation length of 14.5 years at r=0.05 and 21.5 years at r=0.0 and assuming a female reproductive span from age 6–55 years.

Reproductive Plasticity

Humpback whale breeding grounds are generally characterized by warm, shallow, low-relief ocean bottom in sheltered areas (Ersts and Rosenbaum 2003; Sanders et al. 2005; Rasmussen et al. 2007; Rasmussen 2012). Individuals of the Gulf of Maine stock mate and calve with other North Atlantic humpback whales in the West Indies during winter time (Katona and Beard 1990; Palsbøll et al. 1997; Stevick et al. 2003a). Although humpback whales can be found throughout the Antillean arc during the winter time, the majority of the population occurs within Dominican Republic waters from January through March (Winn et al. 1975; Levenson and Leapley 1978; Balcomb and Nichols 1982; Whitehead and Moore 1982; Price 1985; Mattila and Clapham 1989; Mattila et al. 1989, 1994). A portion of the North Atlantic population may overwinter in an as-yet-unidentified location (IWC 2002; Punt et al. 2006; Smith and Pike 2009).

Migration

Humpback whales in the Gulf of Maine feeding stock undergo long-distance migration between the breeding grounds in the West Indies and the feeding grounds in the Gulf of Maine (Katona and Beard 1990; Palsbøll et al. 1997; Smith et al. 1999; Stevick et al. 2003a). Some individuals may not complete the migration every year, because some individuals are sighted within the Gulf of Maine and other mid- and high-latitude waters during the winter (CETAP 1982; Clapham et al. 1993; Swingle et al. 1993; Robbins 2007).

Home Range

Humpback whales are known to cover distances of several hundred kilometers while foraging (Stevick et at. 2016) and breeding in addition to long-distance migration in the North Atlantic (e.g., Kennedy et al. 2014) and in other regions (e.g., Zerbini et al. 2006; Lagerquist et al. 2008; Hauser et al. 2010; Rosenbaum et al. 2014)

Stock Abundance

Hayes et al. (2020) considered the best abundance estimate for stock assessment purposes to be 1,396 individuals (95% credible intervals 1363−1429) in 2016 based on the results of a state-space model using photo-identification data (Robbins and Pace 2018). Although other types of estimates were available, the mark-recapture approach produced a long series of high precision estimates suitable for detecting population trends (Hayes et al. 2020).

Stock Abundance Trend

Robbins and Pace (2018) suggested the stock abundance increased at 2.8% per year during the period 2000−2016. Clapham et al. (2003) estimated the humpback whale Gulf of Maine rate of increase at 0–4% per year during the period 1992–2000. Barlow and Clapham (1997) estimated the humpback whale Gulf of Maine rate of increase at 6.5% (SE=0.012) per year during the period 1979–1991.

Other estimates of population trend that included, but were not exclusive to, the Gulf of Maine feeding stock include an estimated average trend of 3.1% per year (SE=0.005) for the entire North Atlantic population during the period 1979–1993 (Stevick et al. 2003b) and an estimated average trend of 3.1% per year (SE=0.005) for the West Indies breeding population that includes the Gulf of Maine feeding stock during the period 1979–1993 (Stevick et al. 2003b).

Cumulative Stressors

Threats to the humpback whale Gulf of Maine feeding stock include fisheries interactions (e.g., pot and gillnet gear entanglements) and vessel strikes (Robbins 2010, 2011, 2012; Van der Hoop et al. 2013; Hill et al. 2017).

During the time period 2013–2017, minimum annual average human-caused mortality and serious injury was 12.15 individuals, which includes fisheries interactions (7.75 individuals per year) and vessel strikes (4.4 individuals per year; Henry et al. 2020).

There have been several humpback whale Unusual Mortality Events (UMEs) in the western North Atlantic, including during late 1987–early 1988 due to saxitoxin poisoning (Geraci et al. 1989), and additional events from undetermined causes in 1990, 2003, 2005 and 2006. The latest UME started in 2016 and is ongoing (NMFS 2021).

Distribution and Sightings

Density model results for humpback whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017), Mannocci et al. (2017), Chavez-Rosales et al. (2019), Palka et al. (2021a, 2021b).

Further Reading

Bettridge, S., C.S. Baker, J. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D.K. Mattila, R.M. Pace III, P.E. Rosel, G.K. Silber, and P.R. Wade. 2015. Status review of the humpback whale (*Megaptera novaeangliae*) under the Endangered Species Act. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: NOAA Technical Memorandum NMFS-SWFSC-540. 240 p.
Clapham, P.J. 2018. Humpback Whale: *Megaptera novaeangliae*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 489–492. doi: 10.1016/B978-0-12-804327-1.00154-0
Cooke, J.G. 2018. *Megaptera novaeangliae*. The IUCN Red List of Threatened Species 2018: e.T13006A50362794. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T13006A50362794.en
Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

References

Balcomb, K.C. and G. Nichols. 1982. Humpback whale censuses in the West Indies. Reports of the International Whaling Commission 32:401–406.
Barlow, J. and P.J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecology 78(2):535–546.
Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.
Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6
Clapham, P.J. 1992. Age at attainment of sexual maturity in humpback whales, *Megaptera-novaeangliae*. Canadian Journal of Zoology 70(7):1470–1472. doi: 10.1139/z92-202
Clapham, P.J., J. Barlow, M. Bessinger, T. Cole, D. Mattila, R. Pace, D. Palka, J. Robbins, and R. Seton. 2003. Abundance and demographic parameters of humpback whales from the Gulf of Maine, and stock definition relative to the Scotian Shelf. Journal of Cetacean Research and Management 5:13–22.
Clapham, P.J., D.K. Mattila, and P.J. Palsboll. 1993. A high-latitude-area composition of humpback whale competitive groups in Samana Bay - further evidence for panmixis in the North-Atlantic population. Canadian Journal of Zoology 71(5):1065–1066. doi: 10.1139/z93-142
Clapham, P.J. and C.A. Mayo. 1987a. The attainment of sexual maturity in 2 female humpback whales. Marine Mammal Science 3(3):279–283. doi: 10.1111/j.1748-7692.1987.tb00170.x
Clapham, P.J. and C.A. Mayo. 1987b. Reproduction and recruitment of individually identified humpback whales, *Megaptera-novaeangliae*, observed in Massachusetts Bay, 1979-1985. Canadian Journal of Zoology 65(12):2853–2863. doi: 10.1139/z87-434
Clapham, P.J. and C.A. Mayo. 1990. Reproduction of humpback whales, *Megaptera novaeangliae*, observed in the Gulf of Maine. Reports of the International Whaling Commission (Special Issue) 12:171–175.
Doniol-Valcroze, T., D. Berteaux, P. Larouche, and R. Sears. 2007. Influence of thermal fronts on habitat selection by four rorqual whale species in the Gulf of St. Lawrence. Marine Ecology Progress Series 335:207–216. doi: 10.3354/meps335207
Ersts, P.J. and H.C. Rosenbaum. 2003. Habitat preference reflects social organization of humpback whales (*Megaptera novaeangliae*) on a wintering ground. Journal of Zoology 260:337–345. doi: 10.1017/S0952836903003807

Geraci, J.R., D.M. Anderson, R.J. Timperi, D.J. Staubin, G.A. Early, J.H. Prescott, and C.A. Mayo. 1989. Humpback whales (*Megaptera-novaeangliae*) fatally poisoned by dinoflagellate toxin. Canadian Journal of Fisheries and Aquatic Sciences 46(11):1895–1898. doi: 10.1139/f89-238

Glockner-Ferrari, D.A. and M.J. Ferrari. 1990. Reproduction in the humpback whale (*Megaptera novaeangliae*) in Hawaiian waters, 1975–1988: The life history, reproductive rates and behavior of known individuals identified through surface and underwater photography. Reports of the International Whaling Commission (Special Issue) 12:161–169.

Hain, J.H.W., S.L. Ellis, R.D. Kenney, P.J. Clapham, B.K. Gray, M.T. Weinrich, and I.G. Babb. 1995. Apparent bottom feeding by humpback-whales on Stellwagen Bank. Marine Mammal Science 11(4):464–479. doi: 10.1111/j.1748-7692.1995.tb00670.x

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hauser, N., A.N. Zerbini, Y. Geyer, M.P. Heide-Jorgensen, and P. Clapham. 2010. Movements of satellite-monitored humpback whales, *Megaptera novaeangliae*, from the Cook Islands. Marine Mammal Science 26(3):679–685. doi: 10.1111/j.1748-7692.2009.00363.x

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Henry, A., M. Garron, D.M. Morin, A. Reid, W. Ledwell, and T.V.N. Cole. 2020. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2013-2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-06. 53 p. doi: 10.25923/fbc7-ky15

Hill, A.N., C. Karniski, J. Robbins, T. Pitchford, S. Todd, and R. Asmutis-Silvia. 2017. Vessel collision injuries on live humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Marine Mammal Science 33(2):558–573. doi: 10.1111/mms.12386

International Whaling Commission (IWC). 2002. Report of the Scientific Committee. Annex H: Report of the Subcommittee on the Comprehensive Assessment of North Atlantic humpback whales. Journal of Cetacean Research and Management 4 (Supplement):230–260.

Katona, S.K. and J.A. Beard. 1990. Population size, migrations and feeding aggregations of the humpback whale (*Megaptera novaeangliae*) in the western North Atlantic Ocean. Reports of the International Whaling Commission (Special Issue) 12:295–305.

Kennedy, A.S., A.N. Zerbini, O.V. Vasquez, N. Gandilhon, P.J. Clapham, and O. Adam. 2014. Local and migratory movements of humpback whales (*Megaptera novaeangliae*) satellite-tracked in the North Atlantic Ocean. Canadian Journal of Zoology 92(1):9–18. doi: 10.1139/cjz-2013-0161

Kenney, R.D., P.M. Payne, D.J. Heinemann, and H.E. Winn. 1996. Shifts in Northeast shelf cetacean distributions relative to trends in Gulf of Maine/Georges Bank finfish abundance. In: K. Sherman, N.A.J., and T. J. Smayda (Ed.), The Northeast Shelf ecosystem: assessment, sustainability, and management. Blackwell Science, Boston. pp. 169–196.

Kenney, R.D. and H.E. Winn. 1986. Cetacean high-use habitats of the Northeast United-States continental-shelf. Fishery Bulletin 84(2):345–357.

Lagerquist, B.A., B.R. Mate, J.G. Ortega-Ortiz, M. Winsor, and J. Urbán-Ramirez. 2008. Migratory movements and surfacing rates of humpback whales (*Megaptera novaeangliae*) satellite tagged at Socorro Island, Mexico. Marine Mammal Science:???–??? doi: 10.1111/j.1748-7692.2008.00217.x

Levenson, C. and W.T. Leapley. 1978. Distribution of humpback whales (*Megaptera novaeangliae*) in the Caribbean determined by a rapid acoustic method. Journal of the Fisheries Board of Canada 35:1150–1152. doi: 10.1139/f78-180

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Martin, A.R., S.K. Katona, D. Matilla, D. Hembree, and T.D. Waters. 1984. Migration of humpback whales between the Caribbean and Iceland. Journal of Mammalogy 65(2):330–333. doi: 10.2307/1381174

Mattila, D.K. and P.J. Clapham. 1989. Humpback whales, *Megaptera-novaeangliae*, and other cetaceans on Virgin Bank and in the Northern Leeward Islands, 1985 and 1986. Canadian Journal of Zoology 67(9):2201–2211. doi: 10.1139/z89-311

Mattila, D.K., P.J. Clapham, S.K. Katona, and G.S. Stone. 1989. Population composition of humpback whales, *Megaptera-novaeangliae*, on Silver Bank, 1984. Canadian Journal of Zoology 67(2):281–285. doi: 10.1139/z89-041

Mattila, D.K., P.J. Clapham, O. Vasquez, and R.S. Bowman. 1994. Occurrence, population composition, and habitat use of humpback whales in Samana Bay, Dominican-Republic. Canadian Journal of Zoology 72(11):1898–1907. doi: 10.1139/z94-258

National Marine Fisheries Service (NMFS). 2021. Active and closed Unusual Mortality Events. https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

Pace, R.M., III, P.J. Corkeron, and S.D. Kraus. 2017. State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right whales. Ecology and Evolution 7(21):8730–8741. doi: 10.1002/ece3.3406

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palsbøll, P.J., J. Allen, M. Berube, P.J. Clapham, T.P. Feddersen, P.S. Hammond, R.R. Hudson, H. Jorgensen, S. Katona, A.H. Larsen, F. Larsen, J. Lien, D.K. Mattila, J. Sigurjonsson, R. Sears, T. Smith, R. Sponer, P. Stevick, and N. Oien. 1997. Genetic tagging of humpback whales. Nature 388(6644):767–769. doi: 10.1038/42005

Palsbøll, P.J., P.J. Clapham, D.K. Mattila, F. Larsen, R. Sears, H.R. Siegismund, J. Sigurjonsson, O. Vasquez, and P. Arctander. 1995. Distribution of mtDNA haplotypes in North-Atlantic humpback whales - the influence of behavior on population-structure. Marine Ecology Progress Series 116(1-3):1–10. doi: 10.3354/meps116001

Paquet, D., C. Haycock, and H. Whitehead. 1997. Numbers and seasonal occurrence of humpback whales (*Megaptera novaeangliae*) off Brier Island, Nova Scotia. Canadian Field-Naturalist 111:548–552.

Payne, P.M., J.R. Nicolas, L. Obrien, and K.D. Powers. 1986. The distribution of the humpback whale, *Megaptera-novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes-americanus*. Fishery Bulletin 84(2):271–277.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fishery Bulletin 88(4):687–696.

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Punt, A.E., N.A. Friday, and T.D. Smith. 2006. Reconciling data on the trends and abundance of North Atlantic humpback whales within a population modelling framework. Journal of Cetacean Research and Management 8:145–159.

Rasmussen, K. 2012. Comparison of two distinct humpback whale populations (*Megaptera novaeangliae*) off Pacific Central American waters San Francisco State University. Dissertation.

Rasmussen, K., D.M. Palacios, J. Calambokidis, M.T. Saborío, L. Dalla Rosa, E.R. Secchi, G.H. Steiger, J.M. Allen, and G.S. Stone. 2007. Southern Hemisphere humpback whales wintering off Central America: insights from water temperature into the longest mammalian migration. Biology Letters 3(3):302–305. doi: 10.1098/rsbl.2007.0067

Robbins, J. 2007. Structure and dynamics of the Gulf of Maine humpback whale population. University of St. Andrews. Ph.D. Thesis. 179 p.

Robbins, J. 2010. Scar-based inference into Gulf of Maine humpback whale entanglement: 2008. Report to the Northeast Fisheries Science Center. Woods Hole, MA. 18 p.

Robbins, J. 2011. Scar-based inference into Gulf of Maine humpback whale entanglement: 2009. Report to the Northeast Fisheries Science Center. Woods Hole, MA. 27 p.

Robbins, J. 2012. Scar-based inference into Gulf of Maine humpback whale entanglement: 2010. Report to the Northeast Fisheries Science Center. Woods Hole, MA. 28 p.

Robbins, J. and R.M. Pace. 2018. Trends in abundance of North Atlantic humpback whales in the Gulf of Maine. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Contract EE133F-17-SE-1320, Task I. 40 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Rosenbaum, H.C., S.M. Maxwell, F. Kershaw, and B. Mate. 2014. Long-range movement of humpback whales and their overlap with anthropogenic activity in the South Atlantic ocean. Conservation Biology 28(2):604–615. doi: 10.1111/cobi.12225

Sanders, I.M., J.C. Barrios-Santiago, and R.S. Appeldoorn. 2005. Distribution and relative abundance of humpback whales off western Puerto Rico during 1995-1997. Caribbean Journal of Science 41(1):101–107.

Smith, T.D., J. Allen, P.J. Clapham, P.S. Hammond, S. Katona, F. Larsen, J. Lien, D. Mattila, P.J. Palsboll, J. Sigurjonsson, P.T. Stevick, and N. Oien. 1999. An ocean-basin-wide mark-recapture study of the

North Atlantic humpback whale (*Megaptera novaeangliae*). Marine Mammal Science 15(1):1–32. doi: 10.1111/j.1748-7692.1999.tb00779.x
Smith, T.D. and D.G. Pike. 2009. The enigmatic whale: the North Atlantic humpback. NAMMCO Scientific Publications 7:161–178. doi: 10.7557/3.2712
Stevick, P.T., J. Allen, M. Berube, P.J. Clapham, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsboll, J. Robbins, J. Sigurjonsson, T.D. Smith, N. Oien, and P.S. Hammond. 2003a. Segregation of migration by feeding ground origin in North Atlantic humpback whales (*Megaptera novaeangliae*). Journal of Zoology 259:231–237. doi: 10.1017/S0952836902003151
Stevick, P.T., J. Allen, P.J. Clapham, N. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsboll, J. Sigurjonsson, T.D. Smith, N. Oien, and P.S. Hammond. 2003b. North Atlantic humpback whale abundance and rate of increase four decades after protection from whaling. Marine Ecology Progress Series 258:263–273. doi: 10.3354/meps258263
Stevick, P.T., S.D. Berrow, M. Bérubé, L. Bouveret, F. Broms, B. Jann, A. Kennedy, P. López Suárez, M. Meunier, C. Ryan, and F. Wenzel. 2016. There and back again: multiple and return exchange of humpback whales between breeding habitats separated by an ocean basin. Journal of the Marine Biological Association of the United Kingdom 96(4):885–890. doi: 10.1017/s0025315416000321
Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. Mclellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Marine Mammal Science 9(3):309–315. doi: 10.1111/j.1748-7692.1993.tb00458.x
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Van der Hoop, J.M., M.J. Moore, S.G. Barco, T.V.N. Cole, P.Y. Daoust, A.G. Henry, D.F. Mcalpine, W.A. McLellan, T. Wimmer, and A.R. Solow. 2013. Assessment of management to mitigate anthropogenic effects on large whales. Conservation Biology 27(1):121–133. doi: 10.1111/j.1523-1739.2012.01934.x
Waring, G.T., J.M. Quintal, and S.L. Swartz. 2000. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments--2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-162. 301 p.
Weinrich, M., M. Martin, R. Griffiths, J. Bove, and M. Schilling. 1997. A shift in distribution of humpback whales, *Megaptera novaeangliae*, in response to prey in the southern Gulf of Maine. Fishery Bulletin 95(4):826–836.
Whitehead, H. and M.J. Moore. 1982. Distribution and movements of West-Indian humpback whales in winter. Canadian Journal of Zoology 60(9):2203–2211. doi: 10.1139/z82-282
Winn, H.E., R.K. Edel, and A.G. Taruski. 1975. Population estimate of the humpback whale (*Megaptera novaeangliae*) in the West Indies by visual and acoustic techniques. Journal of the Fisheries Board of Canada 32:499–506. doi: 10.1139/f75-061
Zerbini, A.N., P.J. Clapham, and P.R. Wade. 2010. Assessing plausible rates of population growth in humpback whales from life-history data. Marine Biology 157(6):1225–1236. doi: 10.1007/s00227-010-1403-y

Killer whale − *Orcinus orca*

Gulf of Mexico Stock

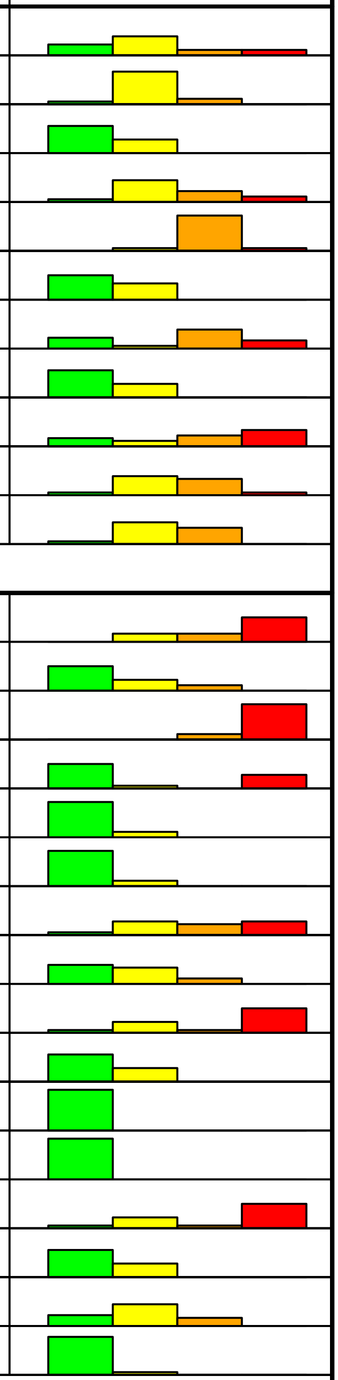
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 85% of scores ≥ 2

	Orcinus orca	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.0	
	Habitat Specificity	2.1	2.3	
	Site Fidelity	1.3	1.3	
	Lifetime Reproductive Potential	2.5	2.3	
	Generation Length	3.0	2.3	
	Reproductive Plasticity	1.4	2.0	
	Migration	2.6	1.0	
	Home Range	1.3	2.0	
	Stock Abundance	2.9	2.7	
	Stock Abundance Trend	2.5	0.7	
	Cumulative Stressors	2.3	1.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	3.0	
	Sea Surface Temperature (Change in variability)	1.5	3.0	
	Air Temperature (Change in mean)	3.9	3.0	
	Air Temperature (Change in variability)	2.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	2.9	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	3.2	3.0	
	Ocean pH (Change in variability)	1.3	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.2	3.0	
	Dissolved oxygen (Change in variability)	1.3	3.0	
	Circulation	1.9	2.3	
	Sea level rise	1.1	2.3	
	Exposure Score	High		
	Overall Vulnerability Rank	Moderate		



Low
Moderate
High
Very High

Killer whale (Gulf of Mexico Stock)

Orcinus orca

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (63% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than or equal to 3.0: Air Temperature (Standard anomaly) (3.87), Sea Surface Temperature (Standard anomaly) (3.40), Dissolved oxygen (Standard anomaly) (3.20), and Ocean pH (Standard anomaly) (3.20).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than or equal to 2.5: Generation Time (3.00), Species Abundance (2.87), and Migration (2.60).

Distributional Response: Very High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 85 % of the data quality scores were 2 or greater. 64 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The killer whale Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Killer whale diets vary regionally and may consist of prey including fish, cephalopods, seabirds, sea turtles, and other marine mammals (Katona et al. 1988; Jefferson et al. 1991; Fertl et al. 1996; Ford 2018). Killer whales in the Gulf of Mexico were observed preying on a pantropical spotted dolphin (Pitman et al. 2003) and may prey on other marine mammal species (Whitt et al. 2015). They may also prey on large fish such as tuna which are common in the Gulf of Mexico.

Habitat Specificity

In the northern Gulf of Mexico, killer whales are found primarily in oceanic waters (O'Sullivan and Mullin 1997) and are rarely reported in shelf waters (Katona et al. 1988). Garrison and Aichinger Dias (2020) report that the main area of occurrence is in the central Gulf off the Mississippi River Delta.

Site Fidelity

During GoMMAPPS Summer 2017 survey, there was a photo match for killer whale to previous sighting in 2001 (Rappucci and Garrison 2019). Previous studies have found individuals resighted over a 5-year period, and one individual resighted over 10 years (O'Sullivan and Mullin 1997)

Lifetime Reproductive Potential

Taylor et al. (2007) estimated killer whale interbirth interval of 5.02 years based on data reported by Perrin and Reilly (1984) and Christensen (1984).

Taylor et al. (2007) reported killer whale age at first reproduction of 14 years and age at last reproduction of 41 years (observed) and 48 years (estimated) based on data reported by Olesiuk et al. (1990).

Generation Length

Taylor et al. (2007) reported generation length of 24.0 years at r = 0.02 and 25.7 years at r = 0.0.

Reproductive Plasticity

Information regarding killer whale reproductive seasonality, habitat, and/or location in the Gulf of Mexico was not found in the literature.

Migration

Killer whales were observed in the northern Gulf of Mexico only during summer months of GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000). Vessel surveys and opportunistic sightings suggest killer whales are present in the northern Gulf of Mexico during summer and fall (O'Sullivan and Mullin 1997; Mullin and Fulling 2004; Maze-Foley and Mullin 2006).

Home Range

In the Gulf of Mexico, individuals have been resighted over 1,100km (O'Sullivan and Mullin 1997).

Stock Abundance

The abundance of killer whales in the northern Gulf of Mexico is estimated to be 267 individuals (CV=0.75), based on 2017 and 2018 surveys (Garrison et al. 2020). Previous abundance estimates of killer whales in the northern Gulf of Mexico include 1991–1994 (277 individuals; CV=0.42; Hansen et al. 1995); 1996–2001 (133 individuals; CV=0.49; Mullin and Fulling 2004); 2003–2004 (49 individuals; CV=0.77; Mullin 2007); and 2009 (28 individuals; CV=1.02; Waring et al. 2012).

Stock Abundance Trend

Five point estimates of killer whale abundance have been made based on data from surveys in 2003 (0), 2004 (198; CV=1.002), 2009 (52; CV=0.97), 2017 (86; CV=0.87), and 2018 (450; CV=0.88). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021). However, imprecise estimates make comparisons between years difficult (Hayes et al. 2021).

Cumulative Stressors

Killer whales in the Gulf of Mexico interact with longline fisheries. During the time period 2014–2018, annual average fishery-related mortality or serious injury was zero (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the time period 2014–2018, no killer whales were reported stranded along the U.S. Gulf of Mexico coast (Hayes et al. 2021).

The killer whale stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for killer whales in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Ford, J.K.B. 2018. Killer Whale: *Orcinus orca*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 531–537. doi: 10.1016/B978-0-12-804327-1.00010-8

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Reeves, R., R.L. Pitman, and J.K.B. Ford. 2017. *Orcinus orca*. The IUCN Red List of Threatened Species 2017: e.T15421A50368125. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15421A50368125.en

References

Christensen, I. 1984. Growth and reproduction of killer whales, (*Orcinus orcu*), in Norwegian coastal waters. Reports of the International Whaling Commission (Special Issue) 6:253–258.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fertl, D. and A. AcevedoGutierrez. 1996. A report of killer whales (*Orcinus orca*) feeding on a carcharhinid shark in Costa Rica. Marine Mammal Science 12(4):606–611.

Ford, J.K.B. 2018. Killer whale: *Orcinus orca*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 531–537. doi: 10.1016/B978-0-12-804327-1.00010-8

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hansen, L.J., K.D. Mullin, and C.L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. MIA-94/95-25. 9 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A., P.J. Stacey, and R.W. Baird. 1991. A review of killer whale interactions with other marine mammals - predation to coexistence. Mammal Review 21(4):151–180. doi: 10.1111/j.1365-2907.1991.tb00291.x

Katona, S.K., J.A. Beard, P.E. Girton, and F. Wenzel. 1988. Killer whales (*Orcinus orca*) from the Bay of Fundy to the Equator, including the Gulf of Mexico. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:205–224.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mullin, K.D. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Pascagoula, MS. 26 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Olesiuk, P.F., M.A. Bigg, and G.M. Ellis. 1990. Life history and population dynamics of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Reports of the International Whaling Commission (Special Issue) 12:209–243.

O'Sullivan, S. and K.D. Mullin. 1997. Killer whales (*Orcinus orca*) in the northern Gulf of Mexico. Marine Mammal Science 13(1):141–147. doi: 10.1111/j.1748-7692.1997.tb00618.x

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Pitman, R.L., S. O'Sullivan, and B. Mase. 2003. Killer whales (*Orcinus orca*) attack a school of pantropical spotted dolphins (*Stenella attenuata*) in the Gulf of Mexico. Aquatic Mammals 29(3):321–324.

Rappucci, G. and L. Garrison. 2019. SEFSC GoMMAPPS Vessel Survey 2017 Summer. Data downloaded from OBIS-SEAMAP (http://seamap.env.duke.edu/dataset/1980).

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G. Lockhart. 2015. Density model for killer whale (*Orcinus orca*) for the U.S. Gulf of Mexico version 1.3, 2015-09-30, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 35 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

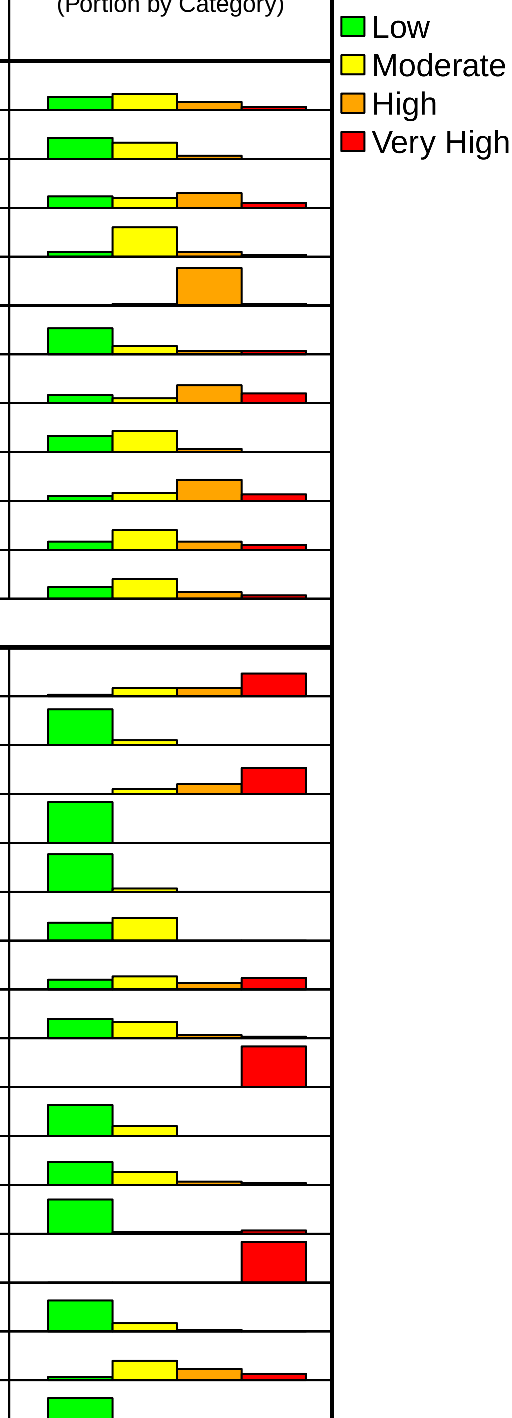
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Whitt, A.D., M.A. Baran, M. Bryson, and L.E. Rendell. 2015. First report of killer whales harassing sperm whales in the Gulf of Mexico. Aquatic Mammals 41(3):252–255. doi: 10.1578/AM.41.3.2015.252

Killer whale − *Orcinus orca*
Western North Atlantic Stock

Overall Vulnerability Rank = High
Biological Sensitivity = Moderate
Climate Exposure = Very High
Data Quality = 70% of scores ≥ 2

	Orcinus orca	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.0	
	Habitat Specificity	1.6	1.6	
	Site Fidelity	2.3	1.8	
	Lifetime Reproductive Potential	2.1	2.0	
	Generation Length	3.0	2.0	
	Reproductive Plasticity	1.6	1.4	
	Migration	2.7	1.4	
	Home Range	1.7	1.8	
	Stock Abundance	2.7	0.4	
	Stock Abundance Trend	2.2	0.4	
	Cumulative Stressors	2.0	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.3	2.4	
	Sea Surface Temperature (Change in variability)	1.1	2.4	
	Air Temperature (Change in mean)	3.5	2.4	
	Air Temperature (Change in variability)	1.0	2.6	
	Precipitation (Change in mean)	1.1	2.4	
	Precipitation (Change in variability)	1.6	2.4	
	Sea Surface Salinity (Change in mean)	2.5	2.4	
	Sea Surface Salinity (Change in variability)	1.7	2.4	
	Ocean pH (Change in mean)	4.0	2.6	
	Ocean pH (Change in variability)	1.2	2.4	
	Sea ice coverage (Change in mean)	1.6	2.0	
	Sea ice coverage (Change in variability)	1.4	2.0	
	Dissolved oxygen (Change in mean)	4.0	2.6	
	Dissolved oxygen (Change in variability)	1.3	2.4	
	Circulation	2.5	1.6	
	Sea level rise	1.2	2.2	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Killer whale (Western North Atlantic)

Orcinus orca

CVA Results Summary

Overall Climate Vulnerability Rank: High (57% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Air Temperature (Standard anomaly) (3.52).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Generation Time (3.00), Migration (2.72), and Species Abundance (2.72).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 70% of the data quality scores were 2 or greater. 36% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The killer whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore and Canadian waters (Waring et al. 2014). Killer whales are considered uncommon in U.S. and Canadian waters in the western North Atlantic (Katona et al. 1988; Mitchell and Reeves 1988).

Prey/Diet Specificity

Killer whale diets vary regionally and may consist of prey including fish, cephalopods, seabirds, sea turtles, and other marine mammals such as dolphins and minke whales (*Balaenoptera acutorostrata*; Katona et al. 1988; Jefferson et al. 1991; Fertl et al. 1996; Ford 2018). In the eastern North Atlantic, killer whales are known to consume a variety of fish including herring (*Clupea harengus*), salmon (*Salmo spp*.), mackerel (*Scomber scombrus*), cod (*Gadus morhua*), squid, seals , and bottlenose whales (*Hyperoodon ampullatus*; Jonsgård 1968; Jonsgård and Lyshoel 1970; Christensen 1978, 1982, 1988; Øien 1988; Bloch and Lockyer 1988; Evans 1988; Sigurjonsson et al. 1988).

Habitat Specificity

In the western North Atlantic, killer whales are found most frequently along the shelf break and in oceanic waters (Katona et al. 1988; Mitchell and Reeves 1988). Nearshore sightings are more common off Newfoundland and southern Labrador than other areas of the western North Atlantic (Lawson and Stevens 2013).

Site Fidelity

Information regarding killer whale site fidelity in the western North Atlantic is limited. Some killer whales off Newfoundland and southern labrador appear to return to the same general coastal location over multiple years, indicating some level of inter-annual site fidelity (Lawson and Stevens 2013). Elsewhere in the North Atlantic, killer whales show high inter-annual site fidelity (Bisther and Vongraven 1995; Similä et al. 1996; Foote et al. 2010).

Lifetime Reproductive Potential

Taylor et al. (2007) estimated killer whale interbirth interval of 5.02 years based on data reported by Perrin and Reilly (1984) and Christensen (1984).

Taylor et al. (2007) reported killer whale age at first reproduction of 14 years and age at last reproduction of 41 years (observed) and 48 years (estimated) based on data reported by Olesiuk et al. (1990).

Generation Length

Taylor et al. (2007) reported killer whale generation length of 24.0 years at r = 0.02 and 25.7 years at r = 0.0.

Reproductive Plasticity

Information regarding killer whale reproductive seasonality, habitat, and/or location in the western North Atlantic was not found in the literature.

Migration

Killer whale sightings in eastern Canada show some seasonality, with more frequent sightings between June and September, although this observation may be due to seasonal differences in effort(Lawson and Stevens 2013). A general progression of sightings off Newfoundland and southern Labrador from south to north in the spring and early summer has been observed and may be linked to annual sea ice recession (Lawson and Stevens 2013).

Home Range

Information regarding killer whale home range in the western North Atlantic was not found in the literature. The range of the stock extends from the Arctic ice edge to the West Indies. In the Gulf of Mexico, individuals have been resighted over 1,100km (O'Sullivan and Mullin 1997). Killer whales off eastern Canada are highly mobile and appear to exhibit transient-type movement and residency patterns (Lawson and Stevens 2013).

Stock Abundance

The total number of killer whales off the eastern U.S. coast is unknown (Waring et al. 2014).

Stock Abundance Trend

Insufficient data exist to calculate a stock abundance trend (Waring et al. 2014).

Cumulative Stressors

Killer whales in the western North Atlantic interact with gillnet fisheries, with one recorded instance of a killer whale caught in the New England multispecies sink gillnet fishery released alive in 1994 (Waring et al. 2014). In eastern Canada, annual mortality averages 0.5 individuals per year (Lawson and Stevens 2013). Other likely stressors to the population include anthropogenic noise, contaminants, and pollution.

Distribution and Sightings

Density model results for killer whales in the western North Atlantic are presented by Roberts et al. (2016a, b).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Ford, J.K.B. 2018. Killer whale: *Orcinus orca*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 531–537. doi: 10.1016/B978-0-12-804327-1.00010-8

Reeves, R., R.L. Pitman, and J.K.B. Ford. 2017. *Orcinus orca*. The IUCN Red List of Threatened Species 2017: e.T15421A50368125. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15421A50368125.en

Waring, G.T., E. Josephson, K. Maze-Foley, P.E. Rosel, T.V.N. Cole, L. Engleby, L.P. Garrison, A. Henry, K. Mullin, C. Orphanides, R.M. Pace, D.L. Palka, M. Lyssikatos, and F.W. Wenzel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. Northeast Fisheries Science Center: NOAA technical memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

References

Bisther, A. and D. Vongraven. 1995. Studies of the social ecology of Norwegian killer whales (*Orcinus orca*). In: Blix, A.S., L. Walløe, and Ø. Ulltang (Eds.), Whales, seals, fish and man. Elsevier, Amsterdam. pp. 169–176.

Bloch, D. and C. Lockyer. 1988. Killer whales (*Orcinus orca*) in Faroese waters. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:55–64.

Christensen, I. 1978. Spekkhoggeren (*Orcinus orca*) i det nordøstlige Atlanterhav. (The killer whale (*Orcinus orca*) in the northeast Atlantic). Fisken Havet 1:23–31.

Christensen, I. 1982. Killer whales in Norwegian coastal waters. Reports of the International Whaling Commission 32:633–672.

Christensen, I. 1984. Growth and reproduction of killer whales, (*Orcinus orcu*), in Norwegian coastal waters. Reports of the International Whaling Commission (Special Issue) 6:253–258.

Christensen, I. 1988. Distribution, movements and abundance of killer whales (*Orcinus orca*) in Norwegian coastal waters, 1982-1987, based on questionnaire surveys. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik):79–88.

Evans, P.G. 1988. Killer whales (*Orcinus orca*) in British and Irish waters. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:42–54.

Fertl, D. and A. AcevedoGutierrez. 1996. A report of killer whales (*Orcinus orca*) feeding on a carcharhinid shark in Costa Rica. Marine Mammal Science 12(4):606–611.

Foote, A.D., T. Similä, G.A. Víkingsson, and P.T. Stevick. 2009. Movement, site fidelity and connectivity in a top marine predator, the killer whale. Evolutionary Ecology 24(4):803–814. doi: 10.1007/s10682-009-9337-x

Ford, J.K.B. 2018. Killer whale: *Orcinus orca*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 531–537. doi: 10.1016/B978-0-12-804327-1.00010-8

Jefferson, T.A., P.J. Stacey, and R.W. Baird. 1991. A review of killer whale interactions with other marine mammals - predation to coexistence. Mammal Review 21(4):151–180. doi: 10.1111/j.1365-2907.1991.tb00291.x

Jonsgård, Å. 1968. A note on the attacking behavior of the killer whale (*Orcinus orca*). Norsk Hvalfangst-Tidende 57:84–85.

Jonsgård, Å. and P.B. Lyshoel. 1970. A contribution to the knowledge of the biology of the killer whale *Orcinus orca* (L.). Norwegian Journal of Zoology 18:41–48.

Katona, S.K., J.A. Beard, P.E. Girton, and F. Wenzel. 1988. Killer whales (*Orcinus orca*) from the Bay of Fundy to the Equator, including the Gulf of Mexico. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:205–224.

Lawson, J.W. and T.S. Stevens. 2013. Historic and current distribution patterns, and minimum abundance of killer whales (*Orcinus orca*) in the North-west Atlantic. Journal of the Marine Biological Association of the United Kingdom 94(06):1253–1265. doi: 10.1017/s0025315413001409

Mitchell, E. and R.R. Reeves. 1988. Records of killer whales in the western North Atlantic, with emphasis on eastern Canadian waters. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:161–193.

Øien, N. 1988. The distribution of killer whales (*Orcinus orca*) in the North Atlantic based on Norwegian catches, 1938-1981, and incidental sightings, 1967-1987. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:65–78.

Olesiuk, P.F., M.A. Bigg, and G.M. Ellis. 1990. Life history and population dynamics of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Reports of the International Whaling Commission (Special Issue) 12:209–243.

O'Sullivan, S. and K.D. Mullin. 1997. Killer whales (*Orcinus orca*) in the northern Gulf of Mexico. Marine Mammal Science 13(1):141–147. doi: 10.1111/j.1748-7692.1997.tb00618.x

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for killer whale (*Orcinus orca*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 68 p.

Sigurjónnson, J., T. Lyrholm, S. Leatherwood, E. Jónsson, and G. Víkingsson. 1988. Photoidentification of killer whales off Iceland 1981 through 1986. Rit Fiskideildar (Journal of the Marine Research Institute Reykjavik) 11:1185–1189.

Similä, T., J.C. Holst, and I. Christensen. 1996. Occurrence and diet of killer whales in northern Norway: seasonal patterns relative to the distribution and abundance of Norwegian spring-spawning herring. Canadian Journal of Fisheries and Aquatic Sciences 53(4):769–779. doi: 10.1139/f95-253

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Kogia sp. − *Kogia sima; Kogia breviceps*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 67% of scores ≥ 2

	Kogia sima; Kogia breviceps	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.8	1.7	
	Habitat Specificity	1.8	1.7	
	Site Fidelity	1.8	1.0	
	Lifetime Reproductive Potential	2.0	1.7	
	Generation Length	2.5	2.3	
	Reproductive Plasticity	1.8	1.0	
	Migration	2.6	1.3	
	Home Range	1.7	1.7	
	Stock Abundance	2.8	2.3	
	Stock Abundance Trend	2.4	0.7	
	Cumulative Stressors	2.4	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.2	3.0	
	Sea Surface Temperature (Change in variability)	1.8	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	2.5	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.3	3.0	
	Sea Surface Salinity (Change in variability)	1.9	3.0	
	Ocean pH (Change in mean)	3.4	3.0	
	Ocean pH (Change in variability)	1.9	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.4	3.0	
	Dissolved oxygen (Change in variability)	1.9	3.0	
	Circulation	1.8	1.7	
	Sea level rise	1.0	3.0	
	Exposure Score	High		
	Overall Vulnerability Rank	Moderate		

Low
Moderate
High
Very High

Kogia sp. (Northern Gulf of Mexico Stock Group)

Kogia sima; Kogia breviceps

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (66% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0:Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (3.4), Ocean pH (Standard anomaly) (3.4), and Sea Surface Temperature (Standard anomaly) (3.2).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than 2.5: Prey/Diet Specificity (2.80), Species Abundance (2.80), Migration (2.60), and Generation Time (2.53).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 67% of the data quality scores were 2 or greater, 27% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The *Kogia* sp. northern Gulf of Mexico stock group includes pygmy and dwarf sperm whales that are found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock group is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Kogia sp. diet consists primarily of cephalopods and also includes deep-sea fishes and shrimps (Raun et al. 1970; Caldwell and Caldwell 1989; McAlpine et al. 1997; Barros et al. 1998; Willis and Baird 1998). In the Gulf of Mexico, Raun et al. (1970) reported finding squid and shrimp in stomach contents of a pygmy sperm whale stranded on the Texas coast. Delgado-Estrella et al. (1998) reported finding squid beaks and shrimp in the stomach of a dwarf sperm whale and squid ink in a pygmy sperm whale found stranded in Veracruz on the Mexican coastline of the Gulf of Mexico. Along the U.S. mid-Atlantic coast, pygmy and dwarf sperm whales consume similar prey from similar habitats (Staudinger et al. 2014).

Habitat Specificity

In the northern Gulf of Mexico, *Kogia* sp. are found primarily in oceanic waters (Mullin et al. 1991; Mullin and Fulling 2004; Maze-Foley and Mullin 2006; Schick et al. 2011; Merkens 2013; Ramírez-León et al. 2020) and in frontal regions along the shelf break (Baumgartner et al. 2001). *Kogia* sp. can be found along the edges of warm-core rings (Davis et al. 2002). One tagged individual in the western North

Atlantic was found to associate with the Gulf Stream and moved in waters deeper than the shelf break (Scott et al. 2001).

Pygmy sperm whales are more frequently found in deeper waters, while dwarf sperm whales are more frequently found in shallower waters (Willis and Baird 1998; Barros et al. 1998; Rice 1998; Wang et al. 2002; MacLeod et al. 2004).

Site Fidelity

Information regarding *Kogia* sp. site fidelity in the Gulf of Mexico was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported interbirth interval of 2.00 years for both pygmy and dwarf sperm whales based on data reported by Plön (2004).

Taylor et al. (2007) estimated pygmy sperm whale age at first reproduction of 6 years and age at last reproduction of 23 years (observed) and 36 years (estimated) and dwarf sperm whale age at first reproduction of 6 years and age at last reproduction of 22 years (observed) and 32 years (estimated) based on data reported by Plön (2004). Studies from South Africa (Plön 2004) and South Carolina (Smar 2006) have suggested that both species reach sexual maturity around 4 years.

Generation Length

Taylor et al. (2007) reported pygmy sperm whale generation length of 10.8 years at r = 0.04 and 12.1 years at r = 0.0. Taylor et al. (2007) reported dwarf sperm whale generation length of 10.6 years at r = 0.04 and 11.7 years at r = 0.0.

Reproductive Plasticity

Information regarding *Kogia* sp. reproductive season, habitat, and/or location in the western North Atlantic was not found in the literature.

Migration

Kogia sp. were observed in the northern Gulf of Mexico in all seasons during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000). Merkens (2013) suggested a seasonal north-south or east-west movement in the northern Gulf of Mexico based on acoustic monitoring. Hildebrand et al. (2019) found season differences in density at two of three sites in the northern Gulf of Mexico, though the influence of the *Deepwater Horizon* oil spill on that seasonality is unclear.

Home Range

Information regarding *Kogia* sp. home range in the Gulf of Mexico was not found in the literature.

Stock Abundance

The abundance of *Kogia* sp. in the northern Gulf of Mexico is estimated to be 336 individuals (CV=0.35), based on 2017 and 2018 oceanic surveys (Garrison et al. 2020). This estimate is likely an underestimate due to omitting trackline detection probability correction, difficulty seeing *Kogia* sp. at sea, deep diving nature, and avoidance behavior (Hayes et al. 2021). Previously, the abundance of *Kogia* sp. was estimated to be 186 (CV=1.04) based on a 2009 oceanic survey (Waring et al. 2012).

Stock Abundance Trend

Five point estimates of *Kogia* sp. abundance have been made based on data from surveys in 2003 (441; CV=0.42), 2004 (38; CV=0.71), 2009 (276; CV=0.59), 2017 (293; CV=0.59), and 2018 (360; CV=0.42). Pairwise comparisons of the log-transformed means were conducted between years, and found significant differences between the 2003 and 2004 estimates, 2004 and 2017 estimates, and 2004 and 2018 estimates (see Garrison et al. 2020 and Hayes et al. 2021).

Cumulative Stressors

Kogia sp. in the Gulf of Mexico interact with longline fisheries. During the time period 2014–2018, annual average fishery-related mortality or serious injury was zero (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the time period 2014–2018, 9 dwarf sperm whales, 19 pygmy sperm whales, and 10 unspecified *Kogia* sp. were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

Plastic pollution poses a threat to *Kogia* sp. in the Gulf of Mexico, as stranded individuals have been found with ingested plastic (Stamper et al. 2006; Claro et al. 2019).

Kogia sp. stocks were likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). However densities of *Kogia* sp. in the area near the spill were low during and immediately following the event, suggesting the stocks may have avoided the area (Merkens 2013; Hildebrand et al. 2019). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for *Kogia* sp. in the Gulf of Mexico are presented by Hildebrand et al. (2012), Roberts et al. (2015, 2016), and Mannocci et al. (2017).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Kiszka, J. and G. Braulik. 2020. *Kogia breviceps*. The IUCN Red List of Threatened Species 2020: e.T11047A50358334. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T11047A50358334.en

Kiszka, J. and G. Braulik. 2020. *Kogia sima*. The IUCN Red List of Threatened Species 2020: e.T11048A50359330. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T11048A50359330.en

McAlpine, D.F. 2018. Pygmy and dwarf sperm whales: *Kogia breviceps* and *K. sima*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 786–788. doi: 10.1016/B978-0-12-804327-1.00209-0

References

Barros, N.B., D.A. Duffield, P.H. Ostrom, D.K. Odell, and V.R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. sima* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.

Baumgartner, M.F., K.D. Mullin, L.N. May, and T.D. Leming. 2001. Cetacean habitats in the northern Gulf of Mexico. Fishery Bulletin 99(2):219–239.

Caldwell, D.K. and M.C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): Dwarf sperm whale *Kogia simus* Owen, 1866. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, London, UK. pp. 235–260.

Claro, F., M.C. Fossi, C. Ioakeimidis, M. Baini, A.L. Lusher, W. Mc Fee, R.R. McIntosh, T. Pelamatti, M. Sorce, F. Galgani, and B.D. Hardesty. 2019. Tools and constraints in monitoring interactions between marine litter and megafauna: Insights from case studies around the world. Marine Pollution Bulletin 141:147–160. doi: 10.1016/j.marpolbul.2019.01.018

Davis, R.W., J.G. Ortega-Ortiz, C.A. Ribic, W.E. Evans, D.C. Biggs, P.H. Ressler, R.B. Cady, R.R. Leben, K.D. Mullin, and B. Wursig. 2002. Cetacean habitat in the northern oceanic Gulf of Mexico. Deep-Sea Research Part I-Oceanographic Research Papers 49(1):121–142. doi: 10.1016/S0967-0637(01)00035-8

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Delgado-Estrella, A., B. Villa-R., and L.E.V. M. 1998. First records of dwarf sperm whale (*Kogia breviceps*) pygmy sperm whale (*K. simus*) and pygmy killer whale (*Feresa attenuata*) in Veracruz, Mexico. Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología 69(1):129–134.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Hildebrand, J.A., K.E. Frasier, S. Baumann-Pickering, S.M. Wiggins, K.P. Merkens, L.P. Garrison, M.S. Soldevilla, and M.A. McDonald. 2019. Assessing seasonality and density from passive acoustic monitoring of signals presumed to be from pygmy and dwarf sperm whales in the Gulf of Mexico. Frontiers in Marine Science 6:66. doi: 10.3389/fmars.2019.00066

Hildebrand, J.A., K.P. Merkens, K.E. Frasier, H. Bassett, S. Baumann-Pickering, A. Širović, S.M. Wiggins, M. McDonald, T.A. Marques, D. Harris, and L. Thomas. 2012. Passive acoustic monitoring of cetaceans in the northern Gulf of Mexico during 2010-2011. Progress Report for Research Agreement #20105138. Prepared for Natural Resource Damage Assessment Program. 31 p.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

McAlpine, D.F., L.D. Murison, and E.P. Hoberg. 1997. New records for the pygmy sperm whale, *Kogia breviceps* (Physeteridae) from Atlantic Canada with notes on diet and parasites. Marine Mammal Science 13(4):701–704. doi: 10.1111/j.1748-7692.1997.tb00093.x

Merkens, K. 2013. Deep-diving cetaceans of the Gulf of Mexico: Acoustic ecology and response to natural and anthropogenic forces including the Deepwater Horizon Oil Spill. University of California, San Diego, CA. p.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers, and B. Taggart. 1991. Cetaceans on the upper continental slope in the North-central Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office: New Orleans, LA. OCS Study/MMS 91-0027. 108 p.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Plön, S. 2004. The status and natural history of pygmy (*Kogia breviceps*) and dwarf (*K. sima*) sperm whales off Southern Africa. Rhodes University. Dissertation. 480 p.

Ramírez-León, M.R., M.C. García-Aguilar, O. Sosa-Nishizaki, A.E. Romo-Curiel, Z. Ramírez-Mendoza, and A. Fajardo-Yamamoto. 2020. Identification of cetacean hotspots in the Gulf of Mexico based on niche model. Abstracts, Ocean Sciences Meeting. 16-21 February 2020. San Diego, California.

Raun, G.G., H.D. Hoese, and F. Moseley. 1970. Pygmy sperm whales, genus *Kogia*, on the Texas coast. Texas Journal of Science 21(3):269–274.

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016b. Density model for *Kogia* *w*hales (*Kogia* spp.) for the U.S. Gulf of Mexico version 3.3, 2015-10-07, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 55 p.

Ross, G.J.B. 1979. Records of pygmy and dwarf sperm whales, genus *Kogia*, from southern Africa, with biological notes and some comparisons. Annals of the Cape Provincial Museums (Natural History) 11(4):259–327.

Ross, G.J.B. 1984. The smaller cetaceans of the south east coast of southern Africa. Annals of the Cape Provincial Museums (Natural History) 15(2):173–410.

Schick, R.S., P.N. Halpin, A.J. Read, D.L. Urban, B.D. Best, C.P. Good, J.J. Roberts, E.A. LaBrecque, C. Dunn, L.P. Garrison, K.D. Hyrenbach, W.A. McLellan, D.A. Pabst, D.L. Palka, and P. Stevick. 2011. Community structure in pelagic marine mammals at large spatial scales. Marine Ecology Progress Series 434:165–U193. doi: 10.3354/meps09183

Scott, M.D., A.A. Hohn, A.J. Westgate, J.R. Nicolas, B.R. Whitaker, and W.B. Campbell. 2001. A note on the release and tracking of a rehabilitated pygmy sperm whale (*Kogia breviceps*). Journal of Cetacean Research and Management 3(1):87–94.

Smar, C. 2006. Age estimation and life history of the pygmy sperm whale (*Kogia breviceps*). College of Charleston. Thesis. 85 p.

Stamper, M.A., B.R. Whitaker, and T.D. Schofield. 2006. Case study: Morbidity in a pygmy sperm whale *Kogia breviceps* due to ocean-bourne plastic. Marine Mammal Science 22(3):719–722. doi: 10.1111/j.1748-7692.2006.00062.x

Staudinger, M.D., R.J. McAlarney, W.A. McLellan, and D.A. Pabst. 2014. Foraging ecology and niche overlap in pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales from waters of the U. S. mid-Atlantic coast. Marine Mammal Science 30(2):626–655. doi: 10.1111/mms.12064

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Wang, M.-C., W.A. Walker, K.-T. Shao, and L.-S. Chou. 2002. Comparative analysis of the diets of pygmy sperm whales and dwarf sperm whales in Taiwanese waters. Acta Zoologica Taiwanica 13(2):53–62.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Willis, P.M. and R.W. Baird. 1998. Status of the dwarf sperm whale, *Kogia simus*, with special reference to Canada. Canadian Field-Naturalist 112(1):114–125.

Kogia sp. − *Kogia sima; Kogia breviceps*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

	Kogia sima; Kogia breviceps	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	2.3	
	Habitat Specificity	1.6	2.3	
	Site Fidelity	2.0	1.0	
	Lifetime Reproductive Potential	1.3	2.3	
	Generation Length	2.1	2.3	
	Reproductive Plasticity	1.2	1.0	
	Migration	3.1	2.0	
	Home Range	2.2	2.0	
	Stock Abundance	2.2	1.7	
	Stock Abundance Trend	2.3	0.7	
	Cumulative Stressors	1.9	1.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	4.0	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	2.5	2.5	
	Precipitation (Change in variability)	1.2	2.5	
	Sea Surface Salinity (Change in mean)	2.8	2.5	
	Sea Surface Salinity (Change in variability)	2.0	2.5	
	Ocean pH (Change in mean)	4.0	2.5	
	Ocean pH (Change in variability)	1.6	2.5	
	Sea ice coverage (Change in mean)	1.1	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	2.5	
	Dissolved oxygen (Change in variability)	1.4	2.5	
	Circulation	1.3	2.5	
	Sea level rise	1.0	2.5	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Kogia sp. (Western North Atlantic Stock Group)

Kogia sima; Kogia breviceps

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (75% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), and Sea Surface Temperature (Standard anomaly) (3.8).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Migration (3.07).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 81% of the data quality scores were 2 or greater, 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The *Kogia sp.* western North Atlantic stock group includes pygmy and dwarf sperm whales that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Kogia sp. diet consists primarily of cephalopods and also includes deep-sea fishes and shrimps (Raun et al. 1970; Caldwell and Caldwell 1989; McAlpine 1997; Barros et al. 1998; Willis and Baird 1998). Along the U.S. mid-Atlantic coast, pygmy and dwarf sperm whales consume similar prey from similar habitats (Staudinger et al. 2014). In the Gulf of Mexico, Raun et al. (1970) reported finding squid and shrimp in stomach contents of a pygmy sperm whale stranded on the Texas coast. Delgado-Estrella et al. (1998) reported finding squid beaks and shrimp in the stomach of a dwarf sperm whale and squid ink in a pygmy sperm whale found stranded in Veracruz on the Mexican coastline of the Gulf of Mexico.

Habitat Specificity

Kogia sp. in the western North Atlantic are found in oceanic and continental shelf waters (Rice 1998; Wang et al. 2002; Mullin and Fulling 2003; MacLeod et al. 2004; Roberts et al. 2016a). One tagged individual, *K. breviceps*, in the western North Atlantic was found to associate with the Gulf Stream and moved in waters deeper than the shelf break (Scott et al. 2001).

Pygmy sperm whales are more frequently found in deeper waters, while dwarf sperm whales are more frequently found in shallower waters (Willis and Baird 1998; Barros et al. 1998; Rice 1998; Wang et al. 2002; MacLeod et al. 2004).

Site Fidelity

Information regarding *Kogia sp.* site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported interbirth interval of 2.00 years for both pygmy and dwarf sperm whales based on data reported by Plön (2004).

Taylor et al. (2007) estimated pygmy sperm whale age at first reproduction of 6 years and age at last reproduction of 23 years (observed) and 36 years (estimated) and dwarf sperm whale age at first reproduction of 6 years and age at last reproduction of 22 years (observed) and 32 years (estimated) based on data reported by Plön (2004). Studies from South Africa (Plön 2004) and South Carolina (Smar 2006) have suggested that both species reach sexual maturity around 4 years.

Generation Length

Taylor et al. (2007) reported pygmy sperm whale generation length of 10.8 years at r = 0.04 and 12.1 years at r = 0.0. Taylor et al. (2007) reported dwarf sperm whale generation length of 10.6 years at r = 0.04 and 11.7 years at r = 0.0.

Reproductive Plasticity

Information regarding *Kogia sp.* reproductive season, habitat, and/or location in the western North Atlantic was not found in the literature.

Migration

Montey (2015) reported a possible seasonal offshore-inshore migration seasonally likely for calving purposes and based on stable isotope teeth data and on high incidence of mother/calf pair, and adult male strandings for pygmy sperm whales.

Home Range

Information regarding *Kogia sp.* home range in the western North Atlantic was not found in the literature.

Stock Abundance

The abundance of *Kogia sp.* in the western North Atlantic is estimated to be 7,750 individuals (CV=0.38), based on summer 2016 surveys from central Florida to the lower Bay of Fundy (Garrison 2020; Palka 2020). This estimate is likely negatively biased due to probability of detection on the trackline, long dive times, and avoidance behavior (Hayes et al. 2020).

Stock Abundance Trend

Previous abundance estimates of Kogia sp. in the western North Atlantic were from summer 1998 surveys (536; CV=0.45); summer 2004 surveys (395; CV=0.4); and summer 2011 surveys (3,785; CV=0.47; Palka 2012; Garrison 2016). A generalized linear model did indicate a statistically significant trend in abundance, and methodological differences between the estimates further complicate trend assessment (Hayes et al. 2020).

Cumulative Stressors

Kogia sp. in the western North Atlantic interact with longline fisheries. During the time period 2013–2017, annual average fishery-related mortality or serious injury was zero (Hayes et al. 2020). During the same period, 46 dwarf sperm whales, 120 pygmy sperm whales, and 12 unspecified *Kogia sp.* reported stranded along the U.S. Atlantic coast and Puerto Rico (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Plastic pollution poses a threat to *Kogia sp.* in the western North Atlantic, as stranded individuals have been found with ingested plastic (Stamper et al 2006; Claro et al. 2019). Pollution (Bryan et al. 2012; Staudinger et al. 2014; Reed et al. 2015; Hall et al. 2018), harmful algal blooms (Fire et al. 2009), and anthropogenic sound (Gomez et al. 2016) also present threats to *Kogia sp.* in the western North Atlantic.

Distribution and Sightings

Density model results for *Kogia sp.* in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Kiszka, J. and G. Braulik. 2020. *Kogia breviceps*. The IUCN Red List of Threatened Species 2020: e.T11047A50358334. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T11047A50358334.en

Kiszka, J. and G. Braulik. 2020. *Kogia sima*. The IUCN Red List of Threatened Species 2020: e.T11048A50359330. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T11048A50359330.en

McAlpine, D.F. 2018. Pygmy and dwarf sperm whales: *Kogia breviceps* and *K. sima*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 786–788. doi: 10.1016/B978-0-12-804327-1.00209-0

References

Barros, N.B., D.A. Duffield, P.H. Ostrom, D.K. Odell, and V.R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. sima* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.

Bryan, C.E., W.C. Davis, W.E. McFee, C.A. Neumann, J. Schulte, G.D. Bossart, and S.J. Christopher. 2012. Influence of mercury and selenium chemistries on the progression of cardiomyopathy in pygmy sperm whales, *Kogia breviceps*. Chemosphere 89(5):556–562. doi: 10.1016/j.chemosphere.2012.05.051

Caldwell, D.K. and M.C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): Dwarf sperm whale *Kogia simus* Owen, 1866. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, London, UK. pp. 235–260.

Claro, F., M.C. Fossi, C. Ioakeimidis, M. Baini, A.L. Lusher, W. Mc Fee, R.R. McIntosh, T. Pelamatti, M. Sorce, F. Galgani, and B.D. Hardesty. 2019. Tools and constraints in monitoring interactions between marine litter and megafauna: Insights from case studies around the world. Marine Pollution Bulletin 141:147–160. doi: 10.1016/j.marpolbul.2019.01.018

Delgado-Estrella, A., B. Villa-R., and L.E.V. M. 1998. First records of dwarf sperm whale (*Kogia breviceps*) pygmy sperm whale (*K. simus*) and pygmy killer whale (*Feresa attenuata*) in Veracruz, Mexico. Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología 69(1):129–134.

Fire, S.E., Z.H. Wang, T.A. Leighfield, S.L. Morton, W.E. Mcfee, W.A. McLellan, R.W. Litaker, P.A. Tester, A.A. Hohn, G. Lovewell, C. Harms, D.S. Rotstein, S.G. Barco, A. Costidis, B. Sheppard, G.D. Bossart, M. Stolen, W.N. Durden, and F.M. Van Dolah. 2009. Domoic acid exposure in pygmy and dwarf sperm whales (*Kogia* spp.) from southeastern and Mid-Atlantic US waters. Harmful Algae 8(5):658–664. doi: 10.1016/j.hal.2008.12.002

Garrison, L.P. 2016. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during summer 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL PRBD-2016-09. 18 p.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Gomez, C., J.W. Lawson, A.J. Wright, A.D. Buren, D. Tollit, and V. Lesage. 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. Canadian Journal of Zoology 94(12):801–819. doi: 10.1139/cjz-2016-0098

Hall, A.J., B.J. McConnell, L.H. Schwacke, G.M. Ylitalo, R. Williams, and T.K. Rowles. 2018. Predicting the effects of polychlorinated biphenyls on cetacean populations through impacts on immunity and calf survival. Environmental Pollution 233:407–418. doi: 10.1016/j.envpol.2017.10.074

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

McAlpine, D.F., L.D. Murison, and E.P. Hoberg. 1997. New records for the pygmy sperm whale, *Kogia breviceps* (Physeteridae) from Atlantic Canada with notes on diet and parasites. Marine Mammal Science 13(4):701–704. doi: 10.1111/j.1748-7692.1997.tb00093.x

Montey, N. 2015. Investigation of pygmy sperm whale (*Kogia breviceps*) populations in the southeastern US using stable isotopes of carbon, nitrogen, and oxygen in teeth. University of Charleston. Thesis. 90 p.

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603–613.

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Plön, S. 2004. The status and natural history of pygmy (*Kogia breviceps*) and dwarf (*K. sima*) sperm whales off Southern Africa. Rhodes University. Dissertation. 480 p.

Raun, G.G., H.D. Hoese, and F. Moseley. 1970. Pygmy sperm whales, genus *Kogia*, on the Texas coast. Texas Journal of Science 21(3):269–274.

Reed, L.A., W.E. McFee, P.L. Pennington, E.F. Wirth, and M.H. Fulton. 2015. A survey of trace element distribution in tissues of the dwarf sperm whale (*Kogia sima*) stranded along the South Carolina coast from 1990-2011. Marine Pollution Bulletin 100(1):501–506. doi: 10.1016/j.marpolbul.2015.09.005

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Scott, M.D., A.A. Hohn, A.J. Westgate, J.R. Nicolas, B.R. Whitaker, and W.B. Campbell. 2001. A note on the release and tracking of a rehabilitated pygmy sperm whale (*Kogia breviceps*). Journal of Cetacean Research and Management 3(1):87–94.

Smar, C. 2006. Age estimation and life history of the pygmy sperm whale (*Kogia breviceps*). College of Charleston. Thesis. 85 p.

Stamper, M.A., B.R. Whitaker, and T.D. Schofield. 2006. Case study: Morbidity in a pygmy sperm whale *Kogia breviceps* due to ocean-bourne plastic. Marine Mammal Science 22(3):719–722. doi: 10.1111/j.1748-7692.2006.00062.x

Staudinger, M.D., R.J. McAlarney, W.A. McLellan, and D.A. Pabst. 2014. Foraging ecology and niche overlap in pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales from waters of the U. S. mid-Atlantic coast. Marine Mammal Science 30(2):626–655. doi: 10.1111/mms.12064

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Wang, M.-C., W.A. Walker, K.-T. Shao, and L.-S. Chou. 2002. Comparative analysis of the diets of pygmy sperm whales and dwarf sperm whales in Taiwanese waters. Acta Zoologica Taiwanica 13(2):53–62.

Willis, P.M. and R.W. Baird. 1998. Status of the dwarf sperm whale, *Kogia simus*, with special reference to Canada. Canadian Field-Naturalist 112(1):114–125.

Melon−headed whale − *Peponocephala electra*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 81% of scores ≥ 2

	Peponocephala electra	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	2.0	
	Habitat Specificity	1.6	2.3	
	Site Fidelity	1.5	2.3	
	Lifetime Reproductive Potential	2.2	1.7	
	Generation Length	2.7	1.0	
	Reproductive Plasticity	1.6	1.0	
	Migration	2.7	1.3	
	Home Range	1.6	2.3	
	Stock Abundance	1.9	2.7	
	Stock Abundance Trend	2.3	1.0	
	Cumulative Stressors	2.4	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.7	
	Sea Surface Temperature (Change in variability)	1.5	2.7	
	Air Temperature (Change in mean)	4.0	2.7	
	Air Temperature (Change in variability)	2.0	2.7	
	Precipitation (Change in mean)	1.0	2.7	
	Precipitation (Change in variability)	1.0	2.7	
	Sea Surface Salinity (Change in mean)	2.5	2.7	
	Sea Surface Salinity (Change in variability)	1.9	2.7	
	Ocean pH (Change in mean)	3.5	2.7	
	Ocean pH (Change in variability)	1.5	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.5	2.7	
	Dissolved oxygen (Change in variability)	1.5	2.7	
	Circulation	1.5	2.0	
	Sea level rise	2.1	2.7	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Melon-headed whale (Northern Gulf of Mexico Stock)

Peponocephala electra

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (54% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (3.47), Ocean pH (Standard anomaly) (3.47), and Sea Surface Temperature (Standard anomaly) (3.47).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Generation Time (2.73) and Migration (2.67).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 81% of the data quality scores were 2 or greater, 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The melon-headed whale Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021). As noted by Ramírez-León et al. (2020), there is, in particular, a lack of survey effort in deep, Mexican waters of the Gulf.

Prey/Diet Specificity

Pauly et al. (1998) reported species-level diet composition of 35% small squids, 35% large squids, 10% small pelagic fishes, 10% mesopelagic fishes, and 10% miscellaneous fishes. Bossart et al. (2007) found squid beaks in the stomachs of five stranded melon-headed whales from a mass stranding on the Atlantic Coast of Florida. In the Caribbean, a stranded individual’s stomach had a few squid beaks and fish scales (Mignucci-Giannoni et al. 1998). In the eastern North Atlantic, stomach contents of two individuals contained cephalopods and fish remains (Spitz et al. 2011). In Hawaii, prey consisted of 50 different prey species of cephalopods and fish, with cephalopods appearing in all stomachs examined and comprising 75% of prey by mass (West et al. 2018). From tagging data in The Bahamas, foraging dive activity in this species appears to be exclusively confined to nighttime periods, indicating that energetically advantageous prey may be too deep during daylight periods and only become accessible as these prey migrated upward at night (Joyce et al. 2017).

Habitat Specificity

Melon-headed whales are most often sighted in the northern Gulf of Mexico in waters deeper than 800 m and west of Mobile Bay, Alabama (Mullin et al. 1994; Davis and Fargion 1996; Davis et al. 2000, Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Garrison and Aichinger Dias (2020) concluded that with the available data, melon-headed whale sightings are mostly seen in the western waters of the Gulf along the 1,000-m isobath. Melon-headed whales are typically found offshore but may be found in deep waters near the coast (Perryman and Danil 2018), where steep topography is close to shore, such as oceanic islands. In waters around Hawaii, melon-headed whales are found associated with offshore eddy systems; satellite-tagged individuals were shown to move offshore to occupy the edges of cold core cyclonic eddies and the centers of warm core anticyclonic eddies where prey could be concentrated (Woodworth et al. 2012). Individuals tagged in The Bahamas ranged widely over habitats with a variety of bathymetric depths, including habitats substantially deeper than their observed dive depth ranges (Joyce et al. 2017).

Site Fidelity

Based on tagging and stable isotope data from biopsy sampling, there are indications that melon-headed whales in the Bahamas may exhibit some small degree of short-term (2-3 months) foraging site fidelity (Claridge et al. 2015). Photo-identification results from the same project in the Bahamas support the idea of a seasonal open population with an occupation range that extends beyond AUTEC (Vieira 2017). Nonetheless, resighting data demonstrates a regular use of the area in the spring/summer period (Vieira 2017).

Lifetime Reproductive Potential

Based on resightings of a single reproductively active female in Hawaii, melon-headed whales have an estimated interbirth interval of 3 years (Aschettino 2010). In Japan, females seem to give birth every 3-4 years (Amano et al. 2014). Miyazaki et al. (1998) reported an annual ovulation rate of 0.28 in melon-headed whales off Japan, which would suggest an interbirth interval of 3.6 years (Aschettino 2010). Amano et al. (2014) reported annual ovulation rate of 0.28 and 0.36 in two populations of stranded melon-headed whales.

Female melon-headed whales reach sexual maturity at about 11.5 years while males reach sexual maturity at 16.5 years (Jefferson and Barros 1997; Miyazaki et al. 1998). Taylor et al. (2007) reported age at first reproduction of 13 years and age at last reproduction of 34 years (estimated) based on data from Jefferson and Barros (1997).

Generation Length

Information regarding melon-headed whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding melon-headed whale breeding season, habitat, and/or location in the Gulf of Mexico was not found in the literature. Amano et al. (2014) estimated the calving season for melon-headed whales off Japan to be from spring through summer.

Migration

Melon-headed whales in the northern Gulf of Mexico do not show seasonality (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Information regarding melon-headed whale home range in the Gulf of Mexico was not found in the literature.

Stock Abundance

The abundance of melon-headed whales in the northern Gulf of Mexico is estimated to be 1,749 individuals (CV=0.68; Garrison et al. 2020), based on 2017 and 2018 oceanic surveys. Previously, the stock abundance was estimated to be 2,235 individuals (CV=0.75) based on a 2009 oceanic survey (Waring et al. 2012).

Stock Abundance Trend

Five point estimates of melon-headed whale abundance have been made based on data from surveys in 2003 (1,502; CV=0.96), 2004 (7,351; CV=0.87), 2009 (4,188; CV=0.76), 2017 (2,694; CV=0.76), and 2018 (454; CV=0.89). Pairwise comparisons of the log-transformed means were conducted between years, and found significant differences between the 2004 and 2018 estimates (see Garrison et al. 2020 and Hayes et al. 2021). However, poor precision and long survey intervals confound trend detection for this stock (Hayes et al. 2021).

Cumulative Stressors

Melon-headed whales in the Gulf of Mexico interact with longline fisheries. No fishing-related melon-headed whale mortalities were reported in the Gulf of Mexico during the period 2014–2018 (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b).

Twelve melon-headed whales were reported stranded in the Gulf of Mexico during the period 2014–2018 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021), though none were determined to be the result of human interactions.

The melon-headed whale stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Elsewhere, melon-headed whales have shown evidence of sensitivity to sound, such as demonstrating pre-stranding behavior in Hawaii coincident with military training (Southall et al. 2006; Brownell et al. 2009) and a mass stranding in Madagascar coincident with nearby echosounder use (Southall et al. 2013). However, melon-headed whales did not avoid areas in The Bahamas associated with frequent sonar use (Vieira 2017).

Distribution and Sightings

Density model results for melon-headed whales in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Kiszka, J. and R.L. Brownell, Jr. 2019. *Peponocephala electra*. The IUCN Red List of Threatened Species 2019: e.T16564A50369125. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T16564A50369125.en

Perryman, W.L. and K. Danil. 2018. Melon-headed whale: *Peponocephala electra*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 593-595. doi: 10.1016/B978-0-12-804327-1.00171-0

References

Amano, M., T.K. Yamada, T. Kuramochi, A. Hayano, A. Kazumi, and T. Sakai. 2014. Life history and group composition of melon-headed whales based on mass strandings in Japan. Marine Mammal Science 30(2):480–493. doi: 10.1111/mms.12050

Aschettino, J. 2010. Population size and structure of melon-headed whales (*Peponocephala electra*) around the main Hawaiian Islands: evidence of multiple populations based on photographic data. Hawai'i Pacific University. 117 p.

Bossart, G.D., L. Hansen, J.D. Goldstein, D. Kilpatrick, S. Bechdel, E. Howells, K. Kroell, M. de Sieyes, M.K. Stolen, W.N. Durden, J.S. Reif, R.H. Defran, and S.D. McCulloch. 2007. Pathological findings in a rare mass stranding of melon-headed whales (*Peponocephala electra*) in Florida. Aquatic Mammals 33(2):235–240. doi: 10.1578/am.33.2.2007.235

Brownell, R.L., K. Ralls, S. Baumann-Pickering, and M.M. Poole. 2009. Behavior of melon-headed whales, *Peponocephala electra*, near oceanic islands. Marine Mammal Science 25(3):639–658. doi: 10.1111/j.1748-7692.2009.00281.x

Claridge, D., G. Ylitalo, D. Herman, J. Durban, and K. Parsons. 2015. Final report: Behavioral ecology of deep-diving odontocetes in the Bahamas. Strategic Environmental Research and Development Program: Alexandria, VA. SERDP Project RC-2114. 129 p.

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W. and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. Minerals Management Service: New Orleans, LA. 356 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final

Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A. and N.B. Barros. 1997. *Peponocephala electra*. Mammalian Species 553:1–6. doi: 10.2307/3504200

Joyce, T.W., J.W. Durban, D.E. Claridge, C.A. Dunn, H. Fearnbach, K.M. Parsons, R.D. Andrews, and L.T. Ballance. 2017. Physiological, morphological, and ecological tradeoffs influence vertical habitat use of deep-diving toothed-whales in the Bahamas. PLoS ONE 12(10):e0185113. doi: 10.1371/journal.pone.0185113

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A., M.A. Rodriguez-Lopez, J.J. Perez-Zayas, R.A. Montoya-Ospina, and E.H. Williams. 1998. First record of the melonhead whale (*Peponocephala electra*) for Puerto Rico. Mammalia 62(3):452–457.

Miyazaki, N., Y. Fujise, and K. Iwata. 1998. Biological analysis of a mass stranding of melon-headed whales (*Peponocephala electra*) at Aoshima, Japan. Bulletin of the National Science Museum Series A (Zoology), Tokyo 24(1):31–60.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

Mullin, K.D., T.A. Jefferson, L.J. Hansen, and W. Hoggard. 1994. First sightings of melon-headed whales (*Peponocephala electra*) in the Gulf of Mexico. Marine Mammal Science 10(3):342–348.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perryman, W.L. and K. Danil. 2018. Melon-headed whale (*Peponocephala electra*). In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals, Third Edition. Academic Press, London, UK. pp. 593–595.

Ramírez-León, M.R., M.C. García-Aguilar, A. Aguayo-Lobo, I. Fuentes-Allen, and O. Sosa-Nishizaki. 2020. What do we know about cetaceans in the Mexican waters of the Gulf of Mexico? A review. Aquatic Mammals 46(6):623–632. doi: 10.1578/am.46.6.2020.623

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for melon-headed whale (*Peponocephala electra*) for the U.S. Gulf of Mexico version 1.4, 2015-10-01, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 75 p.

Southall, B.L., R. Braun, F.M.D. Gulland, A.D. Heard, R.W. Baird, S.M. Wilkin, and T.K. Rowles. 2006. Hawaiian melon-headed whale (*Peponocephala electra*) mass stranding event of July 3-4, 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources: Silver Spring, MD. NOAA Technical Memorandum NMFS-OPR-31. 55 p.

Southall, B.L., T. Rowles, F. Gulland, R.W. Baird, and P.D. Jepson. 2013. Final report of the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales (*Peponocephala electra*) in Antsohihy, Madagascar. International Whaling Commission: Cambridge, UK. 75 p.

Spitz, J., Y. Cherel, S. Bertin, J. Kiszka, A. Dewez, and V. Ridoux. 2011. Prey preferences among the community of deep-diving odontocetes from the Bay of Biscay, Northeast Atlantic. Deep-Sea Research Part I-Oceanographic Research Papers 58(3):273–282. doi: 10.1016/j.dsr.2010.12.009

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Vieira, D.P.C. 2017. Using mark-recapture methods to analyze a melon-headed whales (*Peponocephala electra*) population in the Bahamas. Instituto Universitário Ciências Psicológicas. Thesis. 79 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

West, K.L., W.A. Walker, R.W. Baird, D.L. Webster, and G.S. Schorr. 2018. Stomach contents and diel diving behavior of melon-headed whales (*Peponocephala electra*) in Hawaiian waters. Marine Mammal Science 34(4):1082–1096. doi: 10.1111/mms.12507

Woodworth, P.A., G.S. Schorr, R.W. Baird, D.L. Webster, D.J. McSweeney, M.B. Hanson, R.D. Andrews, and J.J. Polovina. 2012. Eddies as offshore foraging grounds for melon-headed whales (*Peponocephala electra*). Marine Mammal Science 28(3):638–647. doi: 10.1111/j.1748-7692.2011.00509.x

Melon−headed whale − *Peponocephala electra*

Western North Atlantic Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 0% of scores ≥ 2

	Peponocephala electra	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	1.3	
	Habitat Specificity	1.7	1.3	
	Site Fidelity	1.8	0.7	
	Lifetime Reproductive Potential	1.6	1.3	
	Generation Length	3.0	0.7	
	Reproductive Plasticity	1.6	0.7	
	Migration	2.6	0.3	
	Home Range	2.1	0.3	
	Stock Abundance	2.0	1.3	
	Stock Abundance Trend	2.1	0.3	
	Cumulative Stressors	1.7	0.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	1.0	
	Sea Surface Temperature (Change in variability)	1.0	1.0	
	Air Temperature (Change in mean)	4.0	1.0	
	Air Temperature (Change in variability)	1.0	1.5	
	Precipitation (Change in mean)	1.0	1.0	
	Precipitation (Change in variability)	1.4	1.0	
	Sea Surface Salinity (Change in mean)	3.5	1.0	
	Sea Surface Salinity (Change in variability)	1.4	1.0	
	Ocean pH (Change in mean)	4.0	1.5	
	Ocean pH (Change in variability)	1.2	1.0	
	Sea ice coverage (Change in mean)	1.0	1.0	
	Sea ice coverage (Change in variability)	1.0	1.0	
	Dissolved oxygen (Change in mean)	4.0	1.5	
	Dissolved oxygen (Change in variability)	1.3	1.0	
	Circulation	2.6	1.5	
	Sea level rise	1.0	1.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Melon-headed whale (Western North Atlantic Stock)

Peponocephala electra

CVA Results Summary

Overall Climate Vulnerability Rank: High (60% certainty from bootstrap analysis).

Climate Exposure: Very High. Five exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Sea Surface Temperature (Standard anomaly) (4.0), and Sea Surface Salinity (Standard anomaly) (3.5).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Generation Time (3.00) and Migration (2.60).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 0% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The melon-headed whale western North Atlantic stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic. However, this stock is likely transboundary and the stock area probably includes similar Canadian and offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Pauly et al. (1998) reported species-level diet composition of 35% small squids, 35% large squids, 10% small pelagic fishes, 10% mesopelagic fishes, and 10% miscellaneous fishes. Bossart et al. (2007) found squid beaks in the stomachs of five stranded melon-headed whales from a mass stranding on the Atlantic Coast of Florida. In the Caribbean, a stranded individual's stomach had a few squid beaks and fish scales (Mignucci-Giannoni et al. 1998). In the eastern North Atlantic, stomach contents of two individuals contained cephalopods and fish remains (Spitz et al. 2011). In Hawaii, prey consisted of 50 different prey species of cephalopods and fish, with cephalopods appearing in all stomachs examined and comprising 75% of prey by mass (West et al. 2018). From tagging data in The Bahamas, foraging dive activity in this species appears to be exclusively confined to nighttime periods, indicating that energetically advantageous prey may be too deep during daylight periods and only become accessible as these prey migrated upward at night (Joyce et al. 2017).

Habitat Specificity

Melon-headed whales are typically found offshore but may be found in deep waters near the coast (Perryman and Danil 2018). Along the Atlantic coast of the United States, melon-headed whales are found south of Maryland (Perryman et al. 1994; Jefferson and Barros 1997). Individuals tagged in The Bahamas ranged widely over habitats with a variety of bathymetric depths, including habitats substantially deeper than their observed dive depth ranges (Joyce et al. 2017).

Melon-headed whales are most often sighted in the northern Gulf of Mexico in waters deeper than 800m and west of Mobile Bay, Alabama (Mullin et al. 1994; Davis and Fargion 1996; Davis et al. 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). In waters around Hawaii, melon-headed whales are found associated with offshore eddy systems (Woodworth et al. 2012).

Site Fidelity

Based on tagging and stable isotope data from biopsy sampling, there are indications that melon-headed whales in the Bahamas may exhibit some small degree of short-term (2-3 months) foraging site fidelity (Claridge et al. 2015). Photo-identification results from the same project in the Bahamas support the idea of a seasonal open population with an occupation range that extends beyond AUTEC (Vieira 2017). Nonetheless, resighting data demonstrates a regular use of the area in the spring/summer period (Vieira 2017).

Lifetime Reproductive Potential

Based on resightings of a single reproductively active female in Hawaii, melon-headed whales have an estimated interbirth interval of 3 years (Aschettino 2010). Miyazaki et al. (1998) reported an annual ovulation rate of 0.28 in melon-headed whales off Japan, which would suggest an interbirth interval of 3.6 years (Aschettino 2010). Amano et al. (2014) reported annual ovulation rate of 0.28 and 0.36 in two populations of stranded melon-headed whales.

Female melon-headed whales reach sexual maturity at about 11.5 years while males reach sexual maturity at 16.5 years (Jefferson and Barros 1997; Miyazaki et al. 1998). Taylor et al. (2007) reported age at first reproduction of 13 years and age at last reproduction of 34 years (estimated) based on data from Jefferson and Barros (1997).

Generation Length

Information regarding melon-headed whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding melon-headed whale breeding season, habitat, and/or location in the western North Atlantic was not found in the literature. Amano et al. (2014) estimated the calving season for melon-headed whales off Japan to be from spring through summer.

Migration

Information regarding melon-headed whale migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Information regarding melon-headed whale home range in the western North Atlantic was not found in the literature.

Stock Abundance

Melon-headed whales are rarely seen in surveys in U.S. or Canadian Atlantic waters. Groups of melon-headed whales were sighted during vessel surveys in deep waters off of Cape Hatteras, North Carolina in 1999 (20 individuals; NMFS 1999) and 2002 (80 individuals; NMFS 2002).

Stock Abundance Trend

Data are insufficient to conduct an analysis trend (Hayes et al. 2020).

Cumulative Stressors

Melon-headed whales in the western North Atlantic may interact with longline fisheries. During the time period 2013–2017, melon-headed whale fishery-induced mortality was zero (Hayes et al. 2020). During the same period, three melon-headed whales were reported stranded in Florida (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Distribution and Sightings

Density model results for melon-headed whales in the western North Atlantic are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Kiszka, J. and R.L. Brownell, Jr. 2019. *Peponocephala electra*. The IUCN Red List of Threatened Species 2019: e.T16564A50369125. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T16564A50369125.en

Perryman, W.L. and K. Danil. 2018. Melon-headed whale: *Peponocephala electra*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 593-595. doi: 10.1016/B978-0-12-804327-1.00171-0

References

Amano, M., T.K. Yamada, T. Kuramochi, A. Hayano, A. Kazumi, and T. Sakai. 2014. Life history and group composition of melon-headed whales based on mass strandings in Japan. Marine Mammal Science 30(2):480–493. doi: 10.1111/mms.12050

Aschettino, J. 2010. Population size and structure of melon-headed whales (*Peponocephala electra*) around the main Hawaiian Islands: evidence of multiple populations based on photographic data. Hawai'i Pacific University. 117 p.

Bossart, G.D., L. Hansen, J.D. Goldstein, D. Kilpatrick, S. Bechdel, E. Howells, K. Kroell, M. de Sieyes, M.K. Stolen, W.N. Durden, J.S. Reif, R.H. Defran, and S.D. McCulloch. 2007. Pathological findings in a rare mass stranding of melon-headed whales (*Peponocephala electra*) in Florida. Aquatic Mammals 33(2):235–240. doi: 10.1578/am.33.2.2007.235

Claridge, D., G. Ylitalo, D. Herman, J. Durban, and K. Parsons. 2015. Final report: Behavioral ecology of deep-diving odontocetes in the Bahamas. Strategic Environmental Research and Development Program: Alexandria, VA. SERDP Project RC-2114. 129 p.

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W. and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. Minerals Management Service: New Orleans, LA. 356 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Jefferson, T.A. and N.B. Barros. 1997. *Peponocephala electra*. Mammalian Species 553:1–6. doi: 10.2307/3504200

Joyce, T.W., J.W. Durban, D.E. Claridge, C.A. Dunn, H. Fearnbach, K.M. Parsons, R.D. Andrews, and L.T. Ballance. 2017. Physiological, morphological, and ecological tradeoffs influence vertical habitat use of deep-diving toothed-whales in the Bahamas. PLoS ONE 12(10):e0185113. doi: 10.1371/journal.pone.0185113

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A., M.A. Rodriguez-Lopez, J.J. Perez-Zayas, R.A. Montoya-Ospina, and E.H. Williams. 1998. First record of the melonhead whale (*Peponocephala electra*) for Puerto Rico. Mammalia 62(3):452–457.

Miyazaki, N., Y. Fujise, and K. Iwata. 1998. Biological analysis of a mass stranding of melon-headed whales (*Peponocephala electra*) at Aoshima, Japan. Bulletin of the National Science Museum Series A (Zoology), Tokyo 24(1):31–60.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D., T.A. Jefferson, L.J. Hansen, and W. Hoggard. 1994. First sightings of melon-headed whales (*Peponocephala electra*) in the Gulf of Mexico. Marine Mammal Science 10(3):342–348.

National Marine Fisheries Service (NMFS). 1999. Cruise results. Summer Atlantic Ocean marine mammal survey. NOAA Ship Oregon II cruise 236 (99- 05), 4 August - 30 September 1999.

National Marine Fisheries Service (NMFS). 2002. Cruise results. Mid-Atlantic cetacean survey. NOAA Ship Gordon Gunter cruise GU-02-01, 6 February - 8 April 2002.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perryman, L., D.W.K. Au, S. Leatherwood, and T.A. Jefferson. 1994. Melon-headed whale *Peponocephala electra* Gray, 1846. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, London, UK. pp. 363–386.

Perryman, W.L. and K. Danil. 2018. Melon-headed whale (*Peponocephala electra*). In: Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals, Third Edition. Academic Press, London, UK. pp. 593–595.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for melon-headed whale (*Peponocephala electra*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 139 p.

Spitz, J., Y. Cherel, S. Bertin, J. Kiszka, A. Dewez, and V. Ridoux. 2011. Prey preferences among the community of deep-diving odontocetes from the Bay of Biscay, Northeast Atlantic. Deep-Sea Research Part I-Oceanographic Research Papers 58(3):273–282. doi: 10.1016/j.dsr.2010.12.009

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Vieira, D.P.C. 2017. Using mark-recapture methods to analyze a melon-headed whales (*Peponocephala electra*) population in the Bahamas. Instituto Universitário Ciências Psicológicas. Thesis. 79 p.

West, K.L., W.A. Walker, R.W. Baird, D.L. Webster, and G.S. Schorr. 2018. Stomach contents and diel diving behavior of melon-headed whales (*Peponocephala electra*) in Hawaiian waters. Marine Mammal Science 34(4):1082–1096. doi: 10.1111/mms.12507

Woodworth, P.A., G.S. Schorr, R.W. Baird, D.L. Webster, D.J. McSweeney, M.B. Hanson, R.D. Andrews, and J.J. Polovina. 2012. Eddies as offshore foraging grounds for melon-headed whales (*Peponocephala electra*). Marine Mammal Science 28(3):638–647. doi: 10.1111/j.1748-7692.2011.00509.x

Mesoplodont group − *Mesoplodon densirostris; Mesoplodon europaeus*

Northern Gulf of Mexico Stock Group

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 67% of scores ≥ 2

	Mesoplodon densirostris *Mesoplodon europaeus*	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.7	2.0	
	Habitat Specificity	2.1	2.3	
	Site Fidelity	2.4	0.7	
	Lifetime Reproductive Potential	2.8	0.3	
	Generation Length	2.5	0.7	
	Reproductive Plasticity	1.6	0.3	
	Migration	3.6	0.7	
	Home Range	2.8	0.3	
	Stock Abundance	2.3	1.0	
	Stock Abundance Trend	2.5	0.7	
	Cumulative Stressors	2.8	1.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.7	
	Sea Surface Temperature (Change in variability)	1.1	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.1	2.7	
	Precipitation (Change in mean)	2.1	2.7	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	3.2	2.7	
	Sea Surface Salinity (Change in variability)	1.3	2.7	
	Ocean pH (Change in mean)	3.9	2.7	
	Ocean pH (Change in variability)	1.1	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	2.7	
	Dissolved oxygen (Change in variability)	1.1	2.7	
	Circulation	2.5	2.7	
	Sea level rise	1.1	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Mesoplodont group (Northern Gulf of Mexico Stock Group)

Mesoplodon densirostris; Mesoplodon europaeus

CVA Results Summary

Overall Climate Vulnerability Rank: High (49% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (3.93), Ocean pH (Standard anomaly) (3.93), Sea Surface Temperature (Standard anomaly) (3.93), and Air Temperature (Standard anomaly) (3.87).

Biological Sensitivity: Moderate. Five sensitivity attributes scored greater than 2.5: Migration (3.60), Cumulative Stressors (2.80), Home Range (2.80), Lifetime Reproductive Potential (2.80), and Prey/Diet Specificity (2.67).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 67% of the data quality scores were 2 or greater. 18% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The mesoplodont stock group in the Gulf of Mexico includes Gervais' beaked whales and Blainville's beaked whales found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock group is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021). Cuvier's beaked whales in the Gulf of Mexico are considered in this assessment as a separate, stand-alone stock.

Prey/Diet Specificity

Generally, beaked whale diets consist of mesopelagic fishes, squids, and benthic invertebrates (Heyning 1989; Heyning and Mead 1996; Gannon et al. 1998; Santos et al. 2001; MacLeod et al. 2003; Baird et al. 2005). Pauly et al. (1998) reported species-level Blainville's beaked whale diet composition of 20% small squids, 30% large squids, 30% mesopelagic fishes, and 20% miscellaneous fishes.

Habitat Specificity

Generally, beaked whales are found along the continental slope and in deep oceanic waters (Ritter and Brederlau 1999; Gannier 2000; Waring et al. 2001; Cañadas et al. 2002; Claridge 2003; MacLeod et al. 2003; MacLeod et al. 2004; Ferguson 2005; MacLeod and Zuur 2005; Claridge 2006; Ferguson et al. 2006; MacLeod and Mitchell 2006; Maze-Foley and Mullin 2006; Pitman 2018). Beaked whales are often found associated with bathymetric features (Claridge 2006; MacLeod and D'Amico 2006).

Ward et al. (2005) found beaked whales in waters with a bottom depth ranging from 420 to 3,487 m. In the North Atlantic, Blainville's beaked whale and Gervais' beaked whale occur in warmer southern waters (MacLeod 2000).

Site Fidelity

Information regarding Gervais’ beaked whale and Blainville’s beaked whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Information regarding Gervais’ beaked whale and Blainville’s beaked whale reproductive interval was not found in the literature. Taylor et al. (2007) reported Blainville’s beaked whale age at last reproduction of 40 years (estimated) and Gervais’ beaked whale age at last reproduction of 42 years (estimated).

Generation Length

Information regarding Gervais’ beaked whale and Blainville’s beaked whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding Gervais’ beaked whale and Blainville’s beaked whale reproductive season, location, and habitat was not found in the literature.

Migration

Beaked whales occur year-round in northern Gulf of Mexico waters and were seen in all seasons during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Information regarding Gervais’ beaked whale and Blainville’s beaked whale home range in the Gulf of Mexico was not found in the literature.

Stock Abundance

The abundance estimate for Gervais’ beaked whales and Blainville’s beaked whales in northern Gulf of Mexico waters is 98 individuals (CV=0.46), based on 2017 and 2018 surveys (Garrison et al. 2020). This estimate is negatively biased due to long dive times (Hayes et al. 2021). Unidentified ziphiid abundance for the same time period was estimated to be 181 individuals (CV=0.31; Hayes et al. 2021). A previous estimate of 149 individual mesoplodonts (CV=0.91) was based on a summer 2009 oceanic survey (Waring et al. 2012).

Stock Abundance Trend

Data are insufficient to complete a trend analysis for Gervais' beaked whale and Blainville's beaked whale in the Gulf of Mexico (Hayes et al. 2021). However, comparisons of revised abundance estimates for all ziphiids found significant differences between 2003 and 2004 estimates and between 2004 and 2018 estimates (Garrison et al. 2020).

Cumulative Stressors

Beaked whales in the northern Gulf of Mexico interact with the pelagic longline fishery (Fairfield and Garrison 2008). During the period 2014–2018, there was zero estimated annual fishing-related mortality (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the period 2014–2018, four Gervais' beaked whales and one Blainville's beaked whale were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited by Hayes et al. 2021).

The Gervais' beaked whale and Blainville's beaked whale stocks were likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Beaked whale strandings throughout their worldwide range have been associated with naval activities (Simmonds and Lopez-Jurado 1991; Frantzis 1998; D'Amico et al. 2009; Filadelfo et al. 2009; Bernaldo de Quiros et al. 2019).

Distribution and Sightings

Density model results for beaked whales in the Gulf of Mexico are presented by Roberts et al. (2016a, 2016b) and Mannocci et al. (2017).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

MacLeod, C.D. 2018. Beaked whales, overview. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 80–83. doi: 10.1016/B978-0-12-804327-1.00062-5

Pitman, R. 2018. Mesoplodon beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Mesoplodon densirostris*. The IUCN Red List of Threatened Species 2008: e.T13244A3426474. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T13244A3426474.en

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Mesoplodon europaeus*. The IUCN Red List of Threatened Species 2008: e.T13245A3427527. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T13245A3427527.en

References

Baird, R.W., D.L. Webster, D.J. McSweeney, A.D. Ligon, and G.S. Schorr. 2005. Diving behavior and ecology of Cuvier's (*Ziphius cavirostris*) and Blainville's beaked whales (*Mesoplodon densirostris*) in Hawai'i. Prepared for Southwest Fisheries Science Center (La Jolla, CA) by Cascadia Research Collective, (Olympia, WA). Order No. AB133F-04-RQ-0928. 23 p.

Bernaldo de Quirós, Y., A. Fernandez, R.W. Baird, R.L. Brownell, N. Aguilar de Soto, D. Allen, M. Arbelo, M. Arregui, A. Costidis, A. Fahlman, A. Frantzis, F.M.D. Gulland, M. Iñíguez, M. Johnson, A. Komnenou, H. Koopman, D.A. Pabst, W.D. Roe, E. Sierra, M. Tejedor, and G. Schorr. 2019. Advances in research on the impacts of anti-submarine sonar on beaked whales. Proceedings of the Royal Society B: Biological Sciences 286(1895):20182533. doi: 10.1098/rspb.2018.2533

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

Claridge, D. 2003. Examining distribution and habitat preferences of deep-diving cetaceans, including beaked whales, in Northwest Providence Channel, the Bahamas using geographic information system (GIS) mapping techniques. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals14-19 December 2003. Greensboro, North Carolina. p. 33.

Claridge, D.E. 2006. Fine-scale distribution and habitat selection of beaked whales. Aberdeen University. Dissertation. 119 p.

D'Amico, A., R.C. Gisiner, D.R. Ketten, J.A. Hammock, C. Johnson, P.L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. Aquatic Mammals 35(4):452–472. doi: 10.1578/am.35.4.2009.452

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Ferguson, M.C. 2005. Cetacean population density in the eastern Pacific Ocean: Analyzing patterns with predictive spatial models. University of California, San Diego. 203 p.

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Filadelfo, R., J. Mintz, E. Michlovich, A. D'Amico, P.L. Tyack, and D.R. Ketten. 2009. Correlating military sonar use with beaked whale mass strandings: What do the historical data show? Aquatic Mammals 35(4):435–444. doi: 10.1578/am.35.4.2009.435

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Gannier, A. 2000. Distribution of cetaceans off the Society Islands (French Polynesia) as obtained from dedicated surveys. Aquatic Mammals 26(2):111–126.
Gannon, D.P., J.E. Craddock, and A.J. Read. 1998. Food habits of beaked whales (*Mesoplodon bidens* and *Ziphius cavirostris*) from the northeastern U.S., Abstracts, The World Marine Mammal Science Conference. 20-24 January 1998. Monte Carlo, Monaco. p. 49.
Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142
Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316
Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.
Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.
Heyning, J.E. 1989. Cuvier's beaked whale - *Ziphius cavirostris* (G. Cuvier, 1823). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, San Diego, CA. pp. 289–308.
Heyning, J.E. and J.G. Mead. 1996. Suction feeding in beaked whales: Morphological and observational evidence. Los Angeles County Museum Contributions in Science 464:1–12.
Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K.

Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Macleod, C.D. 2000. Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. Mammal Review 30(1):1–8. doi: 10.1046/j.1365-2907.2000.00057.x

MacLeod, C.D. and A. D'Amico. 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. Journal of Cetacean Research and Management 7(3):211–221.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

MacLeod, C.D., M.B. Santos, and G.J. Pierce. 2003. Review of data on diets of beaked whales: Evidence of niche separation and geographic segregation. Journal of the Marine Biological Association of the United Kingdom 83(3):651–665. doi: 10.1017/S0025315403007616h

MacLeod, C.D. and A.F. Zuur. 2005. Habitat utilization by Blainville's beaked whales off Great Abaco, northern Bahamas, in relation to seabed topography. Marine Biology 147(1):1–11. doi: 10.1007/s00227-004-1546-9

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Pitman, R. 2018. *Mesoplodon* beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Ritter, F. and B. Brederlau. 1999. Behavioural observations of dense beaked whales (*Mesoplodon densirostris*) off La Gomera, Canary Islands (1995-1997). Aquatic Mammals 25(2):55–61.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016b. Density model for beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) for the U.S. Gulf of Mexico version 1.4, 2016-

03-09, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 55 p.

Santos, M.B., G.J. Pierce, J. Herman, A. López, A. Guerra, E. Mente, and M.R. Clarke. 2001. Feeding ecology of Cuvier's beaked whale (*Ziphius cavirostris*): a review with new information on the diet of this species. Journal of the Marine Biological Association of the United Kingdom 81(04):687–694. doi: 10.1017/s0025315401004386

Simmonds, M.P. and L.F. Lopez-Jurado. 1991. Whales and the military. Nature 351(6326):448–448. doi: 10.1038/351448a0

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Ward, J.A., G.H. Mitchell, A.M. Farak, and E.P. Keane. 2005. Beaked whale habitat characterization and prediction. NUWC-NPT Technical Report 11,548. Newport, RI.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Minke whale − *Balaenoptera acutorostrata acutorostrata*

Canadian East Coast Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

Balaenoptera acutorostrata acutorostrata		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	3.0	
	Habitat Specificity	1.5	2.2	
	Site Fidelity	2.7	1.7	
	Lifetime Reproductive Potential	1.0	2.0	
	Generation Length	2.4	1.7	
	Reproductive Plasticity	2.3	1.3	
	Migration	1.3	2.3	
	Home Range	1.7	1.5	
	Stock Abundance	1.6	2.5	
	Stock Abundance Trend	1.9	1.3	
	Cumulative Stressors	2.2	2.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.7	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.3	2.7	
	Precipitation (Change in variability)	1.4	2.7	
	Sea Surface Salinity (Change in mean)	1.9	2.3	
	Sea Surface Salinity (Change in variability)	1.6	2.3	
	Ocean pH (Change in mean)	4.0	2.7	
	Ocean pH (Change in variability)	1.2	2.7	
	Sea ice coverage (Change in mean)	1.5	2.7	
	Sea ice coverage (Change in variability)	1.1	2.7	
	Dissolved oxygen (Change in mean)	4.0	2.7	
	Dissolved oxygen (Change in variability)	1.2	2.7	
	Circulation	2.7	2.3	
	Sea level rise	1.5	2.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Minke whale (Canadian East Coast Stock)

Balaenoptera acutorostrata acutorostrata

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (65% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Air Temperature (Standard anomaly) (3.87), and Sea Surface Temperature (Standard anomaly) (3.67).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Site Fidelity (2.73)

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 81% of the data quality scores were 2 or greater, 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

Minke whales of the Canadian East Coast Stock (which includes those off the eastern coast of the United States) inhabit the area from the western half of the Davis Strait (45°W) to the Gulf of Mexico (Donovan 1991; Hayes et al. 2022).

Prey/Diet Specificity

In the North Atlantic, minke whales consume capelin (*Mallotus villosus*), mackerel (*Scomber scombrus*), herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), salmon (*Salmo salar*), cod (*Gadus morhua*), coal fish (*Pollachius virens*), whiting (*Merlangius merlangus*), wolffish (*Anarhichas lupus*), dogfish (*Squalus acanthias*), pollock (*Pollachius pollachius*), haddock (*Melanogrammus aeglefinus*), euphausiids, and copepods (Stewart and Leatherwood 1985; Kenney et al. 1985; Horwood 1990).

Habitat Specificity

Minke whales are found in waters over the continental shelf (Mitchell and Kozicki 1975; Ivashin and Votrogov 1981; Murphy 1995; Mignucci-Giannoni 1998; Calambokidis et al. 2004), though there is evidence that they also occupy deeper waters (Slijper et al. 1964; Horwood 1990; Mitchell 1991).

Minke whales in the western North Atlantic are associated with habitat that supports and aggregates prey, such as underwater sand dunes and tidal currents (Naud et al. 2003; Johnston et al. 2005)

Site Fidelity

Bartha et al. (2011) found minke whales in Nova Scotia waters to show short-term site fidelity, but only 35% of identified whales were resighted in subsequent years, suggesting only a portion of the population exhibits long-term site fidelity. Lopes et al. (2017) reported similar levels of resighting in the Gulf of St. Lawrence.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 1.00 years. Taylor et al. (2007) reported age at first reproduction of 8 years and age at last reproduction of 51 years (estimated). Females may reach sexual maturity as early as 6 years of age (Perrin et al. 2018).

Generation Length

Taylor et al. (2007) reported generation length of 13.0 years at r=0.09 and 22.1 years at r=0.0.

Reproductive Plasticity

Mating likely occurs in winter or early spring (Stewart and Leatherwood 1985) and calving likely occurs October to March (Hayes et al. 2017).

Migration

Minke whales are relatively widespread on the continental shelf off New England in spring through fall (CETAP 1982; Risch et al. 2013; Risch et al. 2014) and in deep-ocean waters during fall through spring (Clark and Gagnon 2002). Minke whales are also found in the western North Atlantic from Bermuda to the West Indies during the winter months (Mitchell 1991; Mellinger et al. 2000).

Home Range

Minke whales were found broadly distributed in shelf waters during spring and summer surveys (CETAP 1982).

Stock Abundance

Hayes et al. (2022) considered the best abundance estimate for stock assessment purposes to be 21,968 individuals (CV=0.31), based on 2016 shipboard and aerial surveys from central Virginia to Labrador (Lawson and Gosselin 2018; Palka 2020).

Stock Abundance Trend

Insufficient data exist to calculate a stock abundance trend (Hayes et al. 2022).

Cumulative Stressors

Minke whales of the Canadian East Coast stock interact with gillnet fisheries. During the time period 2014−2018, average annual minimum detected fisheries-related mortality and serious injury was 10.55

minke whales per year (Hayes et al. 2022; Henry et al. 2021). Ship strike is another threat to minke whales in this region, with an average of 1.2 minke whales per year struck in U.S. and Canadian waters during the time period 2014−2018 (Henry et al. 2021). An Unusual Mortality Event (UME) was declared for this stock that included 57 minke whales stranding along the U.S. Atlantic Coast from January 2017 to December 2018 (Hayes et al. 2022).

Minke whales in the Canadian East Coast stock were historically hunted until 1972, and minke whale stocks continue to be part of a subsistence hunt in the waters of Greenland, and are commercially hunted in Iceland and Norway (IWC 1992; IWC 2018; Hayes et al. 2022).

Distribution and Sightings

Density model results for minke whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2016c, 2017) and Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Cooke, J.G. 2018. *Balaenoptera acutorostrata*. The IUCN Red List of Threatened Species 2018: e.T2474A50348265. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2474A50348265.en

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Perrin, W.F., S.D. Mallette, and R.L. Brownell. 2018. Minke whales: *Balaenoptera acutorostrata* and *B. bonaerensis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 608-613. doi: 10.1016/B978-0-12-804327-1.00175-8

References

Bartha, G., S. Gowans, P. Simard, M. Tetley, and E.O. Keith. 2011. Population size and site fidelity of North Atlantic minke whales (*Balaenoptera acutorostrata acutorostrata*) off the Atlantic Coast of Nova Scotia, Canada. Aquatic Mammals 37(4):454–463. doi: 10.1578/am.37.4.2011.454

Calambokidis, J., T. Chandler, E. Falcone, and A. Douglas. 2004. Research on large whales off California, Oregon, and Washington in 2003. Annual Report for 2003. Prepared for Southwest Fisheries Science Center (La Jolla, CA) by Cascadia Research (Olympia, WA). Contract number 50ABNF100065. 46 p.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Clark, C.W. and G.J. Gagnon. 2002. Low-frequency vocal behaviors of baleen whales in the North Atlantic: Insights from Integrated Undersea Surveillance System detections, locations, and tracking from 1992 to 1996. Journal of Underwater Acoustics (US Navy) 52(3):609–640.

Donovan, G.P. 1991. A review of IWC stock boundaries. Reports of the International Whaling Commission (Special Issue) 13:39–68.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2017. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-241. 274 p. doi: 10.7289/V5/TM-NEFSC-241

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henry, A.G., M. Garron, D. Morin, A. Smith, A. Reid, W. Ledwell, and T.V.N. Cole. 2021. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2014-2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 21-07. 14 p. doi: 10.25923/ey0b-fw22

Horwood, J. 1990. Biology and exploitation of the minke whale. CRC Press, Boca Raton, FL. 248 p.

International Whaling Commission (IWC). 1992. Annex K. Report of the working group on North Atlantic minke trials. Reports of the International Whaling Commission (Special Issue) 42:246–251.

International Whaling Commission (IWC). 2018. Report of the 2017 AWMP workshops on the development of SLAs for the Greenlandic hunts. SC/67B/REP/06. 24 p.

Ivashin, M.V. and L.M. Votrogov. 1981. Minke whales, *Balaenoptera acutorostrata davidsoni*, inhabiting inshore waters of the Chukotka coast. Reports of the International Whaling Commission 13:231.

Johnston, D.W., L.H. Thorne, and A.J. Read. 2005. Fin whales *Balaentoptera physalus* and minke whales *Balaentoptera acutorostrata* exploit a tidally driven island wake ecosystem in the Bay of Fundy. Marine Ecology Progress Series 305:287–295. doi: 10.3354/meps305287

Kenney, R.D., M.A.M. Hyman, and H.E. Winn. 1985. Calculation of standing stocks and energetic requirements of the cetaceans of the northeast United States outer continental shelf. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-F/NEC-41. 99 p.

Lawson, J. and J.-F. Gosselin. 2018. Estimates of cetacean abundance from the 2016 NAISS aerial surveys of eastern Canadian waters, with a comparison to estimates from the 2007 TNASS. NAMMCO SC/25/AE/09. 40 p.

Lopes, X.M., M. Bérubé, S.D. Berrow, F. Larsen, T. Haug, J. Hoekendijk, A.R. Hoelzel, B. Kot, N. Øien, T. Oosting, and C. Pampoulie. 2017. Site fidelity of female minke whales in the Gulf of. St Lawrence, Canada. 22nd Biennial Conference on the Biology of Marine Mammals, Halifax, Canada,

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mellinger, D.K., C.D. Carson, and C.W. Clark. 2000. Characteristics of minke whale (*Balaenoptera acutorostrata*) pulse trains recorded near Puerto Rico. Marine Mammal Science 16(4):739–756. doi: 10.1111/j.1748-7692.2000.tb00969.x

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mitchell, E. and V.M. Kozicki. 1975. Supplementary information on minke whale (*Balaenoptera acutorostrata*) from Newfoundland fishery. Journal of the Fisheries Research Board of Canada 32(7):985–994. doi: 10.1139/f75-118

Mitchell, E.D., Jr. 1991. Winter records of the minke whale (*Balaenoptera acutorostrata acutorostrata* Lacépède 1804) in the southern North Atlantic. Reports of the International Whaling Commission 41:455–457.

Murphy, M.A. 1995. Occurrence and group characteristics of minke whales, *Balaenoptera-acutorostrata*, in Massachusetts Bay and Cape-Cod Bay. Fishery Bulletin 93(3):577–585.

Naud, M.-J., B. Long, J.-C. Brêthes, and R. Sears. 2003. Influences of underwater bottom topography and geomorphology on minke whale (*Balaenoptera acutorostrata*) distribution in the Mingan Islands (Canada). Journal of the Marine Biological Association of the United Kingdom 83(4):889–896. doi: 10.1017/S0025315403008002h

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Perrin, W.F., S.D. Mallette, and R.L. Brownell. 2018. Minke whales: *Balaenoptera acutorostrata* and *B. bonaerensis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 608–613. doi: 10.1016/B978-0-12-804327-1.00175-8

Risch, D., M. Castellote, C.W. Clark, G.E. Davis, P.J. Dugan, L.E.W. Hodge, A. Kumar, K. Lucke, D.K. Mellinger, S.L. Nieukirk, C.M. Popescu, C. Ramp, A.J. Read, A.N. Rice, M.A. Silva, U. Siebert, K.M. Stafford, H. Verdaat, and S.M. VanParijs. 2014. Seasonal migrations of North Atlantic minke whales: novel insights from large-scale passive acoustic monitoring networks. Movement Ecology 2(1):24. doi: 10.1186/s40462-014-0024-3

Risch, D., C.W. Clark, P.J. Dugan, M. Popescu, U. Siebert, and S.M. Van Parijs. 2013. Minke whale acoustic behavior and multi-year seasonal and diel vocalization patterns in Massachusetts Bay, USA. Marine Ecology Progress Series 489:279–295. doi: 10.3354/meps10426

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016b. Density model for minke whale (*Balaenoptera acutorostrata*) for the U.S. East Coast version 8.4, 2016-04-21, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 126 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016c. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0.

Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Slijper, E.J., W.L. van Utrecht, and C. Naaktgeboren. 1964. Remarks on the distribution and migration of whales, based on observations from Netherlands ships. Bijdragen Tot de Dierkunde 34:3–93.

Stewart, B.S. and S. Leatherwood. 1985. Minke whale – *Balaenoptera acutorostrata* Lacépède, 1804. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 3: The sirenians and baleen whales. Academic Press, London, UK. pp. 91–136.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

North Atlantic right whale − *Eubalaena glacialis*

Western Atlantic Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 100% of scores≥ 2

	Eubalaena glacialis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	3.9	3.0	
	Habitat Specificity	3.3	3.0	
	Site Fidelity	3.6	2.9	
	Lifetime Reproductive Potential	2.5	3.0	
	Generation Length	2.8	2.1	
	Reproductive Plasticity	3.0	3.0	
	Migration	1.6	2.5	
	Home Range	1.8	2.9	
	Stock Abundance	3.0	3.0	
	Stock Abundance Trend	3.4	3.0	
	Cumulative Stressors	3.8	3.0	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	2.9	
	Sea Surface Temperature (Change in variability)	1.0	2.9	
	Air Temperature (Change in mean)	4.0	2.9	
	Air Temperature (Change in variability)	1.0	2.9	
	Precipitation (Change in mean)	1.2	2.9	
	Precipitation (Change in variability)	1.5	2.9	
	Sea Surface Salinity (Change in mean)	1.9	2.9	
	Sea Surface Salinity (Change in variability)	1.7	2.9	
	Ocean pH (Change in mean)	4.0	2.9	
	Ocean pH (Change in variability)	1.4	2.9	
	Sea ice coverage (Change in mean)	1.2	2.9	
	Sea ice coverage (Change in variability)	1.1	2.9	
	Dissolved oxygen (Change in mean)	4.0	2.9	
	Dissolved oxygen (Change in variability)	1.2	2.9	
	Circulation	3.3	2.9	
	Sea level rise	1.8	2.9	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

North Atlantic right whale (Western Atlantic Stock)

Eubalaena glacialis

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (3.80).

Biological Sensitivity: Very High. Three sensitivity attributes scored greater than 3.5: Prey/Diet Specificity (3.90), Cumulative Stressors (3.85), and Site Fidelity (3.60).

Distributional Response: High

Abundance Response: Very High

Phenology Response: High

Data Quality: 100% of the data quality scores were 2 or greater, 100% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The North Atlantic right whale Western Atlantic Stock (NARW) includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore and Canadian waters (Hayes et al. 2022).

Prey/Diet Specificity

The NARW diet consists primarily of late-stage juveniles and adults of copepods in the genera *Calanus* and *Pseudocalanus* (Nemoto 1970; Cummings 1985; Kenney et al. 1985; Mayo and Marx 1990; Beardsley et al. 1996; Mayo et al. 2001; Baumgartner et al. 2003, 2007; Pendleton et al. 2009; Meyer-Gutbrod et al. 2015). NARWs are also known to occasionally feed on other smaller copepods, krill, pteropods, or the planktonic larval stages of barnacles and other crustaceans (Kenney 2018).

Habitat Specificity

Two critical habitats for North Atlantic right whales are designated in U.S. waters: a calving area extending from just south of Cape Canaveral, Florida to Cape Fear, North Carolina, and a foraging area encompassing the U.S. portion of the Gulf of Maine (NMFS 2016). Feeding areas in the Bay of Fundy and Roseway Basin in Canadian waters are designated as critical habitats by Canadian authorities (Fisheries and Oceans Canada 2014).

The winter calving grounds are characterized by cooler, shallow nearshore waters inshore of a mid-shelf front (Kraus et al. 1993; Ward 1999; Keller et al. 2006).

Feeding areas are in nearshore and shelf waters, where some combination of bottom topography, water column structure and stratification, and currents acts to physically aggregate zooplankton into extremely dense concentrations (Kenney et al. 1986, 1995; Wishner et al. 1988; Murison and Gaskin 1989; Kenney and Wishner 1995; Macaulay et al. 1995; Beardsley et al. 1996; Mate et al. 1997; Mate and Baumgartner 2001; Baumgartner et al. 2003, 2007; Baumgartner and Mate 2005). There are probably also offshore feeding grounds, in locations not yet known, based on historical whaling records and on the fact that some known whales are often missing from the known habitats for months or years at a time (Kenney 2018).

Site Fidelity

NARWs have historically aggregated seasonally in seven areas: 1) the coastal waters of the southeastern United States; 2) the Great South Channel; 3) Jordan Basin; 4) Georges Basin along the northeastern edge of Georges Bank; 5) Cape Cod and Massachusetts Bays; 6) the Bay of Fundy; and 7) the Roseway Basin on the Scotian Shelf (Watkins and Schevill 1982; Winn et al. 1986; Kenney et al. 1995; Brown et al. 2001; Hlista et al. 2009; Pendleton et al. 2009; Cole et al. 2013, 2016; Khan et al. 2016, 2018). Since 2013, NARWs have been increasingly present in the Gulf of St. Lawrence from late spring through early fall (Cole et al. 2016; Khan et al. 2016, 2018), and over the last decade occurrence of NARWs south of Massachusetts and Rhode Island has been increasing, as well as expanding temporally from mainly winter-spring to year-round (Leiter et al. 2017; Stone et al. 2017; Quintana-Rizzo et al. 2021; O'Brien et al. 2022).

Despite seasonal aggregation, there is high interannual variability in right whale use of some habitats (Pendleton et al. 2009) and whales may abandon feeding grounds during periods of low prey abundance (Kenney 2001; Patrician and Kenney 2010). Use of seasonal habitat is further divided by sex and reproductive state, with nursing mothers showing preference for different feeding grounds and likely passing that preference on to their offspring (Schaeff et al. 1993; Malik et al. 1999; Brown et al. 2001; Frasier et al. 2007).

Lifetime Reproductive Potential

Mean calving interval is reported from 3 to 4 years, although interannual variability is high (Knowlton et al. 1994; Hamilton et al. 1998; Kraus et al. 2001, 2007; Taylor et al. 2007; Pettis et al. 2021).

Taylor et al. (2007) estimated *Eubalaena glacialis* age at last reproduction of 57 years. NARW average age at first reproduction is reported in the range of 9 to 10 years (Kraus et al. 2001; Taylor et al. 2007). The youngest mature female in the western North Atlantic was 4 at maturity and 5 at first calving (Knowlton et al. 1994). The oldest known NARW was estimated to be over 70 years old based on sighting data (Kraus and Rolland 2007). Corkeron et al. (2018) estimated that half of male NARWs are dead by age 35, and half of females by age 20, in comparison to estimates of 46–69 years for southern right whales.

Generation Length

Taylor et al. (2007) report generation length of 23.3 years at r=0.05 and 35.7 years at r=0.0.

Reproductive Plasticity

Calving grounds are in shallow coastal regions or bays in the western North Atlantic near Georgia and northeastern Florida (Winn et al. 1986; Kraus et al. 1993; Kraus and Rolland 2007) and as far north as North Carolina (Good 2008). Right whales show a clear preference for waters in a relatively narrow depth and temperature range — 13–19 m and 13–16°C (Keller et al. 2006). Calving season runs December through March (Kraus et al. 1993, 2001; Kraus and Rolland 2007; Hamilton and Cooper 2010). The central Gulf of Maine and Roseway Basin on the southwestern Scotian Shelf are possible mating areas, at least in some years (Mussoline et al. 2012; Cole et al. 2013; Brillant et al. 2015; Bort et al. 2015).

Migration

The NARW population migrates primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence (Winn et al. 1986; Hamilton and Mayo 1990; Gaskin 1991; Kenney 2001; Kraus et al. 1993; Nichols et al. 2008), although not all individuals complete this migration (Whitt et al. 2013).

Home Range

Although much of the population is found within the migratory range from Florida to New England and the Canadian Maritimes, NARWs have undertaken long-distance movements to locations as far north as Newfoundland, the Labrador Basin, southeast of Greenland, Iceland, Norway, the British Isles, France, the Azores, Madeira, and the Canaries (Knowlton et al. 1992; Mate et al. 1997; IWC 2001; Jacobsen et al. 2004; Kenney et al. in press). NARWs have also been observed, particularly by passive acoustic monitoring, to occur in any season and at nearly any location within the overall range (Whitt et al. 2013; Davis et al. 2017; Hayes et al. 2022).

Stock Abundance

The abundance of the Western Atlantic stock of NARWs has been monitored since the stock assessment process was instituted in 1995 using the catalog of identified individuals (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). The 2007 SAR was the first to assess the minimum abundance using the Minimum Number Alive (MNA) method, which calculates the sum of the known whales seen in a given year plus any others that were seen both before and after that year. After about 2010, changes in distribution patterns reduced resighting probabilities and made the MNA method less useful and reliable. Pace et al. (2017) developed a new method using Bayesian state-space modeling, still based on the photoID catalog. That method is now being used in both the stock assessments and the annual North Atlantic Right Whale Consortium "report cards" (e.g., Pettis et al. 2021). Pace et al. (2017) reported the peak abundance of 482 in 2010, followed by a decline to 458 in 2015. The NOAA Fisheries 2021 SAR reported an abundance estimate of 368 individuals (95% CI = 356–378) as of November 2019

(Hayes et al. 2022). In October 2022, the North Atlantic Right Whale Consortium announced a revised 2020 abundance estimate (348 +/-5) and released a 2021 abundance estimate (340 +/-7; NEAQ 2022).

Stock Abundance Trend

Knowlton et al. (1994) estimated that the NARW population grew at 2.5% during 1986–1992. A model by Caswell et al. (1999) suggested that population growth reversed to a decline of the same magnitude during the 1990s, but that decline was of short duration. Subsequent analyses by Pace et al. (2017), Corkeron et al. (2018), and in the stock assessments show growth at about 2.8% from 1990 to 2011 but a statistically significant decline since then. The decline is due to both an increase in mortality, especially from entanglement, and a decline in reproduction (Corkeron et al. 2018; Pettis et al. 2021; Hayes et al. 2022).

Cumulative Stressors

Threats to NARW are summarized in five-year status reviews (NMFS 2017), annual report cards (e.g., Pettis et al. 2021; see www.narwc.org for previous and future years), and annual stock assessment reports (e.g., Hayes et al. 2022; see https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock for previous and future years). These threats include vessel strikes (van der Hoop et al. 2012, 2015; Wiley et al. 2016; Henry et al. 2021), and entanglement in fishing gear (Knowlton et al. 2012; van der Hoop et al. 2017) as primary sources of mortality and serious injury, with contaminants, disease, habitat modification, and noise pollution as some examples of additional concerns (Nowacek et al. 2007; Weilgart 2007; Rolland et al. 2012; Rice et al. 2014).

NARWs had an estimated annual human-caused mortality and serious injury (detected and cryptic/undetected) of 27.4 whales during the period 2014–2018 (Pace et al. 2021; Hayes et al. 2022). During that period, fishery entanglement accounted for 6.85 detected mortalities and serious injuries per year and vessel strikes accounted for 1.3 detected mortalities and serious injuries per year. Since 2017, an Unusual Mortality Event (UME) has been declared for NARW that includes 92 documented dead, serious injury, or morbidity (sublethal injuries/illness) whales in the U.S. and Canada (https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event).

Other Relevant Information

Several studies have examined NARW within the context of climate change. Studies have found that climate-driven changes in oceanographic conditions alter the distribution and abundance of NARW prey and affect NARW foraging patterns (Meyer-Gutbrod and Greene 2014; Runge et al. 2015; Meyer-Gutbrod et al. 2015, 2021; Davis et al. 2017; Grieve et al. 2017; Record et al. 2019; Sorochan et al. 2019; Brennan et al. 2021; Gavrilchuk et al. 2021). Several projections of NARW future distribution have been based on projected *Calanus* spp. distribution (Pendleton et al. 2012; Daoust et al. 2017; Meyer-Gutbrod et al. 2018; Ross et al. 2021), while other studies have projected NARW abundance based on future environmental conditions (Meyer-Gutbrod and Greene 2018). Areas used by NARW have experienced a high degree of environmental change in recent years and are projected to continue to experience significant change (Saba et al. 2016; Pershing et al. 2021).

Distribution and Sightings

Density model results for NARW in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2020, 2021a, 2021b).

Further Reading

Cooke, J.G. 2020. *Eubalaena glacialis*. The IUCN Red List of Threatened Species 2020: e.T41712A162001243. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T41712A162001243.en
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16
Kenney, R.D. 2018. Right whales: *Eubalaena glacialis*, *E. japonica*, and *E. australis*, in: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK, pp. 817–822. doi: 10.1016/B978-0-12-804327-1.00217-X
National Marine Fisheries Service (NMFS). 2017. North Atlantic right whale (*Eubalaena glacialis*) 5-year review: Summary and evaluation. https://www.greateratlantic.fisheries.noaa.gov/protected/final_narw_5-year_review_2017.pdf.
North Atlantic Right Whale Consortium. (2021, August 10). Report Cards - NORTH ATLANTIC RIGHT WHALE CONSORTIUM. https://www.narwc.org/report-cards.html

Literature Cited

Baumgartner, M.F., T.V.N. Cole, P.J. Clapham, and B.R. Mate. 2003. North Atlantic right whale habitat in the lower Bay of Fundy and on the SW Scotian Shelf during 1999–2001. Marine Ecology Progress Series 264:137–154. doi: 10.3354/meps264137
Baumgartner, M.F. and B.R. Mate. 2005. Summer and fall habitat of North Atlantic right whales (*Eubalaena glacialis*) inferred from satellite telemetry. Canadian Journal of Fisheries and Aquatic Sciences 62(3):527–543. doi: 10.1139/f04-238
Baumgartner, M.F., C.A. Mayo, and R.D. Kenney. 2007. Enormous carnivores, microscopic food and a restaurant that's hard to find. In: Kraus, S.D. and R.M. Rolland (Eds.), The urban whale: North Atlantic right whales at the crossroads. Harvard University Press, Cambridge, MA. pp. 138–171. doi: 10.2307/j.ctv1pnc1q9.10
Beardsley, R.C., A.W. Epstein, C. Chen, K.F. Wishner, M.C. Macaulay, and R.D. Kenney. 1996. Spatial variability in zooplankton abundance near feeding right whales in the Great South Channel. Deep-Sea Research Part II-Topical Studies in Oceanography 43(7-8):1601–1625. doi: 10.1016/S0967-0645(96)00050-1
Bort, J., S. Van Parijs, P. Stevick, E. Summers, and S. Todd. 2015. North Atlantic right whale *Eubalaena glacialis* vocalization patterns in the central Gulf of Maine from October 2009 through October 2010. Endangered Species Research 26(3):271–280. doi: 10.3354/esr00650
Brennan, C.E., F. Maps, W.C. Gentleman, D. Lavoie, J. Chassé, S. Plourde, and C.L. Johnson. 2021. Ocean circulation changes drive shifts in *Calanus* abundance in North Atlantic right whale foraging habitat: A model comparison of cool and warm year scenarios. Progress in Oceanography 197:102629. doi: 10.1016/j.pocean.2021.102629
Brillant, S.W., A.S.M. Vanderlaan, R.W. Rangeley, and C.T. Taggart. 2015. Quantitative estimates of the movement and distribution of North Atlantic right whales along the northeast coast of North America. Endangered Species Research 27(2):141–154. doi: 10.3354/esr00651

Brown, M.W., S. Brault, P.K. Hamilton, R.D. Kenney, A.R. Knowlton, M. K. Marx, C. A. Mayo, C.K. Slay, and S.D. Kraus. 2001. Sighting heterogeneity of right whales in the western North Atlantic: 1980–1992. Journal of Cetacean Research and Management (Special Issue) 2:245–250. doi: 10.47536/jcrm.vi.284

Caswell, H., M. Fujiwara, and S. Brault. 1999. Declining survival probability threatens the North Atlantic right whale. Proceedings of the National Academy of Sciences 96(6):3308–3313. doi: 10.1073/pnas.96.6.3308

Cole, T.V.N., P. Duley, M. Foster, A. Henry, and D.D. Morin. 2016. 2015 right whale aerial surveys of the Scotian Shelf and Gulf of St. Lawrence. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 16-02. 9 p. doi: 10.7289/V52Z13HQ

Cole, T.V.N., P. Hamilton, A.G. Henry, P. Duley, R.M. Pace, B.N. White, and T. Frasier. 2013. Evidence of a North Atlantic right whale *Eubalaena glacialis* mating ground. Endangered Species Research 21(1):55–64. doi: 10.3354/esr00507

Corkeron, P., P. Hamilton, J. Bannister, P. Best, C. Charlton, K.R. Groch, K. Findlay, V. Rowntree, E. Vermeulen, and R.M. Pace, III. 2018. The recovery of North Atlantic right whales, *Eubalaena glacialis*, has been constrained by human-caused mortality. Royal Society Open Science 5(11):180892. doi: 10.1098/rsos.180892

Cummings, W.C. 1985. Right whales – *Eubalaena glacialis* (Müller, 1776) and *Eubalaena australis* (Desmoulins, 1822). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 3: The sirenians and baleen whales. Academic Press, London, UK. pp. 275–304.

Daoust, P.Y., E.L. Couture, T. Wimmer, and L. Bourque. 2017. Incident report: North Atlantic right whale mortality event in the Gulf of St. Lawrence, 2017. Collaborative report produced by: Canadian Wildlife Health Cooperative, Marine Animal Response Society, and Fisheries and Oceans Canada. 256 p.

Davis, G.E., M.F. Baumgartner, J.M. Bonnell, J. Bell, C. Berchok, J. Bort Thornton, S. Brault, G. Buchanan, R.A. Charif, D. Cholewiak, C.W. Clark, P. Corkeron, J. Delarue, K. Dudzinski, L. Hatch, J. Hildebrand, L. Hodge, H. Klinck, S. Kraus, B. Martin, D.K. Mellinger, H. Moors-Murphy, S. Nieukirk, D.P. Nowacek, S. Parks, A.J. Read, A.N. Rice, D. Risch, A. Sirovic, M. Soldevilla, K. Stafford, J.E. Stanistreet, E. Summers, S. Todd, A. Warde, and S.M. Van Parijs. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. Scientific Reports 7(1):13460. doi: 10.1038/s41598-017-13359-3

Fisheries and Oceans Canada (DFO). 2014. Recovery strategy for the North Atlantic right whale (*Eubalaena glacialis*) in Atlantic Canadian waters [final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada: Ottawa, Ontario, Canada. 68 p.

Frasier, T.R., B.A. McLeod, R.M. Gillett, M.W. Brown, and B.N. White. 2007. Right whales past and present as revealed by their genes. In: Kraus, S.D. and R.M. Rolland (Eds.), The urban whale: North Atlantic right whales at the crossroads. Harvard University Press, Cambridge, MA. pp. 200–231.

Gaskin, D.E. 1991. An update on the status of the right whale, *Eubalaena glacialis*, in Canada. Canadian Field-Naturalist 105(2):198–205.

Gavrilchuk, K., V. Lesage, S.M.E. Fortune, A.W. Trites, and S. Plourde. 2021. Foraging habitat of North Atlantic right whales has declined in the Gulf of St. Lawrence, Canada, and may be insufficient for successful reproduction. Endangered Species Research 44:113–136. doi: 10.3354/esr01097

Good, C.P. 2008. Spatial ecology of the North Atlantic right whale (*Eubalaena glacialis*). Duke University. Dissertation. 135 p.

Grieve, B.D., J.A. Hare, and V.S. Saba. 2017. Projecting the effects of climate change on *Calanus finmarchicus* distribution within the U.S. Northeast Continental Shelf. Scientific Reports 7:6264. doi: 10.1038/s41598-017-06524-1

Hamilton, P.K. and L.A. Cooper. 2010. Changes in North Atlantic right whale (*Eubalaena glacialis*) cow-calf association times and use of the calving ground: 1993–2005. Marine Mammal Science 26:896–916. doi: 10.1111/j.1748-7692.2010.00378.x

Hamilton, P.K., A.R. Knowlton, M.K. Marx, and S.D. Kraus. 1998. Age structure and longevity in North Atlantic right whales (*Eubalaena glacialis*) and their relation to reproduction. Marine Ecology Progress Series 171:285–292. doi: 10.3354/meps171285

Hamilton, P.K. and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978–1986. Reports of the International Whaling Commission (Special Issue) 12:203–208.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Henry, A.G., M. Garron, D. Morin, A. Smith, A. Reid, W. Ledwell, and T.V.N. Cole. 2021. Serious injury and mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces, 2014-2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 21-07. 14 p. doi: 10.25923/ey0b-fw22

Hlista, B., H. Sosik, L.M. Traykovski, R. Kenney, and M. Moore. 2009. Seasonal and interannual correlations between right whale distribution and calving success and chlorophyll concentrations in the Gulf of Maine, USA. Marine Ecology Progress Series 394:289–302. doi: 10.3354/meps08267

International Whaling Commission (IWC). 2001. Report of the workshop on the comprehensive assessment of right whales: A worldwide comparison. Journal of Cetacean Research and Management (Special Issue) 2:1–35. doi: 10.47536/jcrm.vi.270

Jacobsen, K.-O., M. Marx, and N. Oien. 2004. Two-way trans-Atlantic migration of a North Atlantic right whale (*Eubalaena glacialis*). Marine Mammal Science 20(1):161–166. doi: 10.1111/j.1748-7692.2004.tb01147.x

Keller, C.A., L.I. Ward-Geiger, W.B. Brooks, C.K. Slay, C.R. Taylor, and B.J. Zoodsma. 2006. North Atlantic right whale distribution in relation to sea-surface temperature in the southeastern United States calving grounds. Marine Mammal Science 22(2):426–445. doi: 10.1111/j.1748-7692.2006.00033.x

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distributions in the Gulf of Maine. Journal of Cetacean Research and Management (Special Issue) 2:209–223. doi: 10.47536/jcrm.vi.287

Kenney, R.D. 2018. Right whales: *Eubalaena glacialis*, *E. japonica*, and *E. australis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 817–822. doi: 10.1016/B978-0-12-804327-1.00217-X

Kenney, R.D., P.K. Hamilton, and T.R. Frasier. In press. North Atlantic right whale, *Eubalaena glacialis* (Müller, 1776). In: Hackländer, K., F.E. Zachos, C. Weir, P.G.H. Evans, and M.H. Rasmussen (Eds.), Handbook of the Mammals of Europe, Volume 4, Cetacea. Springer Nature, Heidelberg, Germany.

Kenney, R.D., M.A. Hyman, R.E. Owen, G.P. Scott, and H.E. Winn. 1986. Estimation of prey densities required by western North Atlantic right whales. Marine Mammal Science 2:1–13. doi: 10.1111/j.1748-7692.1986.tb00024.x

Kenney, R.D., M.A.M. Hyman, and H.E. Winn. 1985. Calculation of standing stocks and energetic requirements of the cetaceans of the northeast United States outer continental shelf. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-F/NEC-41. 99 p.

Kenney, R.D., H.E. Winn, and M.C. Macaulay. 1995. Cetaceans in the Great South Channel, 1979–1989: right whale (*Eubalaena glacialis*). Continntal Shelf Research 15:385–414. doi: 10.1016/0278-4343(94)00053-P

Kenney, R.D. and K.F. Wishner. 1995. The South Channel Ocean Productivity Experiment. Continental Shelf Research 15:373–384. doi: 10.1016/0278-4343(94)00070-4

Khan, C.B., P. Duley, A.H. Glass, J. Gatzke, L. Crowe, and T.V.N. Cole. 2016. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2014 results summary. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 16-01. 12 p. doi: 10.7289/V59P2ZNN

Khan, C.B., A. Henry, L. Crowe, P. Duley, J. Gatzke, and T.V.N. Cole. 2018. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2016 results summary. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 18-01. 13 p. doi: 10.7289/V5/RD-NEFSC-18-01

Knowlton, A.R., P.K. Hamilton, M.K. Marx, H.M. Pettis, and S.D. Kraus. 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 yr retrospective. Marine Ecology Progress Series 466:293–302. doi: 10.3354/meps09923

Knowlton, A.R., S.D. Kraus, and R.D. Kenney. 1994. Reproduction in North Atlantic right whales (*Eubalaena glacialis*). Canadian Journal of Zoology 72:1297–1305. doi: 10.1139/z94-173

Knowlton, A.R., J. Sigukjosson, J.N. Ciano, and S.D. Kraus. 1992. Long-distance movements of North Atlantic right whales (*Eubalaena glacialis*). Marine Mammal Science 8(4):397–405. doi: 10.1111/j.1748-7692.1992.tb00054.x

Kraus, S.D., P.K. Hamilton, R.D. Kenney, A.R. Knowlton, and C.K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. Journal of Cetacean Research and Management (Special Issue) 2:231–236. doi: 10.47536/jcrm.vi.285

Kraus, S.D., R.D. Kenney, A.R. Knowlton, and J.N. Ciano. 1993. Endangered right whales of the southwestern North Atlantic. Minerals Management Service: Herndon, VA. OCS Study MMS 93-0024. 69 p.

Kraus, S.D., R.M. Pace, III, and T.R. Frasier. 2007. High investment, low return: the strange case of reproduction in *Eubalaena glacialis*. In: Kraus, S.D. and R.M. Rolland (Eds.), The urban whale: North Atlantic right whales at the crossroads. Harvard University Press, Cambridge, MA. pp. 172–199.

Kraus, S.D. and R.M. Rolland. 2007. Right whales in the urban ocean. In: Kraus, S.D. and R.M. Rolland (Eds.), The urban whale: North Atlantic right whales at the crossroads. Harvard University Press, Cambridge, MA. p. 1−38.

Leiter, S.M., K.M. Stone, J.L. Thompson, C.M. Accardo, B.C. Wikgren, M.A. Zani, T.V.N. Cole, R.D. Kenney, C.A. Mayo, and S.D. Kraus. 2017. North Atlantic right whale Eubalaena glacialis occurrence in offshore wind energy areas near Massachusetts and Rhode Island, USA. Endangered Species Research 34:45–59. doi: 10.3354/esr00827

MacAulay, M.C., K.F. Wishner, and K.L. Daly. 1995. Acoustic scattering from zooplankton and micronekton in relation to a whale feeding site near Georges Bank and Cape Cod. Continental Shelf Research 15(4-5):509–537. doi: 10.1016/0278-4343(94)00058-u

Malik, S., M.W. Brown, S.D. Kraus, A.R. Knowlton, P.K. Hamilton, and B.N. White. 1999. Assessment of mitochondrial DNA structuring and nursery use in the North Atlantic right whale (*Eubalaena glacialis*). Canadian Journal of Zoology 77:1217–1222. doi: 10.1139/z99-073

Mate, B. and M. Baumgartner. 2001. Summer feeding season movements and fall migration of North Atlantic right whales from satellite-monitored radio tags. Abstracts, Fourteenth Biennial Conference on the Biology of Marine Mammals. 28 November-3 December 2001. Vancouver, British Columbia. p. 137.

Mate, B.R., S.L. Nieukirk, and S.D. Kraus. 1997. Satellite-monitored movements of the northern right whale. The Journal of Wildlife Management 61(4):1393–1405. doi: 10.2307/3802143

Mayo, C.A., B.H. Letcher, and S. Scott. 2001. Zooplankton filtering efficiency of the baleen of a North Atlantic right whale, *Eubalaena glacialis*. Journal of Cetacean Research and Management (Special Issue) 2:225–229. doi: 10.47536/jcrm.vi.286

Mayo, C.A. and M.K. Marx. 1990. Surface foraging behaviour of the North Atlantic right whale, *Eubalaena glacialis*, and associated zooplankton characteristics. Canadian Journal of Zoology 68(10):2214–2220. doi: 10.1139/z90-308

Meyer-Gutbrod, E., C. Greene, and K. Davies. 2018. Marine species range shifts necessitate advanced policy planning: The case of the North Atlantic right whale. Oceanography 31(2):19–23. doi: 10.5670/oceanog.2018.209

Meyer-Gutbrod, E., C. Greene, K. Davies, and D. Johns. 2021. Ocean regime shift is driving collapse of the North Atlantic right whale population. Oceanography 34(3):22–31. doi: 10.5670/oceanog.2021.308

Meyer-Gutbrod, E.L. and C.H. Greene. 2014. Climate-associated regime shifts drive decadal-scale variability in recovery of North Atlantic right whale population. Oceanography 27(3):148–153. doi: 10.5670/oceanog.2014.64

Meyer-Gutbrod, E.L. and C.H. Greene. 2018. Uncertain recovery of the North Atlantic right whale in a changing ocean. Global Change Biology 24(1):455–464. doi: 10.1111/gcb.13929

Meyer-Gutbrod, E.L., C.H. Greene, P.J. Sullivan, and A.J. Pershing. 2015. Climate-associated changes in prey availability drive reproductive dynamics of the North Atlantic right whale population. Marine Ecology Progress Series 535:243–258. doi: 10.3354/meps11372

Murison, L.D. and D.E. Gaskin. 1989. The distribution of right whales and zooplankton in the Bay of Fundy, Canada. Canadian Journal of Zoology 67(6):1411–1420. doi: 10.1139/z89-200

Mussoline, S.E., D. Risch, L.T. Hatch, M.T. Weinrich, D.N. Wiley, M.A. Thompson, P.J. Corkeron, and S.M. Van Parijs. 2012. Seasonal and diel variation in North Atlantic right whale up-calls: implications for management and conservation in the northwestern Atlantic Ocean. Endangered Species Research 17:17–26. doi: 10.3354/esr00411

National Marine Fisheries Service (NMFS). 2016. Endangered and threatened species; critical habitat for endangered North Atlantic right whale. Federal Register 81:4838–4872.

National Marine Fisheries Service (NMFS). 2017. North Atlantic right whale (*Eubalaena glacialis*) 5-year review: Summary and evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office Gloucester, MA. 34 p.

Nemoto, T. 1970. Feeding patterns of baleen whales in the ocean. In: Steele, J.H. (Ed.), Marine food chains. University of California Press, Berkeley, CA. pp. 241–252.

New England Aquarium (NEAQ). 2022. North Atlantic right whales' downward trend continues as updated population numbers released. https://www.neaq.org/about-us/news-media/press-kit/press-releases/north-atlantic-right-whales-downward-trend-continues-as-updated-population-numbers-released/&sa=D&source=docs&ust=1676002416073590&usg=AOvVaw3n__gtTdfn1Q8GRDVTTpPd

Nichols, O.C., R.D. Kenney, and M.W. Brown. 2008. Spatial and temporal distribution of North Atlantic right whales (*Eubalaena glacialis*) in Cape Cod Bay, and implications for management. Fishery Bulletin 106(3):270–280.

Nowacek, D.P., L.H. Thorne, D.W. Johnston, and P.L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review 37(2):81–115. doi: 10.1111/j.1365-2907.2007.00104.x

O'Brien, O., D.E. Pendleton, L.C. Ganley, K.R. McKenna, R.D. Kenney, E. Quintana-Rizzo, C.A. Mayo, S.D. Kraus, and J.V. Redfern. 2022. Repatriation of a historical North Atlantic right whale habitat during an era of rapid climate change. Scientific Reports 12(1):12407. doi: 10.1038/s41598-022-16200-8

Pace, R.M., III, P.J. Corkeron, and S.D. Kraus. 2017. State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right whales. Ecology and Evolution 7(21):8730–8741. doi: 10.1002/ece3.3406

Pace, R.M., III, R. Williams, S.D. Kraus, A.R. Knowlton, and H.M. Pettis. 2021. Cryptic mortality of North Atlantic right whales. Conservation Science and Practice 3(2):e346. doi: 10.1111/csp2.346

Patrician, M.R. and R.D. Kenney. 2010. Using the Continuous Plankton Recorder to investigate the absence of North Atlantic right whales (*Eubalaena glacialis*) from the Roseway Basin foraging ground. Journal of Plankton Research 32:1685–1695. doi: 10.1093/plankt/fbq073

Pendleton, D.E., A.J. Pershing, M.W. Brown, C.A. Mayo, R.D. Kenney, N.R. Record, and T.V.N. Cole. 2009. Regional-scale mean copepod concentration indicates relative abundance of North Atlantic right whales. Marine Ecology Progress Series 378:211–225. doi: 10.3354/meps07832

Pershing, A.J., M.A. Alexander, D.C. Brady, D. Brickman, E.N. Curchitser, A.W. Diamond, L. McClenachan, K.E. Mills, O.C. Nichols, D.E. Pendleton, N.R. Record, J.D. Scott, M.D. Staudinger, and Y. Wang. 2021. Climate impacts on the Gulf of Maine ecosystem. Elementa: Science of the Anthropocene 9(1):00076. doi: 10.1525/elementa.2020.00076

Pettis, H.M., R.M. Pace, III, and P.K. Hamilton. 2021. North Atlantic right whale consortium 2020 annual report card. North Atlantic Right Whale Consortium: Boston, MA. 22 p.

Quintana-Rizzo, E., S. Leiter, T.V.N. Cole, M.N. Hagbloom, A.R. Knowlton, P. Nagelkirk, O. O'Brien, C.B. Khan, A.G. Henry, P.A. Duley, L.M. Crowe, C.A. Mayo, and S.D. Kraus. 2021. Residency, demographics, and movement patterns of North Atlantic right whales *Eubalaena glacialis* in an offshore wind energy development area in southern New England, USA. Endangered Species Research 45:251–268. doi: 10.3354/esr01137

Record, N., J. Runge, D. Pendleton, W. Balch, K. Davies, A. Pershing, C. Johnson, K. Stamieszkin, R. Ji, Z. Feng, S. Kraus, R. Kenney, C. Hudak, C. Mayo, C. Chen, J. Salisbury, and C. Thompson. 2019. Rapid climate-driven circulation changes threaten conservation of endangered North Atlantic right whales. Oceanography 32(2):162–169. doi: 10.5670/oceanog.2019.201

Rice, A.N., J.T. Tielens, B.J. Estabrook, C.A. Muirhead, A. Rahaman, M. Guerra, and C.W. Clark. 2014. Variation of ocean acoustic environments along the western North Atlantic coast: A case study in context of the right whale migration route. Ecological Informatics 21:89–99. doi: 10.1016/j.ecoinf.2014.01.005

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0.

Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.
Roberts, J.J., B. McKenna, L. Ganley, and C. Mayo. 2021a. Right whale abundance estimates for Cape Cod Bay in December. Document version 3. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 10 p.
Roberts, J.J., R.S. Schick, and P.N. Halpin. 2020. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2018-2020 (Option Year 3). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 142 p.
Roberts, J.J., R.S. Schick, and P.N. Halpin. 2021b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2020 (Option Year 4). Document version 1.0 (DRAFT). Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 11 p.
Rolland, R.M., S.E. Parks, K.E. Hunt, M. Castellote, P.J. Corkeron, D.P. Nowacek, S.K. Wasser, and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proceedings of the Royal Society B: Biological Sciences 279(1737):2363–2368. doi: 10.1098/rspb.2011.2429
Ross, C.H., D.E. Pendleton, B. Tupper, D. Brickman, M.A. Zani, C.A. Mayo, and N.R. Record. 2021. Projecting regions of North Atlantic right whale, *Eubalaena glacialis*, habitat suitability in the Gulf of Maine for the year 2050. Elementa: Science of the Anthropocene 9(1). doi: 10.1525/elementa.2020.20.00058
Runge, J.A., R.B. Ji, C.R.S. Thompson, N.R. Record, C.S. Chen, D.C. Vandemark, J.E. Salisbury, and F. Maps. 2015. Persistence of *Calanus finmarchicus* in the western Gulf of Maine during recent extreme warming. Journal of Plankton Research 37(1):221–232. doi: 10.1093/plankt/fbu098
Saba, V.S., S.M. Griffies, W.G. Anderson, M. Winton, M.A. Alexander, T.L. Delworth, J.A. Hare, M.J. Harrison, A. Rosati, G.A. Vecchi, and R. Zhang. 2016. Enhanced warming of the northwest Atlantic Ocean under climate change. Journal of Geophysical Research: Oceans 121(1):118–132. doi: 10.1002/2015jc011346
Schaeff, C.M., S.D. Kraus, M.W. Brown, and B.N. White. 1993. Assessment of the population structure of western North Atlantic right whales (*Eubalaena glacialis*) based on sightings and mtDNA data. Canadian Journal of Zoology 71:339–345. doi: 10.1139/z93-047
Sorochan, K.A., S. Plourde, R. Morse, P. Pepin, J. Runge, C. Thompson, and C.L. Johnson. 2019. North Atlantic right whale (*Eubalaena glacialis*) and its food: (II) interannual variations in biomass of *Calanus* spp. on western North Atlantic shelves. Journal of Plankton Research 41(5):687–708. doi: 10.1093/plankt/fbz044
Stone, K.M., S.M. Leiter, R.D. Kenney, B.C. Wikgren, J.L. Thompson, J.K.D. Taylor, and S.D. Kraus. 2017. Distribution and abundance of cetaceans in a wind energy development area offshore of Massachusetts and Rhode Island. Journal of Coastal Conservation 21:527–543. doi: 10.1007/s11852-017-0526-4
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
van der Hoop, J., P. Corkeron, and M. Moore. 2017. Entanglement is a costly life-history stage in large whales. Ecology and Evolution 7(1):92–106. doi: 10.1002/ece3.2615
van der Hoop, J.M., A.S.M. Vanderlaan, T.V.N. Cole, A.G. Henry, L. Hall, B. Mase-Guthrie, T. Wimmer, and M.J. Moore. 2015. Vessel strikes to large whales before and after the 2008 ship strike rule. Conservation Letters 8(1):24–32. doi: 10.1111/conl.12105

van der Hoop, J.M., A.S.M. Vanderlaan, and C.T. Taggart. 2012. Absolute probability estimates of lethal vessel strikes to North Atlantic right whales in Roseway Basin, Scotian Shelf. Ecological Applications 22(7):2021–2033. doi: 10.1890/11-1841.1

Ward, J.A. 1999. Right whale (*Balaena glacialis*) South Atlantic Bight habitat characterization and prediction using remotely sensed oceanographic data. University of Rhode Island. Thesis.

Watkins, W.A. and W.E. Schevill. 1982. Observations of right whales, *Eubalaena glacialis*, in Cape Cod Waters. Fishery Bulletin 80:875–880.

Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Canadian Journal of Zoology 85(11):1091–1116. doi: 10.1139/z07-101

Whitt, A.D., K. Dudzinski, and J.R. Laliberté. 2013. North Atlantic right whale distribution and seasonal occurrence in nearshore waters off New Jersey, USA, and implications for management. Endangered Species Research 20(1):59–69. doi: 10.3354/esr00486

Wiley, D.N., C.A. Mayo, E.M. Maloney, and M.J. Moore. 2016. Vessel strike mitigation lessons from direct observations involving two collisions between noncommercial vessels and North Atlantic right whales (*Eubalaena glacialis*). Marine Mammal Science 32(4):1501–1509. doi: 10.1111/mms.12326

Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. Reports of the International Whaling Commission (Special Issue) 10:129–138.

Wishner, K., E. Durbin, A. Durbin, M. Macaulay, H. Winn, and R. Kenney. 1988. Copepod patches and right whales in the Great South Channel off New England. Bulletin of Marine Science 43(3):825–844.

Northern bottlenose whale − *Hyperoodon ampullatus*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 67% of scores ≥ 2

	Hyperoodon ampullatus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.1	2.3	
	Habitat Specificity	1.2	2.7	
	Site Fidelity	2.2	2.3	
	Lifetime Reproductive Potential	1.9	1.3	
	Generation Length	2.6	1.3	
	Reproductive Plasticity	2.0	0.0	
	Migration	3.0	2.0	
	Home Range	1.5	2.0	
	Stock Abundance	1.7	0.3	
	Stock Abundance Trend	2.3	0.3	
	Cumulative Stressors	1.5	0.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.0	2.5	
	Sea Surface Temperature (Change in variability)	1.3	2.5	
	Air Temperature (Change in mean)	3.3	2.5	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.3	2.5	
	Precipitation (Change in variability)	1.5	2.5	
	Sea Surface Salinity (Change in mean)	2.3	2.5	
	Sea Surface Salinity (Change in variability)	1.6	2.5	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.3	2.5	
	Sea ice coverage (Change in mean)	1.4	1.5	
	Sea ice coverage (Change in variability)	1.1	1.5	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.2	2.5	
	Circulation	1.5	1.5	
	Sea level rise	1.0	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Northern bottlenose whale (Western North Atlantic Stock)

Hyperoodon ampullatus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (59% certainty from bootstrap analysis).

Climate Exposure: High: Four exposure factors scored greater than or equal to 3.0: Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), Air Temperature (Standard anomaly) (3.3), and Sea Surface Temperature (Standard anomaly) (3.0).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (3.00) and Generation Time (2.60).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 67% of the data quality scores were 2 or greater. 45% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The northern bottlenose whale western North Atlantic stock includes individuals that are found in U.S. waters and adjacent offshore and Canadian waters (Waring et al. 2015).

Prey/Diet Specificity

Bottlenose whales feed primarily on squid of the genus *Gonatus* (Hooker et al. 2001). Fish (including herring and redfish) and benthic invertebrates such as starfish and sea cucumbers are occasionally consumed (Gowans 2009). Pauly et al. (1998) reported species-level diet composition of 15% benthic invertebrates, 35% small squids, 35% large squids, 5% mesopelagic fishes, and 10% miscellaneous fishes.

Habitat Specificity

Northern bottlenose whales are found in cold temperate waters of the North Atlantic, almost always in waters deeper than 500 m (Mead 1989; Wimmer and Whitehead 2004; Whitehead and Hooker 2012). They often associate with submarine canyons, continental shelf edges, and other areas of high relief (Gowans 2009).

Site Fidelity

Northern bottlenose whales congregate in two locations in the western North Atlantic; a large undersea canyon called "The Gully" and adjacent canyons just east of Sable Island, Nova Scotia, and Davis Strait off northern Labrador (Reeves et al. 1993; Gowans et al. 2000; Hooker et al. 2002). Northern bottlenose whales in the Gully exhibit high site fidelity, with individuals remaining in the area for days to months at a time and frequently returning across seasons and years (Gowans et al. 2000; Wimmer and Whitehead 2004).

Lifetime Reproductive Potential

Recent work by Feyrer et al. (2020) suggests a reproductive interval of at least 4 years. Benjaminsen and Christensen (1979) reported a reproductive interval of 2 years. Northern bottlenose whales reach sexual maturation at 7–11 years for males and 11 years for females (Benjaminsen and Christensen 1979). The oldest known individual was caught during whaling at 37 years age (Gowans 2009). Taylor et al. (2007) reported age at first reproduction of 14 years and age at last reproduction of 27 years (observed) and 48 years (estimated) based on values reported by Mead (1984).

Generation Length

Taylor et al. (2007) estimated generation length of 17.8 years at r = 0.00.

Reproductive Plasticity

Information regarding northern bottlenose whale reproductive season, location, and habitat was not found in the literature.

Migration

One sub-population (individuals found at the Gully) is known to consist of year-round residents (Gowans et al. 2000; Hooker et al. 2002; Stanistreet et al. 2017).

Home Range

Individuals of resident populations are known to make excursions from 100km to 1000km away from the geographic features they are usually associated with (Wimmer and Whitehead 2004; Gowans 2009).

Stock Abundance

Studies at the entrance to the Gully from 1988 to 1995 identified 237 individuals and estimated the local population size at about 230 animals (95% C.I. 160-360) (Whitehead et al. 1997). Wimmer and Whitehead (2004) identified individuals moving between several Scotian Shelf canyons more than 100 km from the Gully. Whitehead and Wimmer (2005) estimated a population of 163 animals (95% confidence interval 119-214), with no statistically significant population trend. O’Brien and Whitehead (2013) applied mark-recapture techniques to estimate the current population size of northern bottlenose whales on the Scotian Shelf as 143 animals (95% CI: 95 to 156 animals).

Stock Abundance Trend

O'Brien and Whitehead (2013) reported a stable abundance trend for the Scotian Shelf population.

Cumulative Stressors

Primary threats to northern bottlenose whales include entanglement in fishing gear, anthropogenic noise, and contaminants (DFO 2016). Strandings in the U.S occur but are rare (Waring et al. 2015).

Distribution and Sightings

Density model results for northern bottlenose whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b).

Further Reading

Moors-Murphy, H.B. 2018. Bottlenose whales: *Hyperoodon ampullatus* and *H. planifrons*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 130–132. doi: 10.1016/B978-0-12-804327-1.00074-1

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Hyperoodon ampullatus*. The IUCN Red List of Threatened Species 2008: e.T10707A3208523. doi: 10.2305/IUCN.UK.2008.RLTS.T10707A3208523.en

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-231. 361 p.

Whitehead, H., R. Reeves, L. Feyrer, and R.L. Brownell, Jr. 2021. *Hyperoodon ampullatus*. The IUCN Red List of Threatened Species 2021: e.T10707A50357742. doi: 10.2305/IUCN.UK.2021-1.RLTS.T10707A50357742.en

References

Benjaminsen, T. and I. Christensen. 1979. The natural history of the bottlenose whale, *Hyperoodon ampullatus* (Forster). Behavior of Marine Animals. pp. 143–164. doi: 10.1007/978-1-4684-2985-5_5

Feyrer, L.J., S.t. Zhao, H. Whitehead, and C.J.D. Matthews. 2020. Prolonged maternal investment in northern bottlenose whales alters our understanding of beaked whale reproductive life history. PLoS ONE 15(6):e0235114. doi: 10.1371/journal.pone.0235114

Fisheries and Oceans Canada (DFO). 2016. Recovery strategy for the northern bottlenose whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian Waters [Final]. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada: Ottawa, Ontario, Canada. 70 p.

Gowans, S. 2009. Bottlenose whales. In: Perrin, W., B. Würsig, and J.G.M. Thewissen (Eds.), Encyclopedia of Marine Mammals, Second Edition. Academic Press, San Diego, CA. pp. 129–131.

Gowans, S., H. Whitehead, J.K. Arch, and S.K. Hooker. 2000. Population size and residency patterns of northern bottlenose whales (*Hyperoodon ampullatus*) using the Gully, Nova Scotia. Journal of Cetacean Research and Management 2(3):201–210.

Hooker, S.K., S.J. Iverson, P. Ostrom, and S.C. Smith. 2001. Diet of northern bottlenose whales inferred from fatty-acid and stable-isotope analyses of biopsy samples. Canadian Journal of Zoology 79(8):1442–1454. doi: 10.1139/z01-096

Hooker, S.K., H. Whitehead, S. Gowans, and R.W. Baird. 2002. Fluctuations in distribution and patterns of individual range use of northern bottlenose whales. Marine Ecology Progress Series 225:287–297. doi: 10.3354/meps225287

Mead, J.G. 1984. Survey of reproductive data for the beaked whales (Ziphiidae). Reports of the International Whaling Commission (Special Issue) 6:91–96.

Mead, J.G. 1989. Bottlenose whales. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, New York, NY. pp. 321–348.

Mitchell, E.D. 1977. Evidence that the northern bottlenose whale is depleted. Reports of the International Whaling Commission 27:195–203.

O'Brien, K. and H. Whitehead. 2013. Population analysis of endangered northern bottlenose whales on the Scotian Shelf seven years after the establishment of a Marine Protected Area. Endangered Species Research 21(3):273–284. doi: 10.3354/esr00533

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Reeves, R.R., E. Mitchell, and H. Whitehead. 1993. Status of the northern bottlenose whale, *Hyperoodon ampullatus*. Canadian Field-Naturalist 107:490–508.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for northern bottlenose whale (*Hyperoodon ampullatus*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 49 p.

Stanistreet, J.E., D.P. Nowacek, S. Baumann-Pickering, J.T. Bell, D.M. Cholewiak, J.A. Hildebrand, L.E.W. Hodge, H.B. Moors-Murphy, S.M. Van Parijs, and A.J. Read. 2017. Using passive acoustic monitoring to document the distribution of beaked whale species in the western North Atlantic Ocean. Canadian Journal of Fisheries and Aquatic Sciences 74(12):2098–2109. doi: 10.1139/cjfas-2016-0503

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-231. 361 p. doi: 10.7289/V5TQ5ZH0

Whitehead, H. and S.K. Hooker. 2012. Uncertain status of the northern bottlenose whale *Hyperoodon ampullatus*: population fragmentation, legacy of whaling and current threats. Endangered Species Research 19(1):47–61. doi: 10.3354/esr00458

Whitehead, H. and T. Wimmer. 2005. Heterogeneity and the mark recapture assessment of the Scotian Shelf population of northern bottlenose whales (*Hyperoodon ampullatus*). Canadian Journal of Fisheries and Aquatic Sciences 62(11):2573–2585. doi: 10.1139/f05-178

Whitehead, H.A.L., S. Gowans, A. Faucher, and S.W. McCarrey. 1997. Population analysis of northern bottlenose whales in the Gully, Nova Scotia. Marine Mammal Science 13(2):173–185. doi: 10.1111/j.1748-7692.1997.tb00625.x

Wimmer, T. and H. Whitehead. 2004. Movements and distribution of northern bottlenose whales, *Hyperoodon ampullatus*, on the Scotian Slope and in adjacent waters. Canadian Journal of Zoology 82(11):1782–1794. doi: 10.1139/z04-168

Pantropical spotted dolphin − *Stenella attenuata*

Gulf of Mexico Stock

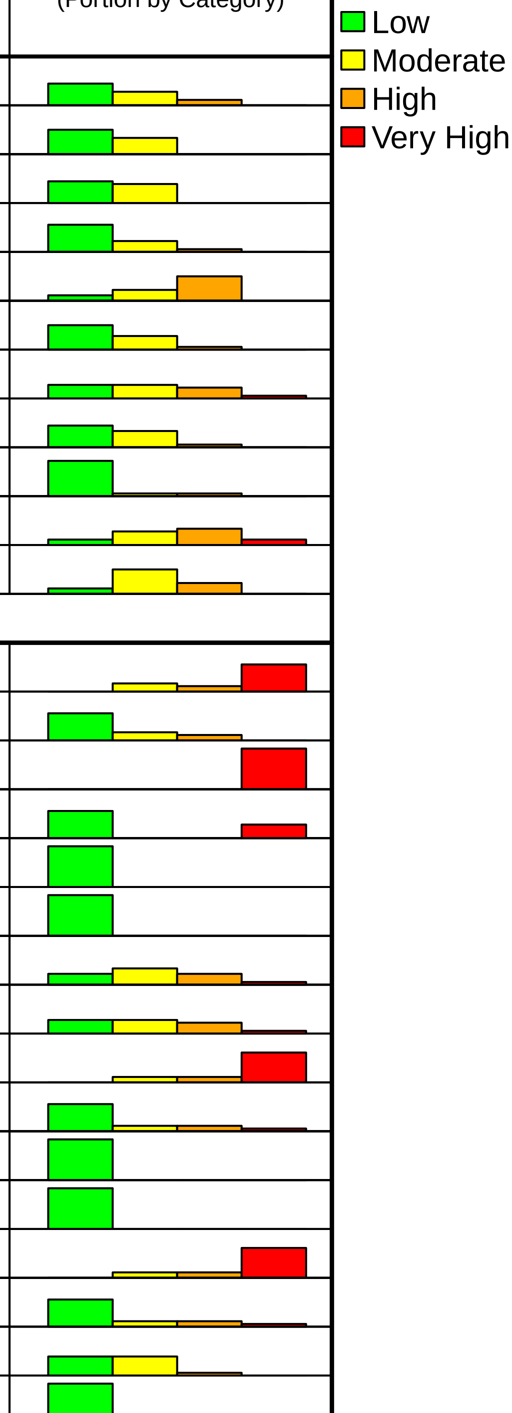
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 89% of scores ≥ 2

	Stenella attenuata	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	2.0	
	Habitat Specificity	1.4	2.3	
	Site Fidelity	1.5	1.0	
	Lifetime Reproductive Potential	1.4	2.3	
	Generation Length	2.5	2.3	
	Reproductive Plasticity	1.5	2.0	
	Migration	2.1	1.7	
	Home Range	1.5	2.0	
	Stock Abundance	1.2	3.0	
	Stock Abundance Trend	2.5	1.3	
	Cumulative Stressors	2.1	2.3	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	3.0	
	Sea Surface Temperature (Change in variability)	1.5	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	2.0	3.0	
	Precipitation (Change in mean)	1.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	2.1	3.0	
	Sea Surface Salinity (Change in variability)	2.1	3.0	
	Ocean pH (Change in mean)	3.6	3.0	
	Ocean pH (Change in variability)	1.6	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.6	3.0	
	Dissolved oxygen (Change in variability)	1.6	3.0	
	Circulation	1.6	2.7	
	Sea level rise	1.0	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		



Pantropical spotted dolphin (Gulf of Mexico Stock)

Stenella attenuata

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (60% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (3.60), and Ocean pH (Standard anomaly) (3.60).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Species Abundance Trend (2.53).

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 89% of the data quality scores were 2 or greater, 73% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The pantropical spotted dolphin Gulf of Mexico stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Pantropical spotted dolphins consume a wide variety of prey that includes epipelagic fish, squid, and crustaceans (Perrin and Hohn 1994). Studies in the Eastern Tropical Pacific and Hawaii suggest that pantropical spotted dolphins feed primarily at night on epipelagic species and species associated with the deep scattering layer (Robertson and Chivers 1997; Scott and Cattanach 1998; Baird et al. 2001).

Habitat Specificity

Pantropical spotted dolphins are found in oceanic waters of the northern Gulf of Mexico (Davis et al. 1998; Baumgartner et al. 2001; Mignucci-Giannoni et al. 2003; Mullin et al. 2004; Mullin and Fulling 2004; Moreno et al. 2005; Maze-Foley and Mullin 2006). Pantropical spotted dolphins in the Gulf of Mexico do not show preference for any individual specific habitat features (Baumgartner et al. 2001). Garrison and Aichinger Dias (2020) reported an overall uniform distribution in the Gulf of Mexico, slightly concentrated south of Mobile Bay and along the Florida Escarpment.

Site Fidelity

Information regarding pantropical spotted dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 3 years, age at first reproduction of 13 years, and age at last reproduction of 45 years (observed) and 33 years (estimated) based on values reported by Myrick et al. (1986) and Perrin and Hohn (1994).

Generation Length

Taylor et al. (2007) reported generation length of 22.7 years at r = 0.00 and 23.1 years at r = 0.0 based on values reported by Perrin and Hohn (1994).

Reproductive Plasticity

Information regarding pantropical spotted dolphin reproductive behavior (reproductive season, location, and habitat) in the Gulf of Mexico was not found in the literature. Pantropical spotted dolphins in the eastern tropical Pacific show one calving peak in spring and one calving peak in fall (Perrin and Hohn 1994).

Migration

Pantropical spotted dolphins occur year-round in northern Gulf of Mexico waters and were seen in all seasons during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000). Frasier et al. (2015) found Stenellid densities increased in summer and decreased in winter at four study sites in the northern Gulf of Mexico.

Home Range

Information regarding pantropical spotted dolphin home range in the Gulf of Mexico was not found in the literature. In other regions, pantropical spotted dolphins can travel up to 100km per day and cover great distances in seasonal migrations (Perrin 2001).

Stock Abundance

The abundance of northern Gulf of Mexico pantropical spotted dolphins is estimated to be 37,195 individuals (CV=0.24), based on 2017 and 2018 surveys of the U.S. Exclusive Economic Zone from Texas to Florida (Garrison et al. 2020; Hayes et al. 2021). Previously, the stock was estimated at 50,880 individuals (CV=0.27) based on a summer 2009 oceanic survey (Waring et al. 2016).

Stock Abundance Trend

Five point estimates of pantropical spotted dolphin abundance have been made based on data from surveys in 2003 (72,901; CV=0.20), 2004 (78,878; CV=0.41), 2009 (84,047; CV=0.36), 2017 (27,362; CV=0.27), and 2018 (58,725; CV=0.41). Pairwise comparisons of the log-transformed means were conducted between years, and found significant differences between the 2003 and 2017 estimates and between the 2009 and 2017 estimates (see Garrison et al. 2020 and Hayes et al. 2021). However, methodological differences make trend analysis difficult to interpret (Hayes et al. 2021). Using passive acoustic monitoring, Frasier et al. (2015) found a significant increase in Stenellid densities at two of four study sites in the northern Gulf of Mexico from 2010 to 2013. No change in density was observed at the other two sites.

Cumulative Stressors

The pantropical spotted dolphin may interact with longline fisheries in the Gulf of Mexico. However, during the period 2014–2018, there was an estimated annual fishing-related mortality of zero individuals (Hayes et al. 2021). During the period 2014–2018, five pantropical spotted dolphins were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The pantropical spotted dolphin stock was exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; DWH MMIQT 2015; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015). A population model suggested 1,203 pantropical spotted dolphins died during the period 2014–2018 due to exposure to the Deepwater Horizon spill (Hayes et al. 2021).

Distribution and Sightings

Density model results for pantropical spotted dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Kiszka, J. and G. Braulik. 2018. *Stenella attenuata*. The IUCN Red List of Threatened Species 2018: e.T20729A50373009. doi: 10.2305/IUCN.UK.2018-2.RLTS.T20729A50373009.en

Perrin, W.F. 2018. Pantropical spotted dolphin: *Stenella attenuata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 676–678. doi: 10.1016/B978-0-12-804327-1.00189-8

References

Baird, R.W., A.D. Ligon, S.K. Hooker, and A.M. Gorgone. 2001. Subsurface and nighttime behaviour of pantropical spotted dolphins in Hawai'i. Canadian Journal of Zoology 79(6):988–996. doi: 10.1139/z01-070

Baumgartner, M.F., K.D. Mullin, L.N. May, and T.D. Leming. 2001. Cetacean habitats in the northern Gulf of Mexico. Fishery Bulletin 99(2):219–239.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Deepwater Horizon Marine Mammai Injury Quantification Team (DWH MMIQT). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. 64 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Frasier, K.E. 2015. Density estimation of delphinids using passive acoustics: A case study in the Gulf of Mexico. University of California, San Diego. Diss. 305 p.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A., S.L. Swartz, A. Martínez, C.M. Burks, and W.A. Watkins. 2003. First records of the pantropical spotted dolphin (*Stenella attenuata*) for the Puerto Rican Bank, with a review of the species in the Caribbean. Caribbean Journal of Science 39(3):381–392.

Moreno, I.B., A.N. Zerbini, D. Danilewicz, S. de Oliveira Sa, P.C. Simões-Lopes, J. Lailson-Brito, and A.F. Azevedo. 2005. Distribution and habitat characteristics of dolphins of the genus *Stenella* (Cetacea: Delphinidae) in the Southwest Atlantic Ocean. Marine Ecology Progress Series 300:229–240. doi: 10.3354/meps300229

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06

Myrick, A.C., JR., , A. Hohn, J. Barlow, and P.A. Sloan. 1986. Reproductive biology of female spotted dolphins *Stenella attenuata* from the eastern tropical Pacific. Fishery Bulletin 84:247–259.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Perrin, W.F. 2001. *Stenella attenuata*. Mammalian Species 683:1–8. doi: 10.1644/1545-1410(2001)683<0001:SA>2.0.CO;2

Perrin, W.F. and A.A. Hohn. 1994. Pantropical spotted dolphin-*Stenella attenuata*. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 71–98.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for pantropical spotted dolphin (*Stenella attenuata*) for the U.S. Gulf of Mexico Version 3.3, 2015-10-06, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 59 p.

Robertson, K.M. and S.J. Chivers. 1997. Prey occurrence in pantropical spotted dolphins, *Stenella attenuata*, from the eastern tropical Pacific. Fishery Bulletin 95(2):334–348.

Scott, M.D. and K.L. Cattanach. 1998. Diel patterns in aggregations of pelagic dolphins and tunas in the Eastern Pacific. Marine Mammal Science 14(3):401–422. doi: 10.1111/j.1748-7692.1998.tb00735.x

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Pilot whale, long−finned − *Globicephala melas*

Western North Atlantic Stock

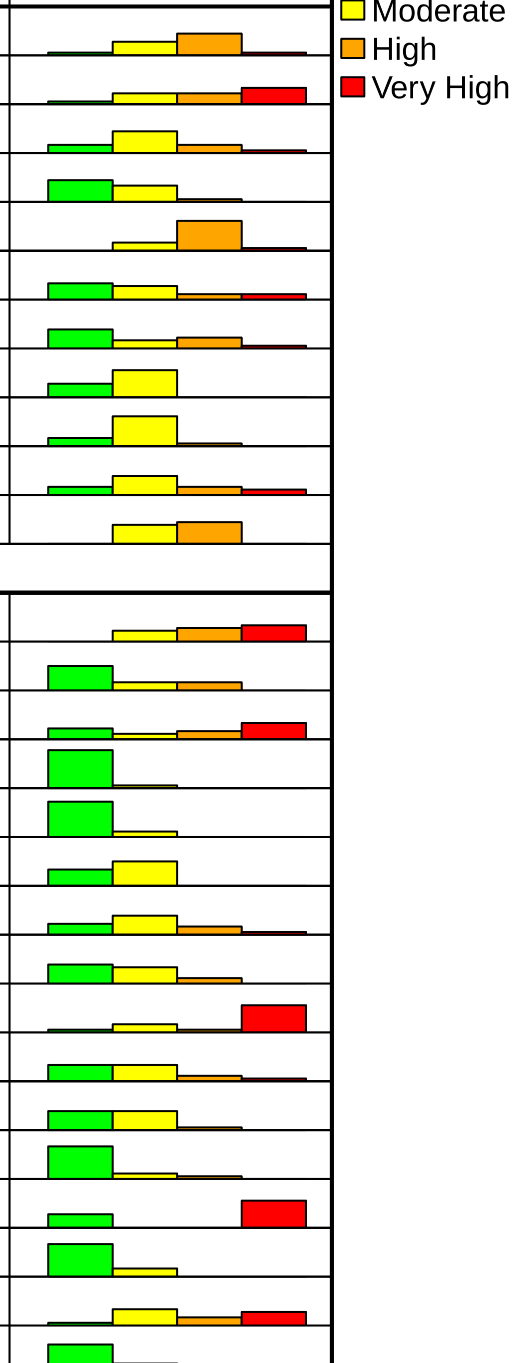
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 85% of scores ≥ 2

	Globicephala melas	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.6	1.3	
	Habitat Specificity	3.0	3.0	
	Site Fidelity	2.1	1.7	
	Lifetime Reproductive Potential	1.5	2.3	
	Generation Length	2.9	2.3	
	Reproductive Plasticity	2.0	1.0	
	Migration	1.9	2.3	
	Home Range	1.7	2.0	
	Stock Abundance	1.9	2.3	
	Stock Abundance Trend	2.3	0.7	
	Cumulative Stressors	2.5	2.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.1	2.7	
	Sea Surface Temperature (Change in variability)	1.6	2.7	
	Air Temperature (Change in mean)	2.7	2.0	
	Air Temperature (Change in variability)	1.1	2.0	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.6	2.0	
	Sea Surface Salinity (Change in mean)	2.1	2.3	
	Sea Surface Salinity (Change in variability)	1.7	2.3	
	Ocean pH (Change in mean)	3.3	2.0	
	Ocean pH (Change in variability)	1.9	2.0	
	Sea ice coverage (Change in mean)	1.6	2.7	
	Sea ice coverage (Change in variability)	1.3	2.7	
	Dissolved oxygen (Change in mean)	3.0	2.3	
	Dissolved oxygen (Change in variability)	1.2	2.3	
	Circulation	2.8	3.0	
	Sea level rise	1.3	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Pilot whale, long-finned (Western North Atlantic Stock)

Globicephala melas

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (87% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than or equal to 3.0: Ocean pH (Standard anomaly) (3.33), Sea Surface Temperature (Standard anomaly) (3.13), and Dissolved oxygen (Standard anomaly) (3.00).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than or equal to 2.5: Habitat Specificity (3.00), Generation Time (2.87), Prey/Diet Specificity (2.60), and Cumulative Stressors (2.53).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: High

Data Quality: 85% of the data quality scores were 2 or greater, 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The long-finned pilot whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (ICES 1993; Bloch and Lastein 1993; Siemann 1994; Fullard et al. 2000; Hayes et al. 2022).

Prey/Diet Specificity

Long-finned pilot whales in the western North Atlantic have a diet that consisting primarily of Atlantic mackerel (*Scomber scombrus*) and long-finned squid (*Loligo pealei*), with Atlantic herring (*Clupea harengus*), silver hake (*Merluccius bilinearis*), short-finned squid (Ommastrephidae) also represented in their diet (Overholtz and Waring 1991; Abend and Smith 1997; Gannon et al. 1997a, 1997b).

Habitat Specificity

Pilot whales are found with the Gulf Stream wall and thermal fronts along the continental shelf edge as well as areas of high relief or submerged banks (Waring et al. 1992). Long-finned pilot whales are found in cooler waters (<22°C), generally north of 42 degrees latitude (Hayes et al. 2020).

Site Fidelity

Information regarding long-finned pilot whale site fidelity in the western North Atlantic was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 3.30 years based on data from Sergeant (1962).

Age at first reproduction is estimated at 8-12 years (Perrin and Reilly 1984; Bloch and Lastein 1993; Taylor et al. 2007; Olson 2018). Taylor et al. (2007) reported age at last reproduction of 40 years (observed) to 43 years (estimated), though females are known to live more than 60 years (Olson 2018).

Generation Length

Taylor et al. (2007) reported generation length of 21.1 years at r = 0.04 and 24.0 years at r = 0.0.

Reproductive Plasticity

Information regarding long-finned pilot whale breeding season, habitat, and/or location in the western North Atlantic was not found in the literature.

Migration

Pilot whales are found along the continental shelf edge off the northeastern U.S. coast in winter and early spring (CETAP 1982; Abend 1993; Payne and Heinemann 1993; Abend and Smith 1999; Hamazaki 2002) and move to Georges Bank, Gulf of Maine, and waters farther north from late spring through late autumn (CETAP 1982; Payne and Heinemann 1993).

Home Range

An individual pilot whale is known to have traveled more than 7500km in just over 3 months (Mate 1989).

Stock Abundance

The abundance of long-finned pilot whales in the western North Atlantic is estimated to be 39,215 individuals (CV=0.30; Lawson and Gosselin 2018; Garrison 2020; Palka 2020; Hayes et al. 2022), based on surveys from Florida to Labrador during summer 2016. The 2016 estimate is greater than the 2011 estimate (11,865 individuals; CV=0.57; Palka 2012) that only included Virginia to the Lower Bay of Fundy and did not correct for availability bias.

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2022).

Cumulative Stressors

Pilot whales interact with bottom trawls, mid-water trawls, gillnet fisheries, and long-line fisheries. Total annual observed average fishery-related mortality or serious injury during 2013–2017 was 21 (CV=0.22) (Garrison and Rosel 2017; Hayes et al. 2020; Lyssikatos et al. 2020).

Pilot whales are known to mass strand throughout the range of this stock (Hayes et al. 2020). During 2013–2017, 16 long-finned pilot whales stranded along the U.S. Atlantic Coast (NOAA National Marine Mammal Health and Stranding Response Database, as cited in Hayes et al. 2020).

Polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.) have been found in pilot whale blubber (Taruski et al. 1975; Muir et al. 1988; Dam and Bloch 2000; Weisbrod et al. 2000) in the North Atlantic. Toxic metals have been found in long-finned pilot whales in the Faroe Island drive fishery (Nielsen et al. 2000).

Distribution and Sightings

Density model results for pilot whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Minton, G., R. Reeves, and G. Braulik. 2018. *Globicephala melas*. The IUCN Red List of Threatened Species 2018: e.T9250A50356171. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9250A50356171.en

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

References

Abend, A. 1993. Long-finned pilot whale distribution and diet as determined from stable carbon and nitrogen ratio isotope tracers. University of Massachusetts. 147 p.

Abend, A.G. and T.D. Smith. 1997. Differences in stable isotope ratios of carbon and nitrogen between long-finned pilot whales (*Globicephala melas*) and their primary prey in the western north Atlantic. ICES Journal of Marine Science 54(3):500–503. doi: 10.1006/jmsc.1996.0192

Abend, A.G. and T.D. Smith. 1999. Review of distribution of the long-finned pilot whale (*Globicephala melas*) in the North Atlantic and Mediterranean. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-117. 22 p.

Bloch, D. and L. Lastein. 1993. Morphometric segregation of long-finned pilot whales in eastern and western North-Atlantic. Ophelia 38(1):55–68. doi: 10.1080/00785326.1993.10429924

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Dam, M. and D. Bloch. 2000. Screening of mercury and persistent organochlorine pollutants in long-finned pilot whale (*Globicephala melas*) in the Faroe Islands. Marine Pollution Bulletin 40(12):1090–1099. doi: 10.1016/S0025-326x(00)00060-6

Fullard, K.J., G. Early, M.P. Heide-Jorgensen, D. Bloch, A. Rosing-Asvid, and W. Amos. 2000. Population structure of long-finned pilot whales in the North Atlantic: A correlation with sea surface temperature? Molecular Ecology 9(7):949–958. doi: 10.1046/j.1365-294x.2000.00957.x

Gannon, D.P., A.J. Read, J.E. Craddock, K.M. Fristrup, and J.R. Nicolas. 1997a. Feeding ecology of long-finned pilot whales *Globicephala melas* in the western North Atlantic. Marine Ecology Progress Series 148:1–10. doi: 10.3354/meps148001

Gannon, D.P., A.J. Ready, J.E. Craddock, and J.G. Mead. 1997b. Stomach contents of long-finned pilot whales (*Globicephala melas*) stranded on the US mid-Atlantic coast. Marine Mammal Science 13(3):405–418. doi: 10.1111/j.1748-7692.1997.tb00648.x

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Garrison, L.P. and P.E. Rosel. 2017. Partitioning short-finned and long-finned pilot whale bycatch estimates using habitat and genetic information. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. PRBD-2016-17. 24 p.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

International Council for the Exploration of the Sea (ICES). 1993. Report of the study group on long-finned pilot whales, Copenhagen, Denmark, 30 August - 3 September 1993. CM 1993/N:5. 29 p.

Lawson, J. and J.-F. Gosselin. 2018. Estimates of cetacean abundance from the 2016 NAISS aerial surveys of eastern Canadian waters, with a comparison to estimates from the 2007 TNASS. NAMMCO SC/25/AE/09. 40 p.

Lyssikatos, M.C., S. Chavez-Rosales, and J.M. Hatch. 2020. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2013-2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-04. 11 p. doi: 10.25923/5we2-g460

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mate, B. 1989. Satellite-monitored radio tracking as a method for studying cetacean movements and behaviour (SC/40/O 42). Reports of the International Whaling Commission 39:389–391.

Muir, D.C.G., R. Wagemann, N.P. Grift, R.J. Norstrom, M. Simon, and J. Lien. 1988. Organochlorine chemical and heavy-metal contaminants in white-beaked dolphins (*Lagenorhynchus-albirostris*) and pilot whales (*Globicephala-melaena*) from the coast of Newfoundland, Canada. Archives of Environmental Contamination and Toxicology 17(5):613–629. doi: 10.1007/Bf01055830

Nielsen, J.B., F. Nielsen, P.J. Jorgensen, and P. Grandjean. 2000. Toxic metals and selenium in blood from pilot whales (*Globicephala melas*) and sperm whales (*Physeter catodon*). Marine Pollution Bulletin 40(4):348–351. doi: 10.1016/S0025-326x(99)00231-3

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

Overholtz, W.J. and G.T. Waring. 1991. Diet composition of pilot whales *Globicephala sp* and common dolphins *Delphinus-delphis* in the Mid-Atlantic Bight during Spring 1989. Fishery Bulletin 89(4):723–728.

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp.*) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Reports of the International Whaling Commission (Special Issue) 14:51–68.

Perrin, W.F. and S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: Perrin, W.F., R.L. Brownell, Jr., and D.P. DeMaster (Eds.), Reproduction in Whales, Dolphins, and Porpoises. pp. 97–134.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version

1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.
Sergeant, D.E. 1962. The biology of the pilot or pothead whale (*Globicephala melaena* (Traill)) in Newfoundland waters. Bulletins of the Fisheries Research Board of Canada 132:1–84.
Siemann, L.A. 1994. Mitochondrial DNA sequence variation in North Atlantic long-finned pilot whales, *Globicephala melas*. Massachusetts Institute of Technology/Woods Hole Oceanographic Institution. Dissertation. 164 p.
Taruski, A.G., C.E. Olney, and H.E. Winn. 1975. Chlorinated hydrocarbons in cetaceans. Journal of the Fisheries Research Board of Canada 32(11):2205–2209. doi: 10.1139/f75-259
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.
Weisbrod, A.V., D. Shea, M.J. Moore, and J.J. John. 2000. Bioaccumulation patterns of polychlorinated biphenyls and chlorinated pesticides in northwest Atlantic pilot whales. Environmental Toxicology and Chemistry 19(3):667–677. doi: 10.1897/1551-5028(2000)019<0667:Bpopba>2.3.Co;2

Pilot whale, short−finned − *Globicephala macrorhynchus*

Northern Gulf of Mexico Stock

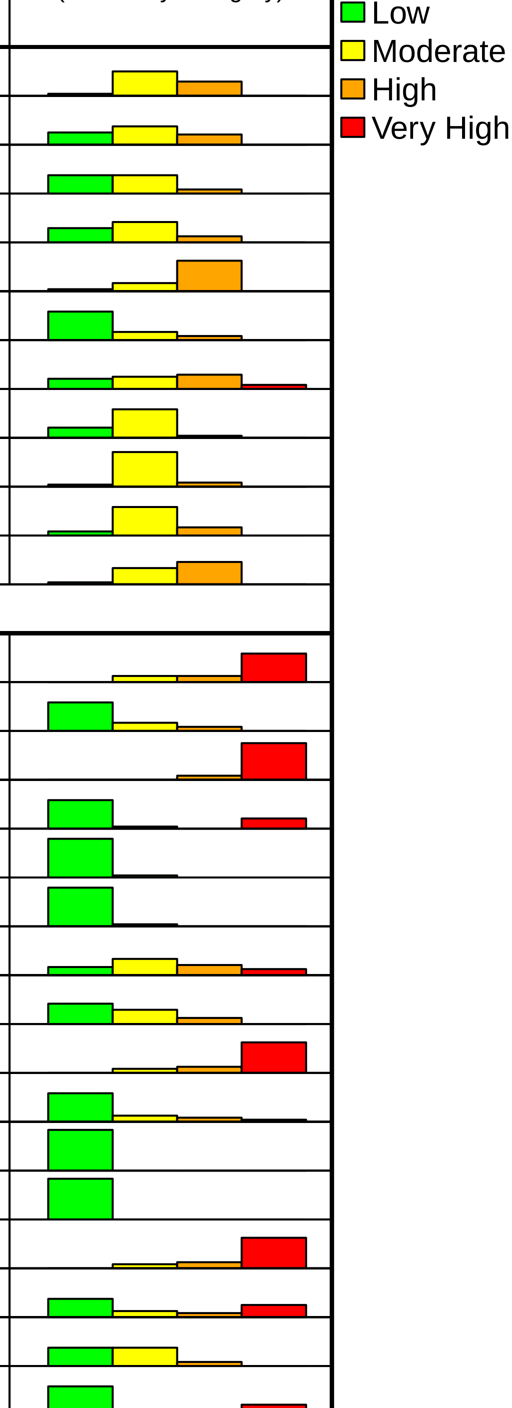
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Globicephala macrorhynchus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	2.0	
	Habitat Specificity	1.9	2.5	
	Site Fidelity	1.6	2.0	
	Lifetime Reproductive Potential	1.8	2.2	
	Generation Length	2.7	2.2	
	Reproductive Plasticity	1.4	1.5	
	Migration	2.3	1.5	
	Home Range	1.8	2.2	
	Stock Abundance	2.0	2.8	
	Stock Abundance Trend	2.1	1.0	
	Cumulative Stressors	2.5	1.8	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.8	
	Sea Surface Temperature (Change in variability)	1.4	2.8	
	Air Temperature (Change in mean)	3.9	2.8	
	Air Temperature (Change in variability)	1.8	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.4	2.8	
	Sea Surface Salinity (Change in variability)	1.6	2.8	
	Ocean pH (Change in mean)	3.6	2.8	
	Ocean pH (Change in variability)	1.5	2.8	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.6	2.8	
	Dissolved oxygen (Change in variability)	2.2	2.8	
	Circulation	1.6	2.2	
	Sea level rise	1.8	2.2	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Pilot whale, short-finned (Northern Gulf of Mexico Stock)

Globicephala macrorhynchus

CVA Results Summary

Overall Climate Vulnerability Rank: High (62% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (3.90), Dissolved oxygen (Standard anomaly) (3.65), Ocean pH (Standard anomaly) (3.65), and Sea Surface Temperature (Standard anomaly) (3.55).

Biological Sensitivity: High. Two sensitivity attributes scored greater than or equal to 2.5: Generation Time (2.70) and Cumulative Stressors (2.50).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 85% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The short-finned whale Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Although no records of short-finned pilot whale diet in the Gulf of Mexico were found in the literature, studies from the western North Atlantic indicate short-finned pilot whale diet primarily consists of squid such as jewel squid (*Histioteuthis reversa*) and common arm squid (*Brachioteuthis riisei*), with a smaller component consisting of fish such as Atlantic cod (*Gadus morhua*), Bean's bigscale (*Scopelogadus beanii*), and Greenland turbot (*Reinhardtius hippoglossoides*; Waring et al. 1990; Bernard and Reilly 1999; Mintzer et al. 2008). Bowers (2006) found no diel patterns in foraging rates or depth on DTAG or SLTDR records from short-finned pilot whales tagged off Cape Hatteras, North Carolina. Pilot whale size classes segregate their foraging habitat by diving to different depths.

Habitat Specificity

In the northern Gulf of Mexico, short-finned pilot whales are primarily found in waters along the continental slope (500m-1000m depth) west of 89°W (Garrison and Aichinger Dias 2020; Mullin and Fulling 2004; Maze-Foley and Mullin 2006).

Site Fidelity

Information regarding short-finned pilot whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Bernard and Reilly (1999) reported short-finned pilot whale interbirth interval of 4.6 to 5.7 years years while Taylor et al. (2007) reported short-finned pilot whale interbirth interval of 6.90 years based on values from Kasuya and Marsh (1984).

Short-finned females become sexually mature at 9 years and live past 60 years, although reproductive senescence may limit the upper age limit for reproduction to around 36 years (Kasuya and Marsh 1984; Marsh and Kasuya 1984; Olson 2018). Taylor et al. (2007) reported short-finned pilot whale age at first reproduction of 11 years and age at last reproduction of 40 years (observed) and 43 years (estimated) based on values from Kasuya and Marsh (1984).

Generation Length

Taylor et al. (2007) reported short-finned pilot whale generation length of 22.7 years at r = 0.01 and 23.5 years at r = 0.0 based on values from Kasuya and Marsh (1984).

Reproductive Plasticity

Information regarding short-finned pilot whale breeding season, habitat, and location was not found in the literature.

Migration

This species is not known to migrate, though long-distance movements are known (e.g., Wells et al. 2013; Tyson Moore et al. 2020). Short-finned pilot whales are present in the northern Gulf of Mexico in all seasons (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Information regarding individual short-finned pilot whale home range was not found in the literature. However, tagging studies have shown short-finned pilot whales are capable of traveling great distances, moving between the Gulf of Mexico, western North Atlantic, and Caribbean waters (Wells et al. 2013; Tyson Moore et al. 2020).

Stock Abundance

The abundance of Gulf of Mexico short-finned pilot whales is estimated to be 1,321 individuals (CV=0.43) based on 2017 and 2018 oceanic surveys (Garrison et al. 2020). Previously, the stock was estimated at 2,415 individuals (CV=0.66) based on a summer 2009 oceanic survey (Waring et al. 2016).

Stock Abundance Trend

Garrison et al. (2020) also revised estimates of short-finned pilot whale abundance from 2003 (2,740 individuals; CV=0.52), 2004 (587 individuals; CV=0.88), and 2009 (4,788 individuals; CV=0.74) and found no significant differences between survey years.

Five point estimates of short-finned pilot whale abundance have been made based on data from surveys in 2003 (2,740; CV=0.52), 2004 (587; CV=0.88), 2009 (4,788; CV=0.74), 2017 (1,274; CV=0.54), and 2018 (1,402; CV=0.71). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021). However, high-frequency acoustic recording package (HARP) data collected following the Deepwater Horizon spill showed a significant increase in short-finned pilot whale density at one site, a small decrease in pilot whale density at a second site, and no change at a third site over a 3 year period (Frasier 2015).

Cumulative Stressors

The short-finned pilot whale stock in the northern Gulf of Mexico interacts with the pelagic longline fishery and suffered an estimated 0.4 serious injuries or mortalities per year during the period 2014–2018 (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b; Hayes et al. 2021). During the same period, 93 short-finned pilot whales were reported stranded in the Gulf of Mexico, with five mass stranding events in Florida (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The short-finned pilot whale stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for short-finned pilot whales in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Minton, G., G. Braulik, and R. Reeves. 2018. *Globicephala macrorhynchus*. The IUCN Red List of Threatened Species 2018: e.T9249A50355227. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9249A50355227.en

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

References

Bernard, H.J. and S.B. Reilly. 1999. Pilot whales *Globicephala Lesson*, 1828. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 245–279.

Bowers, M. 2016. Behavioral ecology of the western Atlantic short-finned pilot whale (*Globicephala macrorhynchus*). Duke University. Dissertation. 164 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Frasier, K.E. 2015. Density estimation of delphinids using passive acoustics: A case study in the Gulf of Mexico. University of California, San Diego. Diss. 305 p.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Kasuya, T. and H. Marsh. 1984. Life history and reproductive biology of the short-finned pilot whale, *Globicephala macrorhynchus*, off the Pacific Coast Japan. Reports of the International Whaling Commission (Special Issue) 6:259–310.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Marsh, H. and T. Kasuya. 1984. Ovarian changes in the short-finned pilot whale, *Globicephala macrorhynchus*. Reports of the International Whaling Commission (Special Issue) 6:311–335.

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mintzer, V.J., D.P. Gannon, N.B. Barros, and A.J. Read. 2008. Stomach contents of mass-stranded short-finned pilot whales (*Globicephala macrorhynchus*) from North Carolina. Marine Mammal Science 24(2):290–302. doi: 10.1111/j.1748-7692.2008.00189.x

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for short-finned pilot whale (*Globicephala macrorhynchus*) for the U.S. Gulf of Mexico version 3.3, 2015-09-30, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 59 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Tyson Moore, R.B., D.C. Douglas, H.H. Nollens, L. Croft, and R.S. Wells. 2020. Post-release monitoring of a stranded and rehabilitated short-finned pilot whale (*Globicephala macrorhynchus*) reveals current-assisted travel. Aquatic Mammals 46(2):200–214. doi: 10.1578/am.46.2.2020.200

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., P. Gerrior, P.M. Payne, B.L. Parry, and J.R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the Northeast United-States, 1977-88. Fishery Bulletin 88(2):347–360.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN

Wells, R., E.M. Fougeres, A.G. Cooper, R.O. Stevens, M. Brodsky, R. Lingenfelser, C. Dold, and D.C. Douglas. 2013. Movements and dive patterns of short-finned pilot whales (*Globicephala macrorhynchus*) released from a mass stranding in the Florida Keys. Aquatic Mammals 39(1):61–72. doi: 10.1578/am.39.1.2013.61

Pilot whale, short−finned − *Globicephala macrorhynchus*

Puerto Rico and US Virgin Islands Stock

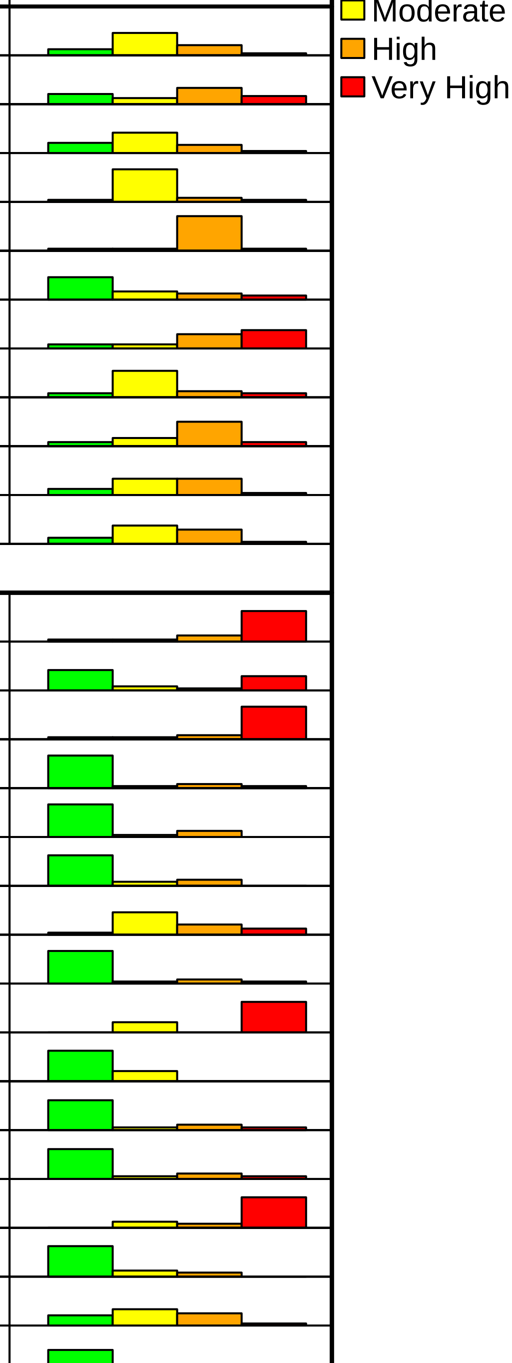
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 70% of scores ≥ 2

	Globicephala macrorhynchus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.2	2.0	
	Habitat Specificity	2.5	2.2	
	Site Fidelity	2.0	2.0	
	Lifetime Reproductive Potential	2.1	2.2	
	Generation Length	2.9	2.2	
	Reproductive Plasticity	1.8	1.2	
	Migration	3.1	1.2	
	Home Range	2.2	2.0	
	Stock Abundance	2.7	0.8	
	Stock Abundance Trend	2.4	0.5	
	Cumulative Stressors	2.3	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	2.2	
	Sea Surface Temperature (Change in variability)	2.2	2.2	
	Air Temperature (Change in mean)	3.6	2.2	
	Air Temperature (Change in variability)	1.4	2.2	
	Precipitation (Change in mean)	1.4	2.2	
	Precipitation (Change in variability)	1.4	2.2	
	Sea Surface Salinity (Change in mean)	2.5	2.2	
	Sea Surface Salinity (Change in variability)	1.4	2.2	
	Ocean pH (Change in mean)	3.5	2.2	
	Ocean pH (Change in variability)	1.2	2.2	
	Sea ice coverage (Change in mean)	1.5	1.7	
	Sea ice coverage (Change in variability)	1.5	1.7	
	Dissolved oxygen (Change in mean)	3.6	2.2	
	Dissolved oxygen (Change in variability)	1.4	2.2	
	Circulation	2.1	1.5	
	Sea level rise	1.8	1.8	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Pilot whale, short-finned (Puerto Rico and US Virgin Islands Stock)

Globicephala macrorhynchus

CVA Results Summary

Overall Climate Vulnerability Rank: High (60% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (3.65), Dissolved oxygen (Standard anomaly) (3.60), Sea Surface Temperature (Standard anomaly) (3.60), and Ocean pH (Standard anomaly) (3.50).

Biological Sensitivity: Moderate. Four sensitivity attributes scored greater than or equal to 2.5: Migration (3.15), Generation Length(2.90), Stock Abundance (2.70), and Habitat Specificity (2.55).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 70% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Puerto Rico and U.S. Virgin Islands short-finned pilot whale stock includes individuals found in waters of the U.S. Exclusive Economic Zone surrounding Puerto Rico and the U.S. Virgin Islands, and in adjacent Caribbean waters (Waring et al. 2012). It is considered a separate stock for management purposes, but no information exists to differentiate this stock from the western North Atlantic and northern Gulf of Mexico stocks (Waring et al. 2012).

Prey/Diet Specificity

Although no records of short-finned pilot whale diet in U.S. Caribbean waters were found in the literature, studies from the western North Atlantic indicate short-finned pilot whale diet primarily consists of squid such as jewel squid (*Histioteuthis reversa*) and common arm squid (*Brachioteuthis riisei*), with a smaller component consisting of fish such as Atlantic cod (*Gadus morhua*) and Greenland turbot (*Reinhardtius hippoglossoides*; Bernard and Reilly 1999; Mintzer et al. 2008; Waring et al. 1990). Bowers (2006) found no diel patterns in foraging rates or depth on DTAG or SLTDR records from short-finned pilot whales tagged off Cape Hatteras, North Carolina. Pilot whale size classes segregate their foraging habitat by diving to different depths.

Habitat Specificity

Generally, short-finned pilot whales are found in waters along the continental slope (500m-1000m depth; Garrison and Aichinger Dias 2020; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). In the waters of Puerto Rico and the U.S. Virgin Islands, sightings suggest short-finned pilot whales use both continental shelf and oceanic waters (Mignucci-Giannoni 1998; Roden and Mullin 2000; Swartz and Burks 2000; Swartz et al. 2002).

Site Fidelity

Information regarding short-finned pilot whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Bernard and Reilly (1999) reported short-finned pilot whale interbirth interval of 4.6 to 5.7 years years while Taylor et al. (2007) reported short-finned pilot whale interbirth interval of 6.90 years based on values from Kasuya and Marsh (1984).

Short-finned females become sexually mature at 9 years and live past 60 years, although reproductive senescence may limit the upper age limit for reproduction to around 36 years (Kasuya and Marsh 1984; Marsh and Kasuya 1984; Olson 2018). Taylor et al. (2007) reported short-finned pilot whale age at first reproduction of 11 years and age at last reproduction of 40 years (observed) and 43 years (estimated) based on values from Kasuya and Marsh (1984).

Generation Length

Taylor et al. (2007) reported short-finned pilot whale generation length of 22.7 years at r = 0.01 and 23.5 years at r = 0.0 based on values from Kasuya and Marsh (1984).

Reproductive Plasticity

Information regarding the short-finned pilot whale breeding season, habitat, and location was not found in the literature.

Migration

This species is not known to migrate, though long-distance movements are known (e.g., Wells et al. 2013; Tyson Moore et al. 2020). Short-finned pilot whales are present in Puerto Rico and U.S. Virgin Islands waters year-round (Mignucci-Giannoni 1998).

Home Range

Information regarding individual short-finned pilot whale home range was not found in the literature. However, tagging studies have shown short-finned pilot whales are capable of traveling great distances, moving between the Gulf of Mexico, western North Atlantic, and Caribbean waters (Wells et al. 2013; Tyson Moore et al. 2020). Short-finned pilot whales occur throughout the Caribbean, though movement between areas requires further study (Caldwell and Erdman 1963; Erdman 1970; Erdman et al. 1973; Taruski and Winn 1976; Mattila and Clapham 1989; Mattila et al. 1994; Gordon et al. 1998; Jérémie et al. 2006; Yoshida et al. 2010; Debrot et al. 1998; Romero et al. 2001; Casinos and Bou 1980; Pardo and Palacios 2006; Caldwell et al. 1970).

Stock Abundance

The current abundance for the Puerto Rico and U.S. Virgin Islands stock of short-finned pilot whales is unknown (Waring et al. 2012).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Waring et al. 2012).

Cumulative Stressors

The short-finned pilot whale has been taken and is still being taken through small-scale whaling in the eastern Caribbean (e.g., Rathjen and Sullivan 1970; Caldwell et al. 1971; Adams 1975; Caldwell and Caldwell 1975; Price 1985; Reeves 1988; Hoyt and Hvenegaard 2002; Romero et al. 2002; Mohammed et al. 2003; Vail 2005; World Council of Whalers 2008).

The short-finned pilot whale stock may interact with longline fisheries (Waring et al. 2012). However, during the period 2001–2015, no fishing-related mortality or serious injury of short-finned pilot whale was reported in Puerto Rico or the U.S. Virgin Islands waters (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010, 2012a, 2012b, 2013, 2014, 2016, 2017). This may represent an underestimation because there was no observer coverage within the Caribbean region for six of those years (Fairfield-Walsh and Garrison 2007; Garrison et al. 2009; Garrison and Stokes 2010, 2012b, 2013, 2016).

Legacy impacts on short-finned pilot whales from naval operations at Roosevelt Roads in Puerto Rico that ceased in 2004 are unknown (Waring et al. 2012).

Coastal pollution may be an issue for the short-finned pilot whale Puerto Rico and U.S. Virgin Islands stock. Parts of Vieques Island, Puerto Rico are listed on the U.S. Environmental Protection Agency's (EPA) Superfund National Priorities List due to unexploded ordnance and associated hazardous materials (Whitall et al. 2016; EPA 2018).

Short-finned pilot whales have been reported as one of the most commonly stranded species in Puerto Rico and the U.S. and British Virgin Islands (Mignucci-Giannoni et al. 1999).

Distribution and Sightings

Density model results for pilot whales in the waters around Puerto Rico and the U.S. Virgin Islands are presented by Mannocci et al. (2017).

Further Reading

Department of the Navy. 2002. Marine Resource Assessment for the Puerto Rico/St. Croix Operating Area, Final Report. Naval Facilities Engineering Command, Norfolk, VA. Contract #N62470-95-D-1160, CTO 0030. Prepared by Geo-Marine, Inc, Plano, TX. 273 p.

Minton, G., G. Braulik, and R. Reeves. 2018. *Globicephala macrorhynchus*. The IUCN Red List of Threatened Species 2018: e.T9249A50355227. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9249A50355227.en

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2011. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-221. 319 p.

References

Adams, J.E. 1975. Primitive whaling in the West Indies. Sea Frontiers 21:303–313.
Bernard, H.J. and S.B. Reilly. 1999. Pilot whales *Globicephala Lesson*, 1828. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 245–279.
Bowers, M. 2016. Behavioral ecology of the western Atlantic short-finned pilot whale (*Globicephala macrorhynchus*). Duke University. Dissertation. 164 p.
Caldwell, D.K. and M.C. Caldwell. 1975. Dolphin and small whale fisheries of the Caribbean and West Indies: Occurrence, history, and catch statistics — with special reference to the Lesser Antillean island of St. Vincent. Journal of the Fisheries Research Board of Canada 32(7):1105–1110. doi: 10.1139/f75-132
Caldwell, D.K., M.C. Caldwell, W.F. Rathjen, and J.R. Sullivan. 1971. Cetaceans from the Lesser Antillean island of St. Vincent. Fishery Bulletin 69:303–312.
Caldwell, D.K. and D.S. Erdman. 1963. The pilot whale in the West Indies. Journal of Mammalogy 44:113–115.
Caldwell, D.K., W.F. Rathjen, and M.C. Caldwell. 1970. Pilot whales mass stranded at Nevis, West Indies. Quarterly Journal of the Florida Academy of Sciences 33(4):241–243.
Casinos, A. and J. Bou. 1980. On a massive stranding of short-finned pilot whale, *Globicephala macrorhynchus* Gray, 1846, on Margarita Island (Venezuela). Scientific Reports of Whales Research Institute 32:145–148.
Debrot, A.O., J.A. De Meyer, and P.J.E. Dezentjé. 1998. Additional records and a review of the cetacean fauna of the Leeward Dutch Antilles. Caribbean Journal of Science 34(3-4):204–210.
Environmental Protection Agency (EPA). 2018. Atlantic Fleet Weapons Training Area, Vieques, PR. 28 August 2018, https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR
Erdman, D.S. 1970. Marine mammals from Puerto Rico to Antigua. Journal of Mammalogy 51(3):636. doi: 10.2307/1378416
Erdman, D.S., J. Harms, and M. Marcial-Flores. 1973. Cetacean records from the northeastern Caribbean region. Cetology 17:1–14.
Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.
Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.
Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.
Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.
Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.
Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.
Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-607. 64 p.
Garrison, L.P. and L. Stokes. 2012a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.
Garrison, L.P. and L. Stokes. 2012b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-632. 61 p.
Garrison, L.P. and L. Stokes. 2013. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-655. 62 p.
Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.

Gordon, J., A. Moscrop, C. Carlson, S. Ingram, R. Leaper, J. Matthews, and K. Young. 1998. Distribution, movements and residency of sperm whales off the Commonwealth of Dominica, eastern Caribbean: Implications for the development and regulation of the local whalewatching industry. Reports of the International Whaling Commission 48:551–557.

Hoyt, E. and G.T. Hvenegaard. 2002. A review of whale-watching and whaling with applications for the Caribbean. Coastal Management 30(4):381–399. doi: 10.1080/089207502900273

Jérémie, S., A. Gannier, S. Bourreau, and J.-C. Nicolas. 2006. Cetaceans of Martinique Island (Lesser Antilles): Occurrence and distribution obtained from a small boat dedicated survey. Paper SC/58/SM23. 58th Annual Meeting of the International Whaling Commission, June 2006, St. Kitts and Nevis, West Indies.

Kasuya, T. and H. Marsh. 1984. Life history and reproductive biology of the short-finned pilot whale, *Globicephala macrorhynchus*, off the Pacific Coast Japan. Reports of the International Whaling Commission (Special Issue) 6:259–310.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Marsh, H. and T. Kasuya. 1984. Ovarian changes in the short-finned pilot whale, *Globicephala macrorhynchus*. Reports of the International Whaling Commission (Special Issue) 6:311–335.

Mattila, D.K. and P.J. Clapham. 1989. Humpback whales, *Megaptera-novaeangliae*, and other cetaceans on Virgin Bank and in the Northern Leeward Islands, 1985 and 1986. Canadian Journal of Zoology 67(9):2201–2211. doi: 10.1139/z89-311

Mattila, D.K., P.J. Clapham, O. Vasquez, and R.S. Bowman. 1994. Occurrence, population composition, and habitat use of humpback whales in Samana Bay, Dominican-Republic. Canadian Journal of Zoology 72(11):1898–1907. doi: 10.1139/z94-258

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mignucci-Giannoni, A.A., B. Pinto-Rodríguez, M. Velasco-Escudero, R.A. Montoya-Ospina, N.M. Jiménez, M.A. Rodríguez-López, J.E.H. Williams, and D.K. Odell. 1999. Cetacean strandings in Puerto Rico and the Virgin Islands. Journal of Cetacean Research and Management 1(2):191–198. doi: 10.47536/jcrm.v1i2.466

Mintzer, V.J., D.P. Gannon, N.B. Barros, and A.J. Read. 2008. Stomach contents of mass-stranded short-finned pilot whales (*Globicephala macrorhynchus*) from North Carolina. Marine Mammal Science 24(2):290–302. doi: 10.1111/j.1748-7692.2008.00189.x

Mohammed, E., L.E. Straker, and C. Jardine. 2003. St. Vincent and the Grenadines: Reconstructed fisheries catches and fishing effort, 1942-2001. Fisheries Centre Research Reports 11(6):95–116.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

Pardo, M.A. and D.M. Palacios. 2006. Cetacean occurrence in the Santa Marta region, Colombian Caribbean, 2004-2005. Latin American Journal of Aquatic Mammals 5(2):129–134. doi: 10.5597/lajam00105

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Rathjen, W.F. and J.R. Sullivan. 1970. West-Indies whaling. Sea Frontiers 16(3):130–137.
Reeves, R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. Reports of the International Whaling Commission 38(445-447).
Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.
Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo di Sciara. 2001. Cetaceans of Venezuela: Their distribution and conservation status. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS 151. 60 p.
Romero, A., R. Baker, and J.E. Creswell. 2002. Environmental history of marine mammal exploitation in Trinidad and Tobago, W.I., and its ecological impact. Environment and History 8:255–274.
Swartz, S.L. and C. Burks. 2000. Cruise results, Windwards humpback (*Megaptera novaeangliae*) survey: NOAA ship Gordon Gunter cruise GU-00-01, 9 February to 3 April 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-438. 31 p.
Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.
Taruski, A.G. and H.E. Winn. 1976. Winter sightings of odontocetes in the West Indies. Cetology 22:1–12.
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Tyson Moore, R.B., D.C. Douglas, H.H. Nollens, L. Croft, and R.S. Wells. 2020. Post-release monitoring of a stranded and rehabilitated short-finned pilot whale (*Globicephala macrorhynchus*) reveals current-assisted travel. Aquatic Mammals 46(2):200–214. doi: 10.1578/am.46.2.2020.200
Vail, C. 2005. Socio-economic assessment of marine mammal utilization in the wider Caribbean region: Captivity, viewing and hunting. Information paper presented at the United Nations Environment Programme Regional Workshop of Experts on the Development of the Marine Mammal Action Plan for the Wider Caribbean Region, Barbados, 18-21 July 2005.
Waring, G.T., P. Gerrior, P.M. Payne, B.L. Parry, and J.R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the Northeast United-States, 1977-88. Fishery Bulletin 88(2):347–360.
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.
Wells, R., E.M. Fougeres, A.G. Cooper, R.O. Stevens, M. Brodsky, R. Lingenfelser, C. Dold, and D.C. Douglas. 2013. Movements and dive patterns of short-finned pilot whales (*Globicephala macrorhynchus*) released from a mass stranding in the Florida Keys. Aquatic Mammals 39(1):61–72. doi: 10.1578/am.39.1.2013.61
Whitall, D.R., A.L. Mason, M.H. Fulton, E.F. Wirth, D. Wehner, A. Ramos, A.S. Pait, B. West, E. Pisarski, B. Shaddrix, and L.A. Reed. 2016. Chemical contaminants in the marine resources of Vieques, Puerto Rico. National Oceanic Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Silver Spring, MD. NOAA Technical Memorandum NOS-NCCOS-223. 70 p. doi: 10.7289/V5/TM-NOS-NCCOS-223
World Council of Whalers. 2008. World whaling – Caribbean. http://www.worldwhalers.com/whaling_around_the_world/caribbean.htm

Yoshida, H., J. Compton, S. Punnett, T. Lovell, K. Draper, G. Franklin, N. Norris, P. Phillip, R. Wilkins, and H. Kato. 2010. Cetacean sightings in the eastern Caribbean and adjacent waters, spring 2004. Aquatic Mammals 36(2):154–161. doi: 10.1578/Am.36.2.2010.154

Pilot whale, short−finned − *Globicephala macrorhynchus*

Western North Atlantic Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 93% of scores ≥ 2

	Globicephala macrorhynchus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.3	2.7	
	Habitat Specificity	2.9	3.0	
	Site Fidelity	1.7	2.7	
	Lifetime Reproductive Potential	1.7	2.3	
	Generation Length	2.6	2.3	
	Reproductive Plasticity	1.1	1.7	
	Migration	2.3	2.3	
	Home Range	1.7	2.3	
	Stock Abundance	1.1	3.0	
	Stock Abundance Trend	1.9	1.7	
	Cumulative Stressors	2.9	2.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.8	2.7	
	Sea Surface Temperature (Change in variability)	1.0	2.7	
	Air Temperature (Change in mean)	3.0	2.7	
	Air Temperature (Change in variability)	1.0	2.7	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.3	2.3	
	Sea Surface Salinity (Change in mean)	2.9	2.3	
	Sea Surface Salinity (Change in variability)	1.3	2.3	
	Ocean pH (Change in mean)	3.5	2.7	
	Ocean pH (Change in variability)	1.1	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.1	2.3	
	Dissolved oxygen (Change in variability)	1.1	2.3	
	Circulation	2.3	2.3	
	Sea level rise	1.9	2.7	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Pilot whale, short-finned (Western North Atlantic Stock)

Globicephala macrorhynchus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (76% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than or equal to 3.0: Sea Surface Temperature (Standard anomaly) (3.80), Ocean pH (Standard anomaly) (3.47), Dissolved oxygen (Standard anomaly) (3.13), and Air Temperature (Standard anomaly) (3.00).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than or equal to 2.5: Cumulative Stressors (2.93), Habitat Specificity (2.93), and Generation Length (2.60).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater. 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The short-finned pilot whale western North Atlantic stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2022).

Prey/Diet Specificity

Studies from the western North Atlantic indicate short-finned pilot whale diet primarily consists of squid such as jewel squid (*Histioteuthis reversa*) and common arm squid (*Brachioteuthis riisei*), with a smaller component consisting of fish such as Atlantic cod (*Gadus morhua*) and Greenland turbot (*Reinhardtius hippoglossoides*; Bernard and Reilly 1999; Mintzer et al. 2008; Waring et al. 1990). Bowers (2006) found no diel patterns in foraging rates or depth on DTAG or SLTDR records from short-finned pilot whales tagged off Cape Hatteras, North Carolina. Pilot whale size classes segregate their foraging habitat by diving to different depths.

Habitat Specificity

Generally, short-finned pilot whales are found in waters along the continental slope (500m-1000m depth; Garrison and Aichinger Dias 2020; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). In the waters of the western North Atlantic, short-finned pilot whales are found associated with waters >25°C and in deeper waters near the Gulf Stream (Garrison and Rosel 2017). Short-finned pilot whales in the western North Atlantic are also found in waters over the continental shelf and along the continental shelf break (CETAP 1982; Payne and Heinemann 1993).

Site Fidelity

Information regarding short-finned pilot whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Bernard and Reilly (1999) reported short-finned pilot whale interbirth interval of 4.6 to 5.7 years while Taylor et al. (2007) reported short-finned pilot whale interbirth interval of 6.90 years based on values from Kasuya and Marsh (1984).

Short-finned females become sexually mature at 9 years and live past 60 years, although reproductive senescence may limit the upper age limit for reproduction to around 36 years (Kasuya and Marsh 1984; Marsh and Kasuya 1984; Olson 2018). Taylor et al. (2007) reported short-finned pilot whale age at first reproduction of 11 years and age at last reproduction of 40 years (observed) and 43 years (estimated) based on values from Kasuya and Marsh (1984).

Generation Length

Taylor et al. (2007) reported short-finned pilot whale generation length of 22.7 years at r = 0.01 and 23.5 years at r = 0.0 based on values from Kasuya and Marsh (1984).

Reproductive Plasticity

Information regarding short-finned pilot whale breeding season, habitat, and location was not found in the literature.

Migration

This species is not known to migrate, though long-distance movements are known (e.g., Wells et al. 2013; Tyson Moore et al. 2020).

Home Range

Information regarding individual short-finned pilot whale home range was not found in the literature. However, tagging studies have shown short-finned pilot whales are capable of traveling great distances, moving between the Gulf of Mexico, western North Atlantic, and Caribbean waters (Wells et al. 2013; Tyson Moore et al. 2020).

Stock Abundance

The best available estimate for short-finned pilot whales in the western North Atlantic 28,924 individuals (CV=0.24) based on summer 2016 surveys (Garrison 2020; Palka 2020; Hayes et al. 2022). The previous best available estimate was 21,515 individuals (CV=0.37; Palka 2012; Garrison 2016) based on summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy.

Stock Abundance Trend

No significant trend was detected between 2004, 2011, and 2016 abundance estimates (Hayes et al. 2022).

Cumulative Stressors

The short-finned pilot whale western North Atlantic stock interacts with pelagic longline fisheries and a hook and line fishery. During the time period 2013–2017, fishery-induced mortality was 160 short-finned pilot whales (CV=0.12; Garrison and Stokes 2014, 2016, 2017, 2019, 2020; Maze-Foley and Garrison 2016). During the same period, 14 short-finned pilot whales were reported stranded between Massachusetts and Florida (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Polychlorinated biphenyls (PCBs), chlorinated pesticides (e.g., DDT), and high levels of toxic metals have been found in pilot whales, although the population effect is unknown (Taruski et al. 1975; Muir et al. 1988; Weisbrod et al. 2000; Nielsen et al. 2000; Dam and Bloch 2000).

Distribution and Sightings

Density model results for pilot whales in the western North Atlantic are presented by Roberts et al. (2015, 2016a, 2016b, 2017), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Minton, G., G. Braulik, and R. Reeves. 2018. *Globicephala macrorhynchus*. The IUCN Red List of Threatened Species 2018: e.T9249A50355227. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9249A50355227.en

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

References

Bernard, H.J. and S.B. Reilly. 1999. Pilot whales *Globicephala Lesson*, 1828. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 245–279.

Bowers, M. 2016. Behavioral ecology of the western Atlantic short-finned pilot whale (*Globicephala macrorhynchus*). Duke University. Dissertation. 164 p.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.
Dam, M. and D. Bloch. 2000. Screening of mercury and persistent organochlorine pollutants in long-finned pilot whale (*Globicephala melas*) in the Faroe Islands. Marine Pollution Bulletin 40(12):1090–1099. doi: 10.1016/S0025-326x(00)00060-6
Garrison, L.P. 2016. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during summer 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL PRBD-2016-09. 18 p.
Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.
Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.
Garrison, L.P. and P.E. Rosel. 2017. Partitioning short-finned and long-finned pilot whale bycatch estimates using habitat and genetic information. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. PRBD-2016-17. 24 p.
Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142
Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Kasuya, T. and H. Marsh. 1984. Life history and reproductive biology of the short-finned pilot whale, *Globicephala macrorhynchus*, off the Pacific Coast Japan. Reports of the International Whaling Commission (Special Issue) 6:259–310.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Marsh, H. and T. Kasuya. 1984. Ovarian changes in the short-finned pilot whale, *Globicephala macrorhynchus*. Reports of the International Whaling Commission (Special Issue) 6:311–335.

Maze-Foley, K. and L.P. Garrison. 2016. Serious injury determinations for small cetaceans off the southeast U.S. coast, 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2016-06. 12 p. doi: 10.7289/V5/RD-PRBD-2016-06

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mintzer, V.J., D.P. Gannon, N.B. Barros, and A.J. Read. 2008. Stomach contents of mass-stranded short-finned pilot whales (*Globicephala macrorhynchus*) from North Carolina. Marine Mammal Science 24(2):290–302. doi: 10.1111/j.1748-7692.2008.00189.x

Muir, D.C.G., R. Wagemann, N.P. Grift, R.J. Norstrom, M. Simon, and J. Lien. 1988. Organochlorine chemical and heavy-metal contaminants in white-beaked dolphins (*Lagenorhynchus-albirostris*) and pilot whales (*Globicephala-melaena*) from the coast of Newfoundland, Canada. Archives of Environmental Contamination and Toxicology 17(5):613–629. doi: 10.1007/Bf01055830

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Nielsen, J.B., F. Nielsen, P.J. Jorgensen, and P. Grandjean. 2000. Toxic metals and selenium in blood from pilot whales (*Globicephala melas*) and sperm whales (*Physeter catodon*). Marine Pollution Bulletin 40(4):348–351. doi: 10.1016/S0025-326x(99)00231-3

Olson, P.A. 2018. Pilot whales: *Globicephala melas* and *G. macrorhynchus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 701–705. doi: 10.1016/B978-0-12-804327-1.00194-1

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides,

N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp.*) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Reports of the International Whaling Commission (Special Issue) 14:51–68.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for pilot whales (*Globicephala* spp.) for the U.S. East Coast version 4.3, 2015-09-30, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 101 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Taruski, A.G. and H.E. Winn. 1976. Winter sightings of odontocetes in the West Indies. Cetology 22:1–12.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Tyson Moore, R.B., D.C. Douglas, H.H. Nollens, L. Croft, and R.S. Wells. 2020. Post-release monitoring of a stranded and rehabilitated short-finned pilot whale (*Globicephala macrorhynchus*) reveals current-assisted travel. Aquatic Mammals 46(2):200–214. doi: 10.1578/am.46.2.2020.200

Waring, G.T., P. Gerrior, P.M. Payne, B.L. Parry, and J.R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the Northeast United-States, 1977-88. Fishery Bulletin 88(2):347–360.

Weisbrod, A.V., D. Shea, M.J. Moore, and J.J. John. 2000. Bioaccumulation patterns of polychlorinated biphenyls and chlorinated pesticides in northwest Atlantic pilot whales. Environmental Toxicology and Chemistry 19(3):667–677. doi: 10.1897/1551-5028(2000)019<0667:Bpopba>2.3.Co;2

Wells, R., E.M. Fougeres, A.G. Cooper, R.O. Stevens, M. Brodsky, R. Lingenfelser, C. Dold, and D.C. Douglas. 2013. Movements and dive patterns of short-finned pilot whales (*Globicephala macrorhynchus*) released from a mass stranding in the Florida Keys. Aquatic Mammals 39(1):61–72. doi: 10.1578/am.39.1.2013.61

Pygmy killer whale – *Feresa attenuata*

Gulf of Mexico Stock

Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 63% of scores ≥ 2

	Feresa attenuata	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	1.3	
	Habitat Specificity	1.7	1.7	
	Site Fidelity	1.7	0.7	
	Lifetime Reproductive Potential	2.6	0.3	
	Generation Length	2.3	0.3	
	Reproductive Plasticity	1.7	0.3	
	Migration	3.3	1.0	
	Home Range	1.8	1.0	
	Stock Abundance	3.0	2.7	
	Stock Abundance Trend	2.9	1.3	
	Cumulative Stressors	2.4	1.7	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	2.7	
	Sea Surface Temperature (Change in variability)	1.5	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	2.1	2.7	
	Precipitation (Change in mean)	1.1	2.7	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	2.9	2.7	
	Sea Surface Salinity (Change in variability)	1.7	2.7	
	Ocean pH (Change in mean)	3.4	2.7	
	Ocean pH (Change in variability)	1.5	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.4	2.7	
	Dissolved oxygen (Change in variability)	1.5	2.7	
	Circulation	1.8	2.0	
	Sea level rise	2.1	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		High		

Low

Moderate

High

Very High

Pygmy killer whale (Northern Gulf of Mexico Stock)

Feresa attenuata

CVA Results Summary

Overall Climate Vulnerability Rank: High (58% certainty from bootstrap analysis).

Climate Exposure: High. Two exposure factors scored greater than 3.0: Air Temperature (Standard anomaly) (3.87) and Dissolved oxygen (Standard anomaly) (3.40).

Biological Sensitivity: High. Two sensitivity attributes scored greater than or equal to 3.0: Migration (3.33) and Species Abundance (3.00).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: High

Data Quality: 63% of the data quality scores were 2 or greater. 9% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The pygmy killer whale Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Pygmy killer whale diet consists of fish and cephalopods, and occasionally other dolphins (Perryman and Foster 1980; Ross and Leatherwood 1994; Elorriaga-Verplancken et al. 2016). Pauly et al. (1998) reported species-level diet composition of 30% small squids, 20% large squids, 10% small pelagic fishes, 20% miscellaneous fishes, and 20% high vertebrates.

Habitat Specificity

In the northern Gulf of Mexico, pygmy killer whales are found in oceanic waters (Davis and Fargion 1996; Davis et al. 2000; Würsig et al. 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006; Garrison and Aichinger Dias 2020). Garrison and Aichinger Dias (2020) reported an overall uniform distribution in the Gulf of Mexico, with a main area of occurrence slightly towards central-east.

Site Fidelity

Information regarding pygmy killer whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Information regarding pygmy killer whale reproductive interval was not found in the literature. Taylor et al. (2007) reported pygmy killer whale age at last reproduction of 32 years (estimated).

Generation Length

Information regarding pygmy killer whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding pygmy killer whale reproductive season, location, and habitat was not found in the literature.

Migration

Pygmy killer whales occur year-round in northern Gulf of Mexico waters and were seen in all seasons during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000; Würsig et al. 2000).

Home Range

Information regarding pygmy killer whale home range in the Gulf of Mexico was not found in the literature.

Stock Abundance

The abundance of northern Gulf of Mexico pygmy killer whales is estimated to be 613 individuals (CV=1.15), based on 2017 and 2018 surveys (Garrison et al. 2020). Previously, the stock was estimated at 152 individuals (CV=1.02) based on a summer 2009 oceanic survey (Waring et al. 2012).

Stock Abundance Trend

Five point estimates of pygmy killer whale abundance have been made based on data from surveys in 2003 (501; CV=0.74), 2004 (490; CV=0.87), 2009 (359; CV=0.96), 2017 (1,227; CV=1.149), and 2018 (0). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021).

Cumulative Stressors

During the period 2014–2018, there was zero estimated annual fishing-related mortality (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the period 2014–2018, seven pygmy killer whales were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The pygmy killer whale stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Anthropogenic noise may be an additional stressor for pygmy killer whales, as evidenced by an unusual stranding event associated with naval exercises near Taiwan in 2004 and 2005 (Wang and Yang 2006).

Distribution and Sightings

Density model results for pygmy killer whale in the Gulf of Mexico are presented by Roberts et al. (2016a, 2016b).

Further Reading

Baird, R.W. 2018. Pygmy killer whale: *Feresa attenuata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 788–790. doi: 10.1016/B978-0-12-804327-1.00210-70

Braulik, G. 2018. *Feresa attenuata*. The IUCN Red List of Threatened Species 2018: e.T8551A50354433. doi: 10.2305/IUCN.UK.2018-2.RLTS.T8551A50354433.en

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

References

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W. and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. Minerals Management Service: New Orleans, LA. 356 p.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Elorriaga-Verplancken, F.R., H. Rosales-Nanduca, A. Paniagua-Mendoza, S. Martínez-Aguilar, A.K. Nader-Valencia, R. Robles-Hernández, F. Gómez-Díaz, and J. Urbán R. 2016. First record of pygmy killer whales (*Feresa attenuata*) in the Gulf of California, Mexico: Diet inferences and probable relation with warm conditions during 2014. Aquatic Mammals 42(1):20–26. doi: 10.1578/AM.42.1.2016.20

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami,

FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142
Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316
Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.
Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.
Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807
Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.
Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x
Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical

report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.
National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.
Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280
Perryman, W.L. and T.C. Foster. 1980. Preliminary report on predation by small whales, mainly the false killer whale, *Pseudorca crassidens*, on dolphins (*Stenella* spp. and *Delphinus delphis*) in the eastern tropical Pacific. NMFS-SWFSC Administrative Report LJ-80-05. 9 p.
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for pygmy killer whale (*Feresa attenuata*) for the U.S. Gulf of Mexico version 1.3, 2015-10-01, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 50 p.
Ross, G.J.B. and S. Leatherwood. 1994. Pygmy killer whale-*Feresa attenuata* Gray, 1874. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 387–404.
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538
Wang, J.Y. and S.C. Yang. 2006. Unusual cetacean stranding events of Taiwan in 2004 and 2005. Journal of Cetacean Research and Management 8:283–292.
Waring, G.T., S.A. Wood, and E. Josephson. 2012. Literature search and data synthesis for marine mammals and sea turtles in the U.S. Atlantic from Maine to the Florida Keys. Bureau of Ocean Energy Management: New Orleans, LA. OCS Study BOEM 2012-109. 456 p.
Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Pygmy killer whale − *Feresa attenuata*

Western North Atlantic Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 0% of scores ≥ 2

	Feresa attenuata	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	0.7	
	Habitat Specificity	1.9	0.7	
	Site Fidelity	2.1	0.7	
	Lifetime Reproductive Potential	2.3	0.3	
	Generation Length	2.7	0.3	
	Reproductive Plasticity	1.7	0.3	
	Migration	2.6	0.0	
	Home Range	1.9	0.7	
	Stock Abundance	2.1	0.7	
	Stock Abundance Trend	2.3	0.0	
	Cumulative Stressors	2.2	1.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	0.0	
	Sea Surface Temperature (Change in variability)	1.0	0.0	
	Air Temperature (Change in mean)	4.0	0.0	
	Air Temperature (Change in variability)	1.0	0.0	
	Precipitation (Change in mean)	1.0	0.0	
	Precipitation (Change in variability)	1.5	0.0	
	Sea Surface Salinity (Change in mean)	2.9	0.0	
	Sea Surface Salinity (Change in variability)	1.4	0.0	
	Ocean pH (Change in mean)	4.0	0.0	
	Ocean pH (Change in variability)	1.5	0.0	
	Sea ice coverage (Change in mean)	1.0	0.0	
	Sea ice coverage (Change in variability)	1.0	0.0	
	Dissolved oxygen (Change in mean)	4.0	0.0	
	Dissolved oxygen (Change in variability)	1.6	0.0	
	Circulation	1.0	0.5	
	Sea level rise	2.4	0.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Pygmy killer whale (Western North Atlantic Stock)

Feresa attenuata

CVA Results Summary

Overall Climate Vulnerability Rank: High (77% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.0), Dissolved oxygen (Standard anomaly) (4.0), Ocean pH (Standard anomaly) (4.0), and Sea Surface Temperature (Standard anomaly) (3.9)

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Generation Time (2.73) and Migration (2.60).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 0% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The pygmy killer whale western North Atlantic stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Pygmy killer whale diet consists of fish and cephalopods, and occasionally other dolphins (Perryman and Foster 1980; Ross and Leatherwood 1994; Elorriaga-Verplancken et al. 2016). Pauly et al. (1998) reported diet composition of 30% small squids, 20% large squids, 10% small pelagic fishes, 20% miscellaneous fishes, and 20% high vertebrates.

Habitat Specificity

In the northern Gulf of Mexico, pygmy killer whales are found in oceanic waters (Davis and Fargion 1996; Davis et al. 2000; Würsig et al. 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006).

Site Fidelity

Information regarding pygmy killer whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Information regarding pygmy killer whale reproductive interval was not found in the literature.

Taylor et al. (2007) reported pygmy killer whale age at last reproduction of 32 years (estimated).

Generation Length

Information regarding pygmy killer whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding pygmy killer whale reproductive season, location, and habitat was not found in the literature.

Migration

Information regarding pygmy killer whale migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Information regarding pygmy killer whale home range in the western North Atlantic was not found in the literature.

Stock Abundance

An abundance estimate is not available for pygmy killer whales in the western North Atlantic because it was rarely seen in any surveys (Hayes et al. 2020). The species was most recently sighted during a 1992 survey, in which six pygmy killer whales were sighted in deep waters off of Cape Hatteras, North Carolina (Hansen et al. 1994).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Hayes et al. 2020).

Cumulative Stressors

Pygmy killer whales in the western North Atlantic had an estimated annual fishing-related mortality of zero during the period 2013–2017 (Garrison and Stokes 2014, 2016, 2017, 2019, 2020). During the same period, 3 pygmy killer whales reported stranded along the U.S. Atlantic coast in Virginia (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited by Hayes et al. 2020).

Distribution and Sightings

Density models were not found for this stock.

Further Reading

Baird, R.W. 2018. Pygmy killer whale: *Feresa attenuata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 788–790. doi: 10.1016/B978-0-12-804327-1.00210-70

Braulik, G. 2018. *Feresa attenuata*. The IUCN Red List of Threatened Species 2018: e.T8551A50354433. doi: 10.2305/IUCN.UK.2018-2.RLTS.T8551A50354433.en

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

References

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W. and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. Minerals Management Service: New Orleans, LA. 356 p.

Elorriaga-Verplancken, F.R., H. Rosales-Nanduca, A. Paniagua-Mendoza, S. Martínez-Aguilar, A.K. Nader-Valencia, R. Robles-Hernández, F. Gómez-Díaz, and J. Urbán R. 2016. First record of pygmy killer whales (*Feresa attenuata*) in the Gulf of California, Mexico: Diet inferences and probable relation with warm conditions during 2014. Aquatic Mammals 42(1):20–26. doi: 10.1578/AM.42.1.2016.20

Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration,

National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Hansen, L.J., K.D. Mullin, and C.L. Roden. 1994. Preliminary estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys, and of selected cetacean species in the U.S. Atlantic Exclusive Economic Zone from vessel survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory: Miami, FL. Contribution No. MIA-93/94-58. 14 p.
Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.
Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.
Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x
Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280
Perryman, W.L. and T.C. Foster. 1980. Preliminary report on predation by small whales, mainly the false killer whale, *Pseudorca crassidens*, on dolphins (*Stenella* spp. and *Delphinus delphis*) in the eastern tropical Pacific. NMFS-SWFSC Administrative Report LJ-80-05. 9 p.
Ross, G.J.B. and S. Leatherwood. 1994. Pygmy killer whale-*Feresa attenuata* Gray, 1874. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 387–404.
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Rice's whale − *Balaenoptera ricei*

Gulf of Mexico Stock

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High

Climate Exposure = Very High

Data Quality = 63% of scores ≥ 2

	Balaenoptera ricei	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	3.0	1.0	
	Habitat Specificity	2.6	1.7	
	Site Fidelity	3.7	2.0	
	Lifetime Reproductive Potential	1.3	1.7	
	Generation Length	2.3	2.0	
	Reproductive Plasticity	2.8	0.3	
	Migration	3.8	1.7	
	Home Range	3.7	2.7	
	Stock Abundance	4.0	3.0	
	Stock Abundance Trend	3.6	1.0	
	Cumulative Stressors	3.7	1.7	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	2.0	
	Sea Surface Temperature (Change in variability)	1.0	2.0	
	Air Temperature (Change in mean)	4.0	2.0	
	Air Temperature (Change in variability)	1.0	2.0	
	Precipitation (Change in mean)	1.0	2.0	
	Precipitation (Change in variability)	1.0	2.0	
	Sea Surface Salinity (Change in mean)	1.7	1.3	
	Sea Surface Salinity (Change in variability)	1.1	1.3	
	Ocean pH (Change in mean)	4.0	2.0	
	Ocean pH (Change in variability)	1.0	2.0	
	Sea ice coverage (Change in mean)	1.0	2.0	
	Sea ice coverage (Change in variability)	1.0	2.0	
	Dissolved oxygen (Change in mean)	4.0	2.0	
	Dissolved oxygen (Change in variability)	1.0	2.0	
	Circulation	2.4	1.3	
	Sea level rise	1.3	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Very High		

Low
Moderate
High
Very High

Rice's whale (Gulf of Mexico Stock)

Balaenoptera ricei

CVA Results Summary

Overall Climate Vulnerability Rank: Very High (100% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Very High. Six sensitivity attributes scored greater than 3.5: Species Abundance (4.00), Migration (3.80), Cumulative Stressors (3.73), Home Range (3.73), Site Fidelity (3.67), and Species Abundance Trend (3.60).

Distributional Response: Very High

Abundance Response: Very High

Phenology Response: Very High

Data Quality: 63% of the data quality scores were 2 or greater. 36% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Rice’s whale northern Gulf of Mexico stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico (Rosel and Wilcox 2014; Hayes et al. 2021; Rosel et al. 2021). This stock was previously identified as the Bryde’s whale (*Balaenoptera edeni brydei*) northern Gulf of Mexico Stock but was designated as a separate species in 2021 (Rosel et al. 2021).

Prey/Diet Specificity

Rice's whales are thought to feed on schooling fish, and possibly krill, based on studies of the closely related Bryde's whale (Nemoto and Kawamura 1977; Siciliano et al. 2004; Anderson 2005; Kato and Perrin 2018).

Habitat Specificity

In the Gulf of Mexico, Rice’s whales are found near the shelf break near De Soto Canyon and the Florida Escarpment, generally between 100 and 400 m depth (Mullin et al. 1994; Davis and Fargion 1996; Jefferson and Schiro 1997; Davis et al. 1998; Davis et al. 2000; LaBrecque et al. 2015; Garrison and Aichinger Dias 2020). Recently, Rice's whales have been found to occur in similar water depths in the northwestern Gulf along the shelf break offshore of Louisiana (Soldevilla et al. 2022).

Site Fidelity

One satellite-tagged Rice's whale showed strong site fidelity throughout a 33-day tag transmission (Soldevilla et al. 2017). The vast majority of sightings occur within the Biologically Important Area (BIA) bounded by the 100 m and 300 m isobaths in the northeastern Gulf of Mexico from De Soto Canyon to northwest of Tampa Bay, Florida (LaBrecque et al. 2015).

Lifetime Reproductive Potential

Reproductive information for the Rice's whale was not identified in the literature. However, information from the closely related Bryde's whale, Eden's whale (*Balaenoptera edeni*), and Omura's whale (*Balaenoptera omurai*) was found. Bryde's whales have a two-year reproductive cycle (Kato and Perrin 2018). Taylor et al. (2007) reported an interbirth interval of 2.5 years for Bryde's whales, Eden's whales, and Omura's whales. Taylor et al. (2007) reported age at first reproduction of 9 years for Bryde's whales, Eden's whales, and Omura's whales and estimated oldest age at reproduction as 54, 53, and 54 years, respectively, for Bryde's whales, Eden's whales, and Omura's whales, suggesting a reproductive lifespan of 44-45 years.

Generation Length

Taylor et al. (2007) estimated generation length of 18.0 to 18.4 years for the related Bryde's whales based on values reported by Lockyer (1984), the International Whaling Commission (IWC 1997), and Best (1977).

Reproductive Plasticity

Reproductive information for the Rice's whale was not identified in the literature. The related Bryde's whale does not have a well-defined breeding season in most areas.

Migration

Rice's whales exhibit year-round occurrence in the area around De Soto Canyon and part of the Florida Escarpment (Würsig et al. 2000). Rice's whales have been sporadically detected in the western Gulf of Mexico using long-term acoustic monitoring, but there is no obvious migratory pattern or seasonality to the detections (Soldevilla et al. 2022).

Home Range

A satellite-tagged Rice's whale spent the majority of time during a 33 day tag transmission in a 1084 km^2 area (Soldevilla et al. 2017).

Stock Abundance

Rice's whales abundance in US waters of the Gulf of Mexico is estimated to be 51 individuals (CV=0.50) from 2017 and 2018 oceanic surveys (Garrison et al. 2020; Hayes et al. 2021). Previously, the stock was estimated at 33 individuals (CV=1.07) from a summer 2009 oceanic survey (Hayes et al. 2018).

Stock Abundance Trend

A trend analysis has not been conducted for this stock. Five point estimates of Rice's whale abundance have been made based on data from line-transect surveys covering 1991-2018. The estimates vary by a maximum factor of nearly three, but the precision of the estimates is poor (Hayes et al. 2018; Hayes et al. 2021).

Cumulative Stressors

Threats to Rice's whales include habitat destruction, degradation, and modification; oil spills; vessel strikes; and anthropogenic noise (Rosel and Wilcox 2014; Rosel et al. 2016). Rice's whales suffered no reported fishery-related mortality and serious injury during the period 2011–2015 (Hayes et al. 2018), although trawl and longline fisheries operate within the BIA. Three Rice's whales were reported stranded in the Gulf of Mexico during 2009–2013; one due to ship strike (Hayes et al. 2018) and two due to unknown causes. The Rice's whale has likely been exposed to oil and dispersants from the Deepwater Horizon event (DWH MMIQT 2015).

Distribution and Sightings

A review of sightings is presented by Rosel et al. (2021) and a record of acoustic detections is presented by Soldevilla et al. (2022).

Further Reading

Cooke, J.G. and R.L. Brownell, Jr. 2018. *Balaenoptera edeni*. The IUCN Red List of Threatened Species 2018: e.T2476A50349178. doi: 10.2305/IUCN.UK.2018-1.RLTS.T2476A50349178.en

Kato, H. and W.F. Perrin. 2018. Bryde's Whale: *Balaenoptera edeni*, in: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK, pp. 143–145. doi: 10.1016/B978-0-12-804327-1.00079-0

Rosel, P.E., P.J. Corkeron, L. Engleby, D. Epperson, K.D. Mullin, M.S. Soldevilla, and B.L. Taylor. 2016. Status review of Bryde's whales (*Balaenoptera edeni*) in the Gulf of Mexico under the Endangered Species Act. Southeast Fisheries Science Center: Miami, FL. NOAA technical memorandum NMFS-SEFSC-692 133 p. doi: 10.7289/V5/TM-SEFSC-692

Rosel, P.E., L.A. Wilcox, T.K. Yamada, and K.D. Mullin. 2021. A new species of baleen whale (*Balaenoptera*) from the Gulf of Mexico, with a review of its geographic distribution. Marine Mammal Science 37(2):577–610. doi: 10.1111/mms.12776

References

Anderson, R.C. 2005. Observations of cetaceans in the Maldives, 1990–2002. Journal of Cetacean Research and Management 7(2):119–135.

Best, P.B. 1977. Two allopatric forms of Bryde's whale off South Africa. Reports of the International Whaling Commission (Special Issue):10–38.

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W. and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. Minerals Management Service: New Orleans, LA. 356 p.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Deepwater Horizon Marine Mammai Injury Quantification Team (DWH MMIQT). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. 64 p.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2018. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2017: (Second Edition). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-245. 371 p. doi: 10.25923/e764-9g81

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

International Whaling Commission (IWC). 1997. Report of the Scientific Committee. Annex G. Report of the sub-committee on North Pacific Bryde's whales. Reports of the International Whaling Commission 47:163–168.

Jefferson, T.A. and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review 27(1):27–50. doi: 10.1111/j.1365-2907.1997.tb00371.x

Kato, H. and W.F. Perrin. 2018. Bryde’s whale: *Balaenoptera edeni*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 143–145. doi: 10.1016/B978-0-12-804327-1.00079-0

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. 3. Biologically Important Areas for cetaceans within U.S. Waters – Gulf of Mexico Region. Aquatic Mammals 41(1):30–38. doi: 10.1578/am.41.1.2015.30

Lockyer, C. 1984. Review of baleen whale (Mysticeti) reproduction and implications for management. Reports of the International Whaling Commission (Special Issue) 6:27–50.

Mullin, K.D., W. Hoggard, C.L. Roden, R.R. Lohoefener, C.M. Rogers, and B. Taggart. 1994. Cetaceans on the upper continental-slope in the North-Central Gulf-of-Mexico. Fishery Bulletin 92(4):773–786.

Nemoto, T. and A. Kawamura. 1977. Characteristics of food habits and distribution of baleen whales with special reference to the abundance of North Pacific sei and Bryde's whales. Reports of the International Whaling Commission (Special Issue) 1:80–87.

Rosel, P.E., P.J. Corkeron, L. Engleby, D.M. Epperson, K. Mullin, M.S. Soldevilla, and B.L. Taylor. 2016. Status review of Bryde's whales (*Balaenoptera edeni*) in the Gulf of Mexico under the Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine

Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-692. 133 p. doi: 10.7289/V5/TM-SEFSC-692
Rosel, P.E. and L.A. Wilcox. 2014. Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico. Endangered Species Research 25(1):19–34. doi: 10.3354/esr00606
Rosel, P.E., L.A. Wilcox, T.K. Yamada, and K.D. Mullin. 2021. A new species of baleen whale (Balaenoptera) from the Gulf of Mexico, with a review of its geographic distribution. Marine Mammal Science 37(2):577–610. doi: 10.1111/mms.12776
Siciliano, S., M.C.D. Santos, A.F.C. Vicente, F.S. Alvarenga, E. Zampirolli, J.L. Brito, A.F. Azevedo, and J.L.A. Pizzorno. 2004. Strandings and feeding records of Bryde's whales (*Balaenoptera edeni*) in south-eastern Brazil. Journal of the Marine Biological Association of the United Kingdom 84(4):857–859. doi: 10.1017/S0025315404010082h
Soldevilla, M.S., A.J. Debich, L.P. Garrison, J.A. Hildebrand, and S.M. Wiggins. 2022. Rice's whales in the northwestern Gulf of Mexico: call variation and occurrence beyond the known core habitat. Endangered Species Research 48:155–174. doi: 10.3354/esr01196
Soldevilla, M.S., J.A. Hildebrand, K.E. Frasier, L. Aichinger Dias, A. Martinez, K.D. Mullin, P.E. Rosel, and L.P. Garrison. 2017. Spatial distribution and dive behavior of Gulf of Mexico Bryde's whales: potential risk of vessel strikes and fisheries interactions. Endangered Species Research 32:533–550. doi: 10.3354/esr00834
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Risso's dolphin − *Grampus griseus*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 93% of scores ≥ 2

	Grampus griseus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.9	2.0	
	Habitat Specificity	2.4	2.7	
	Site Fidelity	2.4	2.0	
	Lifetime Reproductive Potential	1.8	2.3	
	Generation Length	2.3	2.3	
	Reproductive Plasticity	2.1	2.0	
	Migration	3.4	2.7	
	Home Range	2.1	2.3	
	Stock Abundance	1.9	2.7	
	Stock Abundance Trend	2.4	0.7	
	Cumulative Stressors	2.6	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.9	2.7	
	Sea Surface Temperature (Change in variability)	1.1	2.7	
	Air Temperature (Change in mean)	3.9	2.7	
	Air Temperature (Change in variability)	1.1	2.7	
	Precipitation (Change in mean)	1.1	2.3	
	Precipitation (Change in variability)	1.1	2.7	
	Sea Surface Salinity (Change in mean)	2.9	2.3	
	Sea Surface Salinity (Change in variability)	1.3	2.3	
	Ocean pH (Change in mean)	3.9	2.7	
	Ocean pH (Change in variability)	1.1	2.7	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.9	2.7	
	Dissolved oxygen (Change in variability)	1.1	2.7	
	Circulation	1.7	1.7	
	Sea level rise	2.1	2.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Risso's dolphin (Northern Gulf of Mexico Stock)

Grampus griseus

CVA Results Summary

Overall Climate Vulnerability Rank: High (73% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (3.93), Ocean pH (Standard anomaly) (3.93), Sea Surface Temperature (Standard anomaly) (3.93), and Air Temperature (Standard anomaly) (3.87).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (3.40), Prey/Diet Specificity (2.87), and Cumulative Stressors (2.60).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater. 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Risso's dolphin Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Pauly et al. (1998) reported global species-level diet composition of 5% benthic invertebrates, 50% small squids, 35% large squids, 5% small pelagic fishes, and 5% miscellaneous fishes. Risso's dolphin diet predominantly consisted of squid in waters off South Africa (Cockroft et al. 1993) and in the Mediterranean Sea (Blanco et al. 2006).

Habitat Specificity

Risso's dolphins in the northern Gulf of Mexico are found in oceanic waters and concentrated in waters over the continental slope (Baumgartner 1997; Maze-Foley and Mullin 2006; Jefferson et al. 2014). In the western North Atlantic, Risso's dolphin are found along the continental shelf edge and in deeper oceanic waters, and associated with bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Leatherwood et al. 1976; CETAP 1982; Payne et al. 1984; Baird and Stacey 1991; Green et al. 1992; Waring et al. 1992; Baumgartner 1997; Davis et al. 1998; Mignucci-Giannoni 1998; Kruse et al. 1999; Hamazaki 2002). Risso's dolphin presence in the Pacific has been correlated with SST (Soldevilla et al. 2011; Baumann-Pickering et al. 2016).

Site Fidelity

Studies of Risso’s dolphin site fidelity in the northern Gulf of Mexico were not found in the literature. However, Risso’s dolphins have been found to display seasonal and/or long-term site fidelity elsewhere, such as in waters off Wales (de Boer et al. 2013), in the northwestern Mediterranean (David and DiMéglio 1999; Casacci and Gannier 2000), and in the Azores (Hartman et al. 2015).

Lifetime Reproductive Potential

Taylor et al. (2007) reported Risso’s dolphin interbirth interval of 2.4 years based on values reported by Kruse et al. (1999). Taylor et al. (2007) reported age at first reproduction of 11 years and the oldest reproductive female at 37 years based on values reported by Kruse et al. (1999). Hartman et al. (2016) estimated individuals may live more than 45 years.

Generation Length

Taylor et al. (2007) reported Risso’s dolphin generation length of 18.6 years at r=0.02 and 19.6 years at r=0.

Reproductive Plasticity

Risso’s dolphin calving appears to peak in the summer in the North Atlantic (Jefferson et al. 1993). Information about breeding location and habitat was not found in the literature.

Migration

Risso's dolphins occur year-round in northern Gulf of Mexico waters and were seen in all seasons during GulfCet aerial surveys (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

In the Gulf of Mexico, a female Risso’s dolphin released after stranding and rehabilitation was tracked throughout the northern Gulf of Mexico to waters as far as Texas, Louisiana, and Bahia de Campeche, Mexico, before returning to southwest Florida (Wells et al. 2008). A rehabilitated adult male Risso’s dolphin stranded and released in the Gulf of Mexico off Florida was tracked to waters off Delaware (Wells et al. 2009).

Stock Abundance

The abundance of Risso’s dolphins in the northern Gulf of Mexico is estimated to be 1,974 individuals (CV=0.46) based on 2017 and 2018 surveys (Garrison et al. 2020). Previously, the stock was estimated at 2,442 individuals (CV=0.57) based on summer 2009 surveys (Waring et al. 2016).

Stock Abundance Trend

Five point estimates of Risso’s dolphin abundance have been made based on data from surveys in 2003 (4,471; CV=0.47), 2004 (4,641; CV=0.86), 2009 (7,788; CV=0.67), 2017 (2,998; CV=0.52), and 2018 (632; CV=0.60). Pairwise comparisons of the log-transformed means were conducted between years, and found statistically significant differences between the 2003 and 2018 estimates and between the 2009 and 2018 estimates (see Garrison et al. 2020 and Hayes et al. 2021). However, the ability to detect a trend is confounded by poor precision and long survey intervals (Hayes et al. 2021).

Cumulative Stressors

Risso's dolphins in the northern Gulf of Mexico interact with the pelagic longline fishery. During the period 2014–2018, annual fishing-related mortality was estimated to be zero (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the same period, five Risso's dolphins were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The Risso's dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for Risso's dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017). Sighting records are presented by Jefferson et al. (2014).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Kiszka, J. and G. Braulik. 2018. *Grampus griseus*. The IUCN Red List of Threatened Species 2018: e.T9461A50356660. doi: 10.2305/IUCN.UK.2018-2.RLTS.T9461A50356660.en

Hartman, K.L. 2018. Risso's dolphin: *Grampus griseus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 824–827. doi: 10.1016/B978-0-12-804327-1.00219-3

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

References

Baird, R.W. and P.J. Stacey. 1991. Status of Risso's dolphin, *Grampus griseus*, in Canada. Canadian Field-Naturalist 105(2):233–242.

Baumann-Pickering, S., J.S. Trickey, S.M. Wiggins, and E.M. Oleson. 2016. Odontocete occurrence in relation to changes in oceanography at a remote equatorial Pacific seamount. Marine Mammal Science 32(3):805–825. doi: 10.1111/mms.12299

Baumgartner, M.F. 1997. The distribution of Risso's dolphin (*Grampus griseus*) with respect to the physiography of the northern Gulf of Mexico. Marine Mammal Science 13(4):614–638. doi: 10.1111/j.1748-7692.1997.tb00087.x

Blanco, C., M.Á. Raduán, and J.A. Raga. 2006. Diet of Risso's dolphin (*Grampus griseus*) in the western Mediterranean Sea. Scientia Marina 70(3):407–411. doi: 10.3989/scimar.2006.70n3407

Casacci, C. and A. Gannier. 2000. Habitat variability and site fidelity of the Risso's dolphin in the northwestern Mediterranean: defining home range for a nomad. In: Evans, P.G.H., R. Pitt-Aiken, and E. Rogan (Eds.), Procedings of the 14th Annual Conference of the European Cetacean Society. Cork, Ireland, 2-5 April, 2000. European Cetacean Society. pp. 19–22.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Cockcroft, V.G., S.L. Haschick, and N.W. Klages. 1993. The diet of Risso's dolphin, *Grampus griseus* (Cuvier, 1812), from the east coast of South Africa. Zeitschrift für Säugetierkunde 58(5):286–293.

David, L. and N. Di-Méglio. 1999. First results of summer movements of *Grampus griseus* (Cuvier, 1812) in the northwestern Mediterranean Sea. In: Evans, P.G.H., J. Cruz, and J.A. Raga (Eds.), Procedings of the 13th Annual Conference of the European Cetacean Society. Valencia, Spain, 5-85 April, 1999. European Cetacean Society. pp. 189–194.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

de Boer, M.N., J. Clark, M.F. Leopold, M.P. Simmonds, and P.J.H. Reijnders. 2013. Photo-identification methods reveal seasonal and long-term site-fidelity of risso's dolphins (*Grampus griseus*) in shallow waters (Cardigan Bay, Wales). Open Journal of Marine Science 03(02):66–75. doi: 10.4236/ojms.2013.32A007

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration,

National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnell, and K.C. Balcomb III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. In: Brueggeman, J.J. (Ed.), Oregon and Washington Marine Mammal and Seabird Surveys. pp. 1–100.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hartman, K.L., M. Fernandez, A. Wittich, and J.M.N. Azevedo. 2015. Sex differences in residency patterns of Risso's dolphins (*Grampus griseus*) in the Azores: Causes and management implications. Marine Mammal Science 31(3):1153–1167. doi: 10.1111/mms.12209

Hartman, K.L., A. Wittich, J.J. Cai, F.H. van der Meulen, and J.M.N. Azevedo. 2016. Estimating the age of Risso’s dolphins (*Grampus griseus*) based on skin appearance. Journal of Mammalogy 97(2):490–502. doi: 10.1093/jmammal/gyv193

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide. Marine mammals of the world. Food and Agriculture Organization of the United Nations: Rome, Italy. 320 p.

Jefferson, T.A., C.R. Weir, R.C. Anderson, L.T. Ballance, R.D. Kenney, and J.J. Kiszka. 2014. Global distribution of Risso's dolphin *Grampus griseus*: A review and critical evaluation. Mammal Review 44(1):56–68. doi: 10.1111/mam.12008

Kruse, S., D.K. Caldwell, and M.C. Caldwell. 1999. Risso's dolphin *Grampus griseus* (G. Cuvier, 1812). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 183–212.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic: A guide to their identification. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS CIRC-396. 176 p.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Contract number NA-81-FA-C-00023. 246 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for Risso's dolphin (*Grampus griseus*) for the U.S. Gulf of Mexico version 2.3, 2015-09-29, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 61 p.

Soldevilla, M.S., S.M. Wiggins, J.A. Hildebrand, E.M. Oleson, and M.C. Ferguson. 2011. Risso's and Pacific white-sided dolphin habitat modeling from passive acoustic monitoring. Marine Ecology Progress Series 423:247–260. doi: 10.3354/meps08927

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN
Wells, R.S., C.A. Manire, L. Byrd, D.R. Smith, J.G. Gannon, D. Fauquier, and K.D. Mullin. 2009. Movements and dive patterns of a rehabilitated Risso's dolphin, *Grampus griseus*, in the Gulf of Mexico and Atlantic Ocean. Marine Mammal Science 25(2):420–429. doi: 10.1111/j.1748-7692.2008.00251.x
Wells, R.S., C.A. Manire, and J. Whaley. 2008. Travels with Betty: A Risso's dolphin tour of the Gulf of Mexico. Strandings: Newsletter of the Southeast United States Marine Mammal Health and Stranding Network:1–4.

Risso's dolphin − *Grampus griseus*

Western North Atlantic Stock

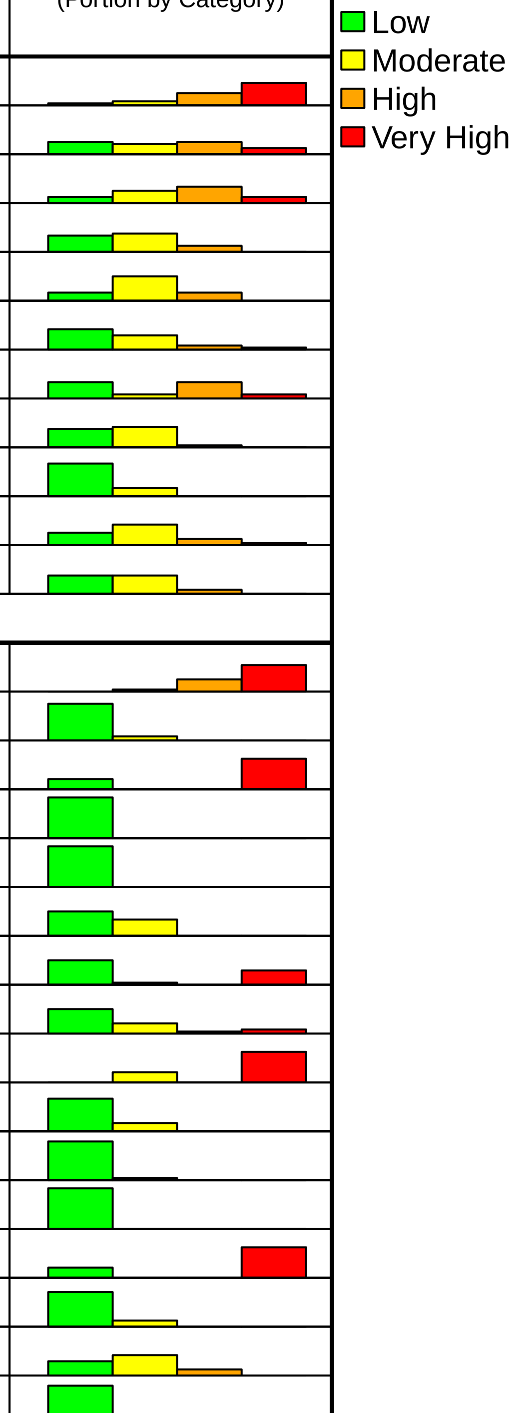
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 93% of scores ≥ 2

	Grampus griseus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	3.4	2.0	
	Habitat Specificity	2.3	2.5	
	Site Fidelity	2.5	2.0	
	Lifetime Reproductive Potential	1.8	2.2	
	Generation Length	2.0	1.8	
	Reproductive Plasticity	1.7	2.0	
	Migration	2.2	2.5	
	Home Range	1.6	3.0	
	Stock Abundance	1.2	2.8	
	Stock Abundance Trend	1.9	0.8	
	Cumulative Stressors	1.6	2.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	2.8	
	Sea Surface Temperature (Change in variability)	1.1	2.8	
	Air Temperature (Change in mean)	3.2	2.5	
	Air Temperature (Change in variability)	1.0	2.5	
	Precipitation (Change in mean)	1.0	2.5	
	Precipitation (Change in variability)	1.4	2.2	
	Sea Surface Salinity (Change in mean)	2.1	2.8	
	Sea Surface Salinity (Change in variability)	1.6	2.8	
	Ocean pH (Change in mean)	3.5	3.0	
	Ocean pH (Change in variability)	1.2	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	3.2	3.0	
	Dissolved oxygen (Change in variability)	1.1	2.8	
	Circulation	1.8	2.8	
	Sea level rise	1.0	3.0	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Risso's dolphin (Western North Atlantic Stock)

Grampus griseus

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (63% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.60), Ocean pH (Standard anomaly) (3.50), Air Temperature (Standard anomaly) (3.25), and Dissolved oxygen (Standard anomaly) (3.25).

Biological Sensitivity: Moderate. Twp sensitivity attributes scored greater than 2.5: Prey/Diet Specificity (3.35) and Site Fidelity (2.55).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: High

Data Quality: 93% of the data quality scores were 2 or greater. 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Descriptions

The Risso's dolphin western North Atlantic stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2022).

Prey/Diet Specificity

Pauly et al. (1998) reported global species-level diet composition of 5% benthic invertebrates, 50% small squids, 35% large squids, 5% small pelagic fishes, and 5% miscellaneous fishes. Risso's dolphin diet predominantly consisted of squid in waters off South Africa (Cockroft et al. 1993) and in the Mediterranean Sea (Blanco et al. 2006).

Habitat Specificity

Risso's dolphin in the western North Atlantic are found along the continental shelf edge and in deeper oceanic waters, and associated with bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Leatherwood et al. 1976; CETAP 1982; Payne et al. 1984; Baird and Stacey 1991; Green et al. 1992; Waring et al. 1992; Baumgartner 1997; Davis et al. 1998; Mignucci-Giannoni 1998; Kruse et al. 1999; Hamazaki 2002). Risso's dolphin presence in the Pacific has been correlated with SST (Soldevilla et al. 2011; Baumann-Pickering et al. 2016).

Site Fidelity

Studies of Risso's dolphin site fidelity in the western North Atlantic were not found in the literature. However, Risso's dolphins have been found to display seasonal and/or long-term site fidelity elsewhere, such as in waters off Wales (de Boer et al. 2013), in the northwestern Mediterranean (David and DiMéglio 1999; Casacci and Gannier 2000), and in the Azores (Hartman et al. 2015).

Lifetime Reproductive Potential

Taylor et al. (2007) reported Risso's dolphin interbirth interval of 2.4 years based on values reported by Kruse et al. (1999). Taylor et al. (2007) reported age at first reproduction of 11 years and the oldest reproductive female at 37 years based on values reported by Kruse et al. (1999). Hartman et al. (2016) estimated individuals may live more than 45 years.

Generation Length

Taylor et al. (2007) reported Risso's dolphin generation length of 18.6 years at r=0.02 and 19.6 years at r=0.

Reproductive Plasticity

Risso's dolphin calving appears to peak in the summer in the North Atlantic (Jefferson et al. 1993). Information about breeding location and habitat was not found in the literature.

Migration

In the western North Atlantic, Risso's dolphin distribution includes waters from Cape Hatteras to Georges Bank during spring, summer, and autumn and shifts to the mid-Atlantic Bight and oceanic waters in the winter (CETAP 1982; Payne et al. 1984).

Home Range

A rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked to waters off Delaware (Wells et al. 2009).

In the Gulf of Mexico, a female Risso's dolphin released after stranding and rehabilitation was tracked throughout the northern Gulf of Mexico to waters as far as Texas, Louisiana, and Bahia de Campeche, Mexico, before returning to southwest Florida (Wells et al. 2008).

Stock Abundance

The Risso's dolphin in the western North Atlantic is estimated at 35,215 individuals (CV=0.19; Garrison 2020; Palka 2020; Hayes et al. 2022) based on summer 2016 surveys. Previously, the stock abundance estimate was 18,250 individuals (CV = 0.46), based on 2011 surveys (Hayes et al. 2017).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2020).

Cumulative Stressors

Risso's dolphins in the western North Atlantic may interact with longline, trawl, and gillnet fisheries. During the period 2013–2017, there was an estimated annual fishing-related mortality of 53.9 individuals (Garrison and Stokes 2014, 2016, 2017, 2019, 2020; Hatch and Orphanides 2015, 2016; Orphanides 2019, 2020; Lyssikatos et al. 2020). During the same period, 38 Risso's dolphins were reported stranded along the U.S. Atlantic coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Distribution and Sightings

Density model results for Risso's dolphin in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017, 2018), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Kiszka, J. and G. Braulik. 2018. *Grampus griseus*. The IUCN Red List of Threatened Species 2018: e.T9461A50356660. doi: 10.2305/IUCN.UK.2018-2.RLTS.T9461A50356660.en

Hartman, K.L. 2018. Risso's dolphin: *Grampus griseus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 824–827. doi: 10.1016/B978-0-12-804327-1.00219-3

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

References

Baird, R.W. and P.J. Stacey. 1991. Status of Risso's dolphin, *Grampus griseus*, in Canada. Canadian Field-Naturalist 105(2):233–242.

Baumann-Pickering, S., J.S. Trickey, S.M. Wiggins, and E.M. Oleson. 2016. Odontocete occurrence in relation to changes in oceanography at a remote equatorial Pacific seamount. Marine Mammal Science 32(3):805–825. doi: 10.1111/mms.12299

Baumgartner, M.F. 1997. The distribution of Risso's dolphin (*Grampus griseus*) with respect to the physiography of the northern Gulf of Mexico. Marine Mammal Science 13(4):614–638. doi: 10.1111/j.1748-7692.1997.tb00087.x

Blanco, C., M.Á. Raduán, and J.A. Raga. 2006. Diet of Risso's dolphin (*Grampus griseus*) in the western Mediterranean Sea. Scientia Marina 70(3):407–411. doi: 10.3989/scimar.2006.70n3407

Casacci, C. and A. Gannier. 2000. Habitat variability and site fidelity of the Risso's dolphin in the northwestern Mediterranean: defining home range for a nomad. In: Evans, P.G.H., R. Pitt-Aiken, and E. Rogan (Eds.), Procedings of the 14th Annual Conference of the European Cetacean Society. Cork, Ireland, 2-5 April, 2000. European Cetacean Society. pp. 19–22.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Cockcroft, V.G., S.L. Haschick, and N.W. Klages. 1993. The diet of Risso's dolphin, *Grampus griseus* (Cuvier, 1812), from the east coast of South Africa. Zeitschrift für Säugetierkunde 58(5):286–293.

David, L. and N. Di-Méglio. 1999. First results of summer movements of *Grampus griseus* (Cuvier, 1812) in the northwestern Mediterranean Sea. In: Evans, P.G.H., J. Cruz, and J.A. Raga (Eds.), Procedings of the 13th Annual Conference of the European Cetacean Society. Valencia, Spain, 5-85 April, 1999. European Cetacean Society. pp. 189–194.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

de Boer, M.N., J. Clark, M.F. Leopold, M.P. Simmonds, and P.J.H. Reijnders. 2013. Photo-identification methods reveal seasonal and long-term site-fidelity of risso's dolphins (*Grampus griseus*) in shallow waters (Cardigan Bay, Wales). Open Journal of Marine Science 03(02):66–75. doi: 10.4236/ojms.2013.32A007

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnell, and K.C. Balcomb III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. In: Brueggeman, J.J. (Ed.), Oregon and Washington Marine Mammal and Seabird Surveys. pp. 1–100.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hartman, K.L., M. Fernandez, A. Wittich, and J.M.N. Azevedo. 2015. Sex differences in residency patterns of Risso's dolphins (*Grampus griseus*) in the Azores: Causes and management implications. Marine Mammal Science 31(3):1153–1167. doi: 10.1111/mms.12209

Hartman, K.L., A. Wittich, J.J. Cai, F.H. van der Meulen, and J.M.N. Azevedo. 2016. Estimating the age of Risso's dolphins (*Grampus griseus*) based on skin appearance. Journal of Mammalogy 97(2):490–502. doi: 10.1093/jmammal/gyv193

Hatch, J.M. and C. Orphanides. 2015. Estimates of cetacean and pinniped bycatch in the 2013 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 15-15. 26 p. doi: 10.7289/V5HD7SNK

Hatch, J.M. and C. Orphanides. 2016. Estimates of cetacean and pinniped bycatch in the 2014 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 16-05. 22 p. doi: 10.7289/V50863BV

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2017. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-241. 274 p. doi: 10.7289/V5/TM-NEFSC-241

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide. Marine mammals of the world. Food and Agriculture Organization of the United Nations: Rome, Italy. 320 p.

Kruse, S., D.K. Caldwell, and M.C. Caldwell. 1999. Risso's dolphin *Grampus griseus* (G. Cuvier, 1812). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. pp. 183–212.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic: A guide to their identification. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS CIRC-396. 176 p.

Lyssikatos, M.C., S. Chavez-Rosales, and J.M. Hatch. 2020. Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom trawl fisheries, 2013-2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-04. 11 p. doi: 10.25923/5we2-g460

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Orphanides, C. 2019. Estimates of cetacean and pinniped bycatch in the 2016 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Narragansett, RI. Northeast Fisheries Science Center Reference Document 19-04. 8 p. doi: 10.25923/jp8y-sv79

Orphanides, C. 2020. Estimates of cetacean and pinniped bycatch in the 2017 New England sink and Mid-Atlantic gillnet fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Narragansett, RI. Northeast Fisheries Science Center Reference Document 20-03. 16 p. doi: 10.25923/fkbm-jr56

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Contract number NA-81-FA-C-00023. 246 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Soldevilla, M.S., S.M. Wiggins, J.A. Hildebrand, E.M. Oleson, and M.C. Ferguson. 2011. Risso’s and Pacific white-sided dolphin habitat modeling from passive acoustic monitoring. Marine Ecology Progress Series 423:247–260. doi: 10.3354/meps08927

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Wells, R.S., C.A. Manire, L. Byrd, D.R. Smith, J.G. Gannon, D. Fauquier, and K.D. Mullin. 2009. Movements and dive patterns of a rehabilitated Risso's dolphin, *Grampus griseus*, in the Gulf of Mexico and Atlantic Ocean. Marine Mammal Science 25(2):420–429. doi: 10.1111/j.1748-7692.2008.00251.x

Wells, R.S., C.A. Manire, and J. Whaley. 2008. Travels with Betty: A Risso’s dolphin tour of the Gulf of Mexico. Strandings: Newsletter of the Southeast United States Marine Mammal Health and Stranding Network:1–4.

Rough−toothed dolphin − *Steno bredanensis*

Gulf of Mexico Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 81% of scores ≥ 2

	Steno bredanensis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	1.6	2.3	
	Site Fidelity	1.3	1.7	
	Lifetime Reproductive Potential	1.5	1.3	
	Generation Length	2.2	1.3	
	Reproductive Plasticity	1.5	1.3	
	Migration	2.4	2.0	
	Home Range	1.6	2.3	
	Stock Abundance	2.3	2.3	
	Stock Abundance Trend	2.7	1.7	
	Cumulative Stressors	2.2	2.0	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	4.0	3.0	
	Sea Surface Temperature (Change in variability)	2.0	3.0	
	Air Temperature (Change in mean)	4.0	3.0	
	Air Temperature (Change in variability)	2.0	3.0	
	Precipitation (Change in mean)	2.0	3.0	
	Precipitation (Change in variability)	1.0	3.0	
	Sea Surface Salinity (Change in mean)	1.8	2.7	
	Sea Surface Salinity (Change in variability)	1.7	2.7	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.0	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.0	3.0	
	Circulation	1.8	3.0	
	Sea level rise	1.1	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Rough-toothed dolphin (Gulf of Mexico Stock)

Steno bredanensis

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (60% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Air Temperature (Standard anomaly) (4.00), Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), and Sea Surface Temperature (Standard anomaly) (4.00).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Species Abundance Trend (2.73).

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 81% of the data quality scores were 2 or greater. 55% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The rough-toothed dolphin Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Rough-toothed dolphin diet consists of cephalopods and fish (Miyazaki and Perrin 1994; Reeves et al. 1999; Würsig et al. 2000; Pitman and Stinchcomb 2002; Gannier and West 2005).

Habitat Specificity

Rough-toothed dolphins are found in oceanic waters and, occasionally, in continental shelf waters (Davis et al. 1998; Fulling et al. 2003; Mullin and Fulling 2004; Mullin et al. 2004; Gannier and West 2005; Maze-Foley and Mullin 2006; Leatherwood and Reeves 1983; Miyazaki and Perrin 1994; West et al. 2011). Individuals tagged in the Gulf of Mexico after a mass stranding event used waters with an average depth of 195m and an average SST of 25°C (Wells et al. 1999).

Site Fidelity

Three individuals tagged in the Gulf of Mexico after a mass stranding event remained in the northeastern Gulf of Mexico throughout the duration of transmission (4-112 days; Wells et al. 1999).

Rough-toothed dolphins have shown high site fidelity in the waters of the Canary Islands (Mayr and Ritter 2005), Honduras (Kuczaj and Yeater 2007), Brazil (Lodi et al. 2012), and Hawaii (Baird et al. 2008).

Lifetime Reproductive Potential

Information regarding rough-toothed dolphin reproductive interval was not found in the literature. Taylor et al. (2007) reported age at first reproduction of 10 years and age at last reproduction of 32 years (observed) and 33 years (estimated) based on values reported by Miyazaki (1980) and Miyazaki and Perrin (1994). Mead et al. (2001) reported female rough-toothed dolphin age at sexual maturity between four and six years.

Generation Length

Information regarding rough-toothed dolphin generation length was not found in the literature.

Reproductive Plasticity

Information regarding rough-toothed dolphin reproductive season, location, and habitat was not found in the literature.

Migration

Rough-toothed dolphins are found in the northern Gulf of Mexico during all seasons (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Three individuals satellite-tagged in the Gulf of Mexico after a mass stranding event remained in the northeastern Gulf of Mexico throughout the duration of transmission (4-112 days; Wells et al. 1999). In the western North Atlantic, satellite-tagging studies following a mass stranding event showed individuals travel along the Gulf Stream off Florida, Georgia, and South Carolina (Wells and Gannon 2005). Other studies have shown individuals moved from the Florida Keys to Cuba and as far as the Lesser Antilles (Wells et al. 2008).

Stock Abundance

The most recent estimate for the Northern Gulf of Mexico rough-toothed dolphin stock is 3,509 individuals (CV=0.67; Garrison et al. 2020), based on a revision of an abundance estimate from 2009 surveys (624 individuals; CV=0.99; Garrison 2016). No rough-toothed dolphins were sighted during 2017 and 2018 surveys (Garrison et al. 2020).

Stock Abundance Trend

Garrison et al. (2020) also revised estimates of rough-toothed dolphin abundance from 2003 (9,253 individuals; CV=0.78), and found no significant differences between the 2003 and 2009 estimates. Trend analysis for this stock is confounded by poor precision, long survey intervals, and difficulty of detection during surveys (Hayes et al. 2021).

Cumulative Stressors

Rough-toothed dolphins in the northern Gulf of Mexico may interact with longline and hook and line fisheries. During the period 2014–2018, there was an estimated annual fishing-related mortality of 1.0 individuals (CV=1.0; Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b; Hayes et al. 2021). During the same period, six strandings were reported along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

Pollution is a potential source of injury or mortality, particularly along the urbanized U.S. Gulf of Mexico coast. Elevated concentrations of polychlorinated biphenyls (PCBs) have been found in the blubber of rough-toothed dolphins (Struntz et al. 2004). Marine debris may also pose a threat to rough-toothed dolphins (de Meirelles and Barros 2007).

The rough-toothed dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for rough-toothed dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Jefferson, T.A. 2018. Rough-toothed dolphin: *Steno bredanensis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 838–840. doi: 10.1016/B978-0-12-804327-1.00223-5

Kiszka, J., R. Baird, and G. Braulik. 2019. *Steno bredanensis*. The IUCN Red List of Threatened Species 2019: e.T20738A50376703. doi: 10.2305/IUCN.UK.2019-2.RLTS.T20738A50376703.en

References

Baird, R.W., D.L. Webster, S.D. Mahaffy, D.J. McSweeney, G.S. Schorr, and A.D. Ligon. 2008. Site fidelity and association patterns in a deep-water dolphin: Rough-toothed dolphins (*Steno bredanensis*) in the Hawaiian Archipelago. Marine Mammal Science 24(3):535–553. doi: 10.1111/j.1748-7692.2008.00201.x

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

de Meirelles, A.C.O. and H.M.D.R. Barros. 2007. Plastic debris ingested by a rough-toothed dolphin, *Steno bredanensis*, stranded alive in northeastern Brazil. Biotemas 20(1):127–131.
Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.
Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101(4):923–932.
Gannier, A. and K.L. West. 2005. Distribution of the rough-toothed dolphin (*Steno bredanensis*) around the Windward Islands (French Polynesia). Pacific Science 59(1):17–24.
Garrison, L.P. 2016. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during summer 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL PRBD-2016-09. 18 p.
Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48
Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696
Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33
Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142
Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60
Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316
Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.
Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Kuczaj, S.A., II and D.B. Yeater. 2007. Observations of rough-toothed dolphins (*Steno bredanensis*) off the coast of Utila, Honduras. Journal of the Marine Biological Association of the United Kingdom 87(1):141–148. doi: 10.1017/s0025315407054999

Leatherwood, S. and R.R. Reeves. 1983. Rough-toothed dolphin. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, CA. pp. 180–183.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Lodi, L., R.H.T. Oliveira, L.D. Figueiredo, and S.M. Simão. 2012. Movements of the rough-toothed dolphin (*Steno bredanensis*) in Rio de Janeiro State, south-eastern Brazil. Marine Biodiversity Records 5:e47. doi: 10.1017/s1755267212000322

Mayr, I. and F. Ritter. 2005. Photo-identification of rough-toothed dolphins (*Steno bredanensis*) off La Gomera (Canary Islands) with new insights into social organization. Proceedings of the European Cetacean Society Annual Meeting, La Rochelle, France, 2005.

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mead, J., K. West, and C. Potter. 2001. Reproduction in the rough-toothed dolphin, *Steno bredanensis*: Attainment of sexual maturity. Abstracts, Fourteenth Biennial Conference on the Biology of Marine Mammals, Vancouver, British Columbia, 28 November-3 December 2001. p. 141.

Miyazaki, N. 1980. Preliminary note on age determination and growth of the rough-toothed dolphin, *Steno bredanensis*, off the Pacific Coast of Japan. Reports of the International Whaling Commission (Special Issue) 3:171–179.

Miyazaki, N. and W.F. Perrin. 1994. Rough-toothed dolphin-*Steno bredanensis* (Lesson, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 1–21.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pitman, R.L. and C. Stinchcomb. 2002. Rough-toothed dolphins (*Steno bredanensis*) as predators of mahimahi (*Coryphaena hippurus*). Pacific Science 56(4):447–450. doi: 10.1353/psc.2002.0043

Reeves, R.R., S. Leatherwood, G.S. Stone, and L.G. Eldredge. 1999. Marine mammals in the area served by the South Pacific Regional Environment Programme (SPREP). South Pacific Regional Environment Programme: Apia, Samoa. 48 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for rough-toothed dolphin (*Steno bredanensis*) for the U.S. Gulf of Mexico version 1.3, 2015-09-29, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 69 p.

Struntz, W.D., J.R. Kucklick, M.M. Schantz, P.R. Becker, W.E. McFee, and M.K. Stolen. 2004. Persistent organic pollutants in rough-toothed dolphins (*Steno bredanensis*) sampled during an unusual mass stranding event. Marine Pollution Bulletin 48(1-2):164–173. doi: 10.1016/j.marpolbul.2003.09.002

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Wells, R., C. Mainire, H. Rhinehart, D. Smith, A. Westgate, F. Townsend, T. Rowles, A. Hohn, and L. Hansen. 1999. Ranging patterns of rehabilitated rough-toothed dolphins, *Steno bredanensis*, released in the northeastern Gulf of Mexico. Thirteenth Biennial Conference on the Biology of Marine Mammals, Wailea, HI, 28 November-3 December 1999. p. 199.

Wells, R.S., G.A. Early, J.G. Gannon, R.G. Lingenfelser, and P. Sweeney. 2008. Tagging and tracking of roughtoothed dolphins (*Steno bredanensis*) from the March 2005 mass stranding in the Florida Keys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-574. 44 p.

Wells, R.S. and J.G. Gannon. 2005. Release and follow-up monitoring of rehabilitated rough-toothed dolphins. In: Manire, C.A. and R.S. Wells (Eds.), Rough-toothed Dolphin Rehabilitation and Post-release Monitoring. Mote Marine Laboratory Technical Report No. 1047. pp. 4–18.

West, K.L., J.G. Mead, and W. White. 2011. *Steno bredanensis* (Cetacea: Delphinidae). Mammalian Species 43:177–189. doi: 10.1644/886.1

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Rough−toothed dolphin − *Steno bredanensis*

Western North Atlantic Stock

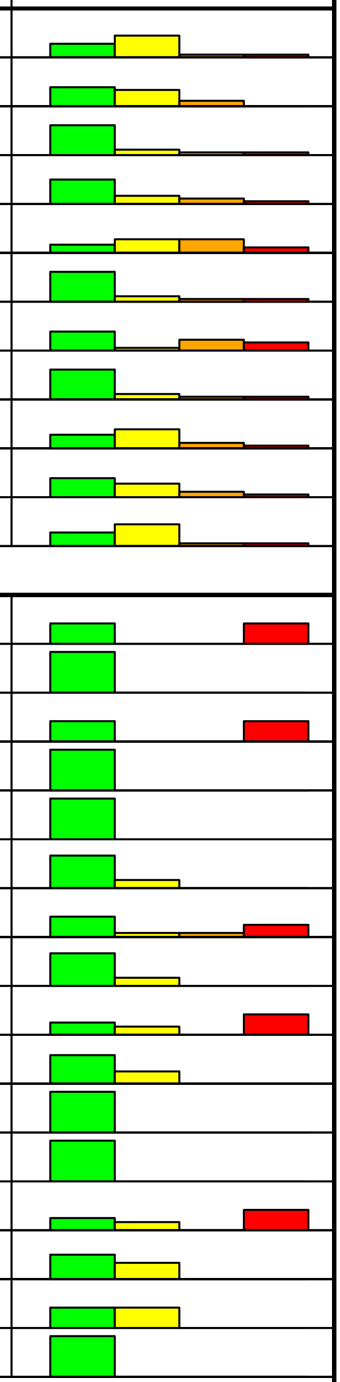
Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = Moderate

Data Quality = 52% of scores ≥ 2

	Steno bredanensis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	1.7	
	Habitat Specificity	1.7	2.3	
	Site Fidelity	1.5	1.0	
	Lifetime Reproductive Potential	1.7	0.7	
	Generation Length	2.4	0.7	
	Reproductive Plasticity	1.5	1.0	
	Migration	2.2	0.3	
	Home Range	1.5	1.7	
	Stock Abundance	1.9	1.0	
	Stock Abundance Trend	1.8	0.0	
	Cumulative Stressors	1.9	2.0	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	2.5	2.5	
	Sea Surface Temperature (Change in variability)	1.0	2.5	
	Air Temperature (Change in mean)	2.5	1.5	
	Air Temperature (Change in variability)	1.0	1.5	
	Precipitation (Change in mean)	1.0	1.5	
	Precipitation (Change in variability)	1.2	1.5	
	Sea Surface Salinity (Change in mean)	2.2	2.5	
	Sea Surface Salinity (Change in variability)	1.2	2.5	
	Ocean pH (Change in mean)	2.7	2.5	
	Ocean pH (Change in variability)	1.3	2.5	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	2.7	2.5	
	Dissolved oxygen (Change in variability)	1.4	2.5	
	Circulation	1.5	2.5	
	Sea level rise	1.0	2.5	
	Exposure Score	Moderate		
Overall Vulnerability Rank		Low		



Rough-toothed dolphin (Western North Atlantic Stock)

Steno bredanensis

CVA Results Summary

Overall Climate Vulnerability Rank: Low (94% certainty from bootstrap analysis).

Climate Exposure: Moderate. Four exposure factors scored greater than or equal to 2.5: Dissolved oxygen (Standard anomaly) (2.7), Ocean pH (Standard anomaly) (2.7), Air Temperature (Standard anomaly) (2.5), and Sea Surface Temperature (Standard anomaly) (2.5).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5.

Distributional Response: Very High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 52% of the data quality scores were 2 or greater. 18% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The rough-toothed dolphin western North Atlantic stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2019).

Prey/Diet Specificity

Rough-toothed dolphin diet consists of cephalopods and fish (Miyazaki and Perrin 1994; Reeves et al. 1999; Würsig et al. 2000; Pitman and Stinchcomb 2002; Gannier and West 2005).

Habitat Specificity

Rough-toothed dolphins are found in oceanic waters and, occasionally, in continental shelf waters (CETAP 1982; Gannier and West 2005; West et al. 2011). Individuals tagged in the western North Atlantic after a mass stranding event used both shallow and deep waters and also associated with the Gulf Stream (Manire and Wells 2005; Wells and Gannon 2005; Wells et al. 2008). These tagged individuals transited waters ranging from 17° to 31°C, (Manire and Wells 2005; Wells and Gannon 2005; Wells et al. 2008).

Site Fidelity

Information regarding rough-toothed dolphin site fidelity in the western North Atlantic was not found in the literature. Three individuals tagged in the Gulf of Mexico after a mass stranding event remained in the northeastern Gulf of Mexico throughout the duration of transmission (4-112 days; Wells et al. 1999).

Rough-toothed dolphins have shown high site fidelity in the waters of the Canary Islands (Mayr and Ritter 2005), Honduras (Kuczaj and Yeater 2007), Brazil (Lodi et al. 2012), and Hawaii (Baird et al. 2008).

Lifetime Reproductive Potential

Information regarding rough-toothed dolphin reproductive interval was not found in the literature. Taylor et al. (2007) reported age at first reproduction of 10 years and age at last reproduction of 32 years (observed) and 33 years (estimated) based on values reported by Miyazaki (1980) and Miyazaki and Perrin (1994). Mead et al. (2001) reported female rough-toothed dolphin age at sexual maturity between four and six years.

Generation Length

Information regarding rough-toothed dolphin generation length was not found in the literature.

Reproductive Plasticity

Information regarding rough-toothed dolphin reproductive season, location, and habitat was not found in the literature.

Migration

Information regarding rough-toothed dolphin migratory behavior in the western North Atlantic was not found in the literature.

Home Range

In the western North Atlantic, satellite-tagging studies following a mass stranding event showed individuals travel along the Gulf Stream off Florida, Georgia, and South Carolina (Wells and Gannon 2005). Other studies have shown individuals moved from the Florida Keys to Cuba and as far as the Lesser Antilles (Wells et al. 2008). In the Gulf of Mexico, three individuals satellite-tagged after a mass stranding event remained in the northeastern Gulf of Mexico throughout the duration of transmission (4-112 days; Wells et al. 1999).

Stock Abundance

The best abundance estimate for the western North Atlantic rough-toothed dolphin is 136 individuals (CV=1.00; Hayes et al. 2019), based on summer 2011 and summer 2016 surveys in the waters from central Florida to the lower Bay of Fundy (Palka 2012; Garrison 2016). The estimate is based on a single sighting during the 2011 survey (Garrison 2016).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Hayes et al. 2019).

Cumulative Stressors

Rough-toothed dolphins in the western North Atlantic had an estimated annual fishing-related mortality of zero during the period 2012–2016 (Hayes et al. 2019). During the same period, no strandings were reported along the U.S. Atlantic coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2019).

Pollution is a potential source of injury or mortality, particularly along the urbanized U.S. Atlantic coast. Although no studies of the effect of pollutants has been conducted for rough-toothed dolphins in the western North Atlantic, a study from the Gulf of Mexico has shown elevated concentrations of polychlorinated biphenyls (PCBs) in the blubber of rough-toothed dolphins (Struntz et al. 2004). Marine debris may also pose a threat to rough-toothed dolphins (de Meirelles and Barros 2007).

Distribution and Sightings

Density model results for rough-toothed dolphins in the western North Atlantic are presented by Roberts et al. (2015, 2016a, 2016b, 2017, 2018).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Virginia Capes Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 711 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2018. Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Jefferson, T.A. 2018. Rough-toothed dolphin: *Steno bredanensis*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 838–840. doi: 10.1016/B978-0-12-804327-1.00223-5

Kiszka, J., R. Baird, and G. Braulik. 2019. *Steno bredanensis*. The IUCN Red List of Threatened Species 2019: e.T20738A50376703. doi: 10.2305/IUCN.UK.2019-2.RLTS.T20738A50376703.en

References

Baird, R.W., D.L. Webster, S.D. Mahaffy, D.J. McSweeney, G.S. Schorr, and A.D. Ligon. 2008. Site fidelity and association patterns in a deep-water dolphin: Rough-toothed dolphins (*Steno bredanensis*) in the Hawaiian Archipelago. Marine Mammal Science 24(3):535–553. doi: 10.1111/j.1748-7692.2008.00201.x

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

de Meirelles, A.C.O. and H.M.D.R. Barros. 2007. Plastic debris ingested by a rough-toothed dolphin, *Steno bredanensis*, stranded alive in northeastern Brazil. Biotemas 20(1):127–131.

Gannier, A. and K.L. West. 2005. Distribution of the rough-toothed dolphin (*Steno bredanensis*) around the Windward Islands (French Polynesia). Pacific Science 59(1):17–24.

Garrison, L.P. 2016. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during summer 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL PRBD-2016-09. 18 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-258. 298 p. doi: 10.25923/9rrd-tx13

Kuczaj, S.A., II and D.B. Yeater. 2007. Observations of rough-toothed dolphins (*Steno bredanensis*) off the coast of Utila, Honduras. Journal of the Marine Biological Association of the United Kingdom 87(1):141–148. doi: 10.1017/s0025315407054999

Lodi, L. and B. Hetzel. 1999. Rough-toothed dolphin, *Steno bredanensis*, feeding behaviors in Ilha Grande Bay, Brazil. Biociências 7(1):29–42.

Manire, C.A. and R.S. Wells. 2005. Rough-toothed dolphin rehabilitation and post-release monitoring. Mote Marine Laboratory: Sarasota, FL. Mote Marine Laboratory Technical Report Number 1047. 18 p.

Mayr, I. and F. Ritter. 2005. Photo-identification of rough-toothed dolphins (*Steno bredanensis*) off La Gomera (Canary Islands) with new insights into social organization. Proceedings of the European Cetacean Society Annual Meeting, La Rochelle, France, 2005.

Mead, J., K. West, and C. Potter. 2001. Reproduction in the rough-toothed dolphin, *Steno bredanensis*: Attainment of sexual maturity. Abstracts, Fourteenth Biennial Conference on the Biology of Marine Mammals, Vancouver, British Columbia, 28 November-3 December 2001. p. 141.

Miyazaki, N. 1980. Preliminary note on age determination and growth of the rough-toothed dolphin, *Steno bredanensis*, off the Pacific Coast of Japan. Reports of the International Whaling Commission (Special Issue) 3:171–179.

Miyazaki, N. and W.F. Perrin. 1994. Rough-toothed dolphin-*Steno bredanensis* (Lesson, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 1–21.

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Pitman, R.L. and C. Stinchcomb. 2002. Rough-toothed dolphins (*Steno bredanensis*) as predators of mahimahi (*Coryphaena hippurus*). Pacific Science 56(4):447–450. doi: 10.1353/psc.2002.0043

Reeves, R.R., S. Leatherwood, G.S. Stone, and L.G. Eldredge. 1999. Marine mammals in the area served by the South Pacific Regional Environment Programme (SPREP). South Pacific Regional Environment Programme: Apia, Samoa. 48 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for rough-toothed dolphin (*Steno bredanensis*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 140 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Struntz, W.D., J.R. Kucklick, M.M. Schantz, P.R. Becker, W.E. McFee, and M.K. Stolen. 2004. Persistent organic pollutants in rough-toothed dolphins (*Steno bredanensis*) sampled during an unusual mass stranding event. Marine Pollution Bulletin 48(1-2):164–173. doi: 10.1016/j.marpolbul.2003.09.002

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Wells, R., C. Mainire, H. Rhinehart, D. Smith, A. Westgate, F. Townsend, T. Rowles, A. Hohn, and L. Hansen. 1999. Ranging patterns of rehabilitated rough-toothed dolphins, *Steno bredanensis*, released in the northeastern Gulf of Mexico. Thirteenth Biennial Conference on the Biology of Marine Mammals, Wailea, HI, 28 November-3 December 1999. p. 199.

Wells, R.S., G.A. Early, J.G. Gannon, R.G. Lingenfelser, and P. Sweeney. 2008. Tagging and tracking of roughtoothed dolphins (*Steno bredanensis*) from the March 2005 mass stranding in the Florida Keys. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-574. 44 p.

Wells, R.S. and J.G. Gannon. 2005. Release and follow-up monitoring of rehabilitated rough-toothed dolphins. In: Manire, C.A. and R.S. Wells (Eds.), Rough-toothed Dolphin Rehabilitation and Post-release Monitoring. Mote Marine Laboratory Technical Report No. 1047. pp. 4–18.

West, K.L., J.G. Mead, and W. White. 2011. *Steno bredanensis* (Cetacea: Delphinidae). Mammalian Species 43:177–189. doi: 10.1644/886.1

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Sei whale − *Balaenoptera borealis*

Nova Scotia Stock

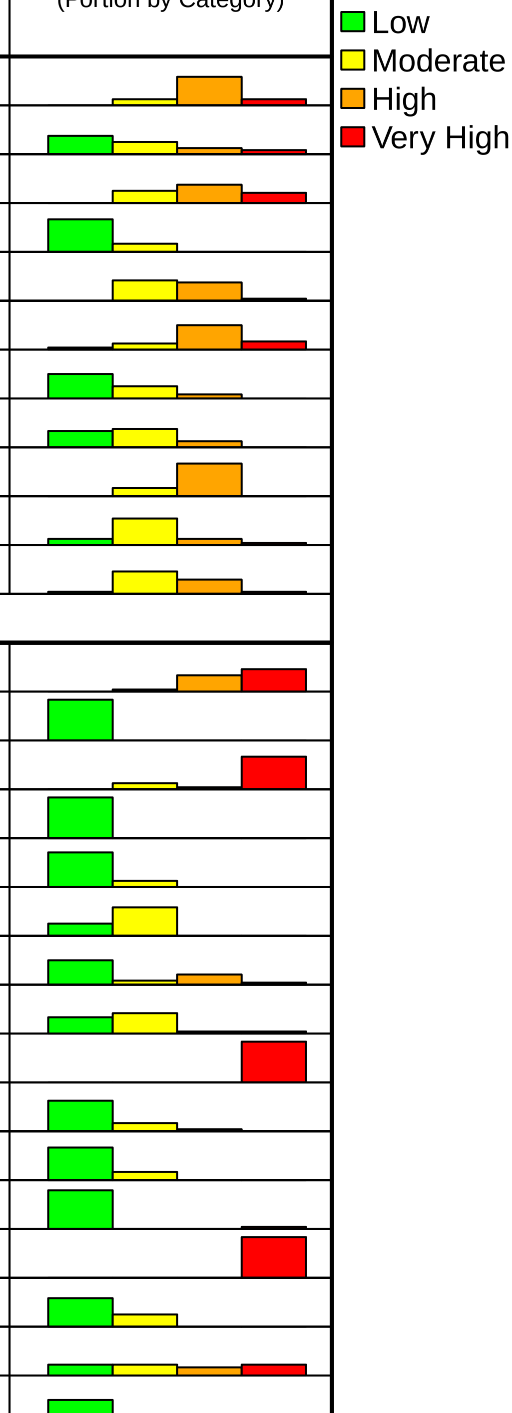
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 74% of scores ≥ 2

	Balaenoptera borealis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	3.0	3.0	
	Habitat Specificity	1.9	2.1	
	Site Fidelity	3.0	1.0	
	Lifetime Reproductive Potential	1.2	1.8	
	Generation Length	2.5	1.8	
	Reproductive Plasticity	3.0	0.8	
	Migration	1.5	1.8	
	Home Range	1.8	1.6	
	Stock Abundance	2.8	2.1	
	Stock Abundance Trend	2.1	0.8	
	Cumulative Stressors	2.4	2.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.8	
	Sea Surface Temperature (Change in variability)	1.0	3.0	
	Air Temperature (Change in mean)	3.6	2.8	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	2.8	
	Precipitation (Change in variability)	1.7	2.8	
	Sea Surface Salinity (Change in mean)	1.8	2.8	
	Sea Surface Salinity (Change in variability)	1.8	2.8	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.3	2.8	
	Sea ice coverage (Change in mean)	1.2	2.8	
	Sea ice coverage (Change in variability)	1.1	3.0	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.3	2.0	
	Circulation	2.5	2.7	
	Sea level rise	1.8	3.0	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Sei whale (Nova Scotia Stock)

Balaenoptera borealis

CVA Results Summary

Overall Climate Vulnerability Rank: High (51% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than or equal to 3.5: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Air Temperature (Standard anomaly) (3.65), and Sea Surface Temperature (Standard anomaly) (3.50).

Biological Sensitivity: Moderate. Five sensitivity attributes scored greater than 2.5: Prey/Diet Specificity (3.00), Reproductive Plasticity (2.95), Site Fidelity (2.95), Species Abundance (2.80), and Generation Time (2.55).

Distributional Response: High

Abundance Response: Moderate

Phenology Response: High

Data Quality: 74% of the data quality scores were 2 or greater. 36% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The sei whale Nova Scotia stock is defined by the International Whaling Commission (IWC) and is bounded by the U.S. east coast to Cape Breton, Nova Scotia to the west, longitude 42°W to the east, and Newfoundland and a line at 46°N between 54°30’W and 42°W to the north (IWC 1978; Donovan 1991; Hayes et al. 2022).

Prey/Diet Specificity

Sei whales in the Northwest Atlantic feed primarily on euphausiids and copepods (Mitchell 1975; Watkins and Schevill 1979; Kenney et al. 1985; Horwood 1987; Schilling et al. 1992; Flinn et al. 2002; Baumgartner and Fratantoni 2008; Baumgartner et al. 2011). Sei whales are capable of using both engulfment and skimming feeding strategies (Prieto et al. 2012). They are known to occasionally consume fish and other prey such as amphipods, decapods, and cephalopods (Budylenko 1978; Horwood 1987; Sigurjónsson and Víkingsson 1997).

Habitat Specificity

During the spring and summer feeding season, sei whales can be found along Georges Bank (CETAP 1982; Palka et al. 2021a, 2021b), in the deeper waters characteristic of the continental shelf edge region (Hain et al. 1985), and off Nova Scotia close to the 2,000-m depth contour (Mitchell 1975). Near-shore influxes have been documented in the Stellwagen Bank National Marine Sanctuary region and adjacent waters of Massachusetts in some years (Schilling et al. 1992). Sei whales often associate with steep bathymetric relief, such as the continental shelf break, canyons, or basins situated between banks and ledges (Kenney and Winn 1987; Schilling et al. 1992; Gregr and Trites 2001; Best and Lockyer 2002).

Site Fidelity

Information regarding sei whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported sei whale interbirth interval of 1.20 years, age at first reproduction of 8 years, and age at last reproduction of 51 years (estimated) based on values reported by Mizroch et al. (1984) and Best and Lockyer (2002).

Generation Length

Taylor et al. (2007) reported sei whale generation length of 13.7 years at r=0.08 and 22.1 years at r=0.0.

Reproductive Plasticity

Information regarding sei whale breeding season, location, and habitat was not found in the literature.

Migration

Sei whales are hypothesized to move from spring feeding grounds (on or near Georges Bank and the Gulf of Maine) to the Scotian Shelf in June and July, eastward to Newfoundland and the Grand Banks in late summer, return to the Scotian Shelf in fall, and spend winters offshore and to the south (Mitchell 1975; Mitchell and Chapman 1977; Davis et al. 2020).

Home Range

Sei whales were found in shelf and shelf edge waters during spring and summer surveys (CETAP 1982). Satellite tagging studies with individuals in the Labrador Sea have shown sei whales in the North Atlantic have the capability to travel thousands of kilometers (Olsen et al. 2009; Prieto et al. 2014).

Stock Abundance

The average spring 2010–2013 sei whales Nova Scotia stock abundance estimate of 6,292 individuals (CV=1.015) is considered the best available (Hayes et al. 2022). This estimate includes the largest proportion of the stock range of the available surveys and has been corrected for sampling bias.

Stock Abundance Trend

Insufficient data exist to calculate a stock abundance trend (Hayes et al. 2022).

Cumulative Stressors

Threats to sei whales in the western North Atlantic include vessel strikes, fisheries interactions (e.g., gear entanglement), and anthropogenic noise. During the period 2014−2018, sei whales suffered an annual fishery-related mortality and serious injury rate of 0.4 whales per year (Hayes et al. 2022). During the same period, mortality and serious injury to sei whales from vessel strikes occurred at a rate of 0.8 whales per year (Hayes et al. 2022).

Distribution and Sightings

Density model results for sei whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2016c, 2017, 2018), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Cooke, J.G. 2018. *Balaenoptera borealis*. The IUCN Red List of Threatened Species 2018: e.T2475A130482064. doi: 10.2305/IUCN.UK.2018-2.RLTS.T2475A130482064.en

Department of the Navy. 2008. Marine Resources Assessment Update for the Virginia Capes Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 711 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Horwood, J. 2018. Sei whale: *Balaenoptera borealis.* In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 845–847. doi: 10.1016/B978-0-12-804327-1.00224-7

Prieto, R., D. Janiger, M.A. Silva, G.T. Waring, and J.M. Gonçalves. 2012. The forgotten whale: a bibliometric analysis and literature review of the North Atlantic sei whale *Balaenoptera borealis*. Mammal Review 42(3):235-272. doi: 10.1111/j.1365-2907.2011.00195.x

References

Baumgartner, M.F. and D.M. Fratantoni. 2008. Diel periodicity in both sei whale vocalization rates and the vertical migration of their copepod prey observed from ocean gliders. Limnology and Oceanography 53(5):2197–2209. doi: 10.4319/lo.2008.53.5_part_2.2197

Baumgartner, M.F., N.S.J. Lysiak, C. Schuman, J. Urban-Rich, and F.W. Wenzel. 2011. Diel vertical migration behavior of *Calanus finmarchicus* and its influence on right and sei whale occurrence. Marine Ecology Progress Series 423:167–184. doi: 10.3354/meps08931

Best, P.B. and C.H. Lockyer. 2002. Reproduction, growth and migrations of sei whales *Balaenoptera borealis* off the west coast of South Africa in the 1960s. South African Journal of Marine Science 24:111–133.

Budylenko, G.A. 1978. On sei whale feeding in the Southern Ocean. Reports of the International Whaling Commission 28:379–385.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Davis, G.E., M.F. Baumgartner, P.J. Corkeron, J. Bell, C. Berchok, J.M. Bonnell, J. Bort Thornton, S. Brault, G.A. Buchanan, D.M. Cholewiak, C.W. Clark, J. Delarue, L.T. Hatch, H. Klinck, S.D. Kraus, B. Martin, D.K. Mellinger, H. Moors-Murphy, S. Nieukirk, D.P. Nowacek, S.E. Parks, D. Parry, N. Pegg, A.J. Read, A.N. Rice, D. Risch, A. Scott, M.S. Soldevilla, K.M. Stafford, J.E. Stanistreet, E. Summers, S. Todd, and S.M. Van Parijs. 2020. Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data. Global Change Biology 26(9):4812–4840. doi: 10.1111/gcb.15191

Donovan, G.P. 1991. A review of IWC stock boundaries. Reports of the International Whaling Commission (Special Issue) 13:39–68.

Flinn, R.D., A.W. Trites, E.J. Gregr, and R.I. Perry. 2002. Diets of fin, sei, and sperm whales in British Columbia: An analysis of commercial whaling records, 1963–1967. Marine Mammal Science 18(3):663–679. doi: 10.1111/j.1748-7692.2002.tb01065.x

Gregr, E.J. and A.W. Trites. 2001. Predictions of critical habitat for five whale species in the waters of coastal British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 58(7):1265–1285. doi: 10.1139/cjfas-58-7-1265

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Marine Fisheries Review 47(1):13–17.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace. 2022. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2021. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-288. 380 p. doi: 10.25923/6tt7-kc16

Horwood, J. 1987. The sei whale: Population biology, ecology, & management. Croom Helm in association with Methuen, Inc., New York, NY. 375 p.

International Whaling Commission (IWC). 1978. Report of the Scientific Committee, Annex C. Geographical boundaries proposed for fin, minke and sei whale stocks in the North Atlantic. Reports of the International Whaling Commission 28:77–78.

Kenney, R.D., M.A.M. Hyman, and H.E. Winn. 1985. Calculation of standing stocks and energetic requirements of the cetaceans of the northeast United States outer continental shelf. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-F/NEC-41. 99 p.

Kenney, R.D. and H.E. Winn. 1987. Cetacean biomass densities near submarine canyons compared to adjacent shelf/slope areas. Continental Shelf Research 7(2):107–114. doi: 10.1016/0278-4343(87)90073-2

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mitchell, E. 1975. Preliminary report on Nova Scotia fishery for sei whales (*Balaenoptera borealis*). Reports of the International Whaling Commission 25:218–225.

Mitchell, E. and D.G. Chapman. 1977. Preliminary assessment of stocks of Northwest Atlantic sei whales (*Balaenoptera borealis*). Reports of the International Whaling Commission (Special Issue) 1:117–120.

Mizroch, S.A., D.W. Rice, and J.M. Breiwick. 1984. The sei whale, *Balaenoptera borealis*. Marine Fisheries Review 46:25–29.

Olsen, E., W.P. Budgell, E. Head, L. Kleivane, L. Nottestad, R. Prieto, M.A. Silva, H. Skov, G.A. Víkingsson, G. Waring, and N. Oien. 2009. First satellite-tracked long-distance movement of a sei whale (*Balaenoptera borealis*) in the North Atlantic. Aquatic Mammals 35(3):313. doi: 10.1578/AM.35.3.2009.313

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Prieto, R., D. Janiger, M.A. Silva, G.T. Waring, and J.M. Gonçalves. 2012. The forgotten whale: a bibliometric analysis and literature review of the North Atlantic sei whale *Balaenoptera borealis*. Mammal Review 42(3):235–272. doi: 10.1111/j.1365-2907.2011.00195.x

Prieto, R., M.A. Silva, G.T. Waring, and J.M.A. Gonçalves. 2014. Sei whale movements and behaviour in the North Atlantic inferred from satellite telemetry. Endangered Species Research 26(2):103–113. doi: 10.3354/esr00630

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016b. Density model for sei whale (*Balaenoptera borealis*) for the U.S. East Coast version 6.5, 2016-04-21, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 171 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016c. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Schilling, M.R., I. Seipt, M.T. Weinrich, S.E. Frohock, A.E. Kuhlberg, and P.J. Clapham. 1992. Behavior of individually-identified sei whales *Balaenoptera borealis* during an episodic influx into the southern Gulf of Maine in 1986. Fishery Bulletin 90(4):749–755.

Sigurjónsson, J. and G. Víkingsson. 1997. Seasonal abundance of and estimated food consumption by cetaceans in Icelandic and adjacent waters. Journal of Northwest Atlantic Fishery Science 22:271–287. doi: 10.2960/J.v22.a20

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Watkins, W.A. and W.E. Schevill. 1979. Aerial observation of feeding behavior in four baleen whales: *Eubalaena glacialis*, *Balaenoptera borealis*, *Megaptera novaeangliae*, and *Balaenoptera physalus*. Journal of Mammalogy 60(1):155–163. doi: 10.2307/1379766

Sowerby's beaked whale − *Mesoplodon bidens*

Western North Atlantic Stock

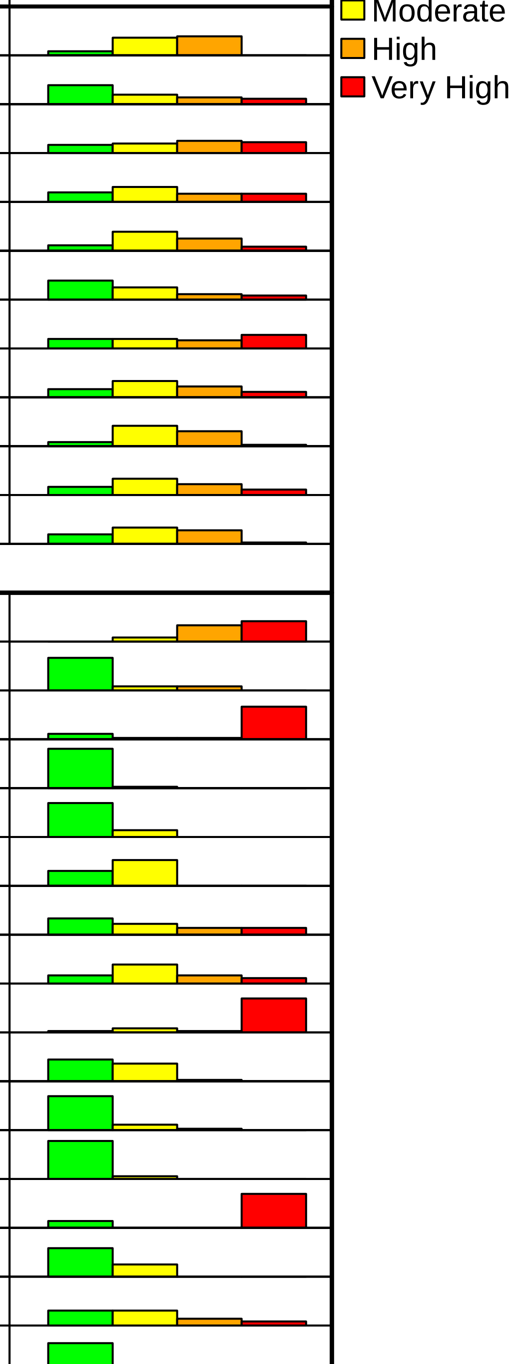
Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 37% of scores ≥ 2

	Mesoplodon bidens	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.4	1.3	
	Habitat Specificity	2.0	1.5	
	Site Fidelity	2.6	0.8	
	Lifetime Reproductive Potential	2.4	0.7	
	Generation Length	2.4	0.7	
	Reproductive Plasticity	1.9	0.3	
	Migration	2.6	0.7	
	Home Range	2.3	0.8	
	Stock Abundance	2.3	1.3	
	Stock Abundance Trend	2.3	0.5	
	Cumulative Stressors	2.2	1.5	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	2.2	
	Sea Surface Temperature (Change in variability)	1.3	2.2	
	Air Temperature (Change in mean)	3.5	1.8	
	Air Temperature (Change in variability)	1.0	2.0	
	Precipitation (Change in mean)	1.2	2.0	
	Precipitation (Change in variability)	1.6	1.8	
	Sea Surface Salinity (Change in mean)	2.1	1.7	
	Sea Surface Salinity (Change in variability)	2.3	1.7	
	Ocean pH (Change in mean)	3.7	2.0	
	Ocean pH (Change in variability)	1.5	1.8	
	Sea ice coverage (Change in mean)	1.2	2.2	
	Sea ice coverage (Change in variability)	1.1	2.2	
	Dissolved oxygen (Change in mean)	3.5	2.2	
	Dissolved oxygen (Change in variability)	1.3	2.0	
	Circulation	2.0	1.7	
	Sea level rise	1.6	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		



Sowerby's beaked whale (Western North Atlantic Stock)

Mesoplodon bidens

CVA Results Summary

Overall Climate Vulnerability Rank: High (36% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than or equal to 3.5: Ocean pH (Standard anomaly) (3.67), Air Temperature (Standard anomaly) (3.50), and Dissolved oxygen (Standard anomaly) (3.50).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (2.63) and Site Fidelity (2.63).

Distributional Response: Moderate

Abundance Response: Low

Phenology Response: Low

Data Quality: 37% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Sowerby's beaked whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Mesopelagic and benthopelagic fish species constitute a significant portion of the Sowerby's beaked whale diet across the North Atlantic (Dix et al. 1986; Santos et al. 1994; Santos et al. 1995; Macleod et al. 2003; Pereira et al. 2011; Spitz et al. 2011; Wenzel et al. 2013). Stomach content analysis of eight Sowerby's beaked whales incidentally caught in the swordfish pelagic drift gillnet fishery in the western North Atlantic showed a diet consisting primarily of mesopelagic and benthopelagic fish in the families Moridae (37.9% of prey), Myctophidae (22.9%), Macrouridae (11.2%), and Phycidae (7.2%; Wenzel et al. 2013). Based on stomach content analysis of stranded Sowerby's beaked whales in the Azores, their diet consisted primarily of mesopelagic fishes (Pereira et al. 2011). Similar results were found with stranded Sowerby's beaked whales in the Bay of Biscay, though crabs (*Polybius* spp.) also represented about a third of the diet (Spitz et al. 2011).

Habitat Specificity

Sowerby's beaked whale tends to have a more northern distribution compared to other beaked whales (MacLeod 2000). Beaked whales off the eastern U.S. are found along the Gulf Stream and its associated warm-core rings, and the continental shelf break (Waring et al. 1992; Waring et al. 2001). Beaked whales south of Georges Bank were found in waters with a mean SST of 20.7° to 24.9°C and 500 to 2,000m depth (Waring et al. 2003).

Beaked whales in general inhabit continental slope and deep oceanic waters (>200 m) (Waring et al. 2001; Cañadas et al. 2002; MacLeod et al. 2004; Ward et al. 2005; MacLeod and Mitchell 2006; Pitman 2018).

Site Fidelity

Information regarding individual Sowerby's beaked whale site fidelity was not found in the literature; however, passive acoustic monitoring has shown that Sowerby's beaked whales inhabit the Gully off Nova Scotia year-round (Stanistreet et al. 2017).

Lifetime Reproductive Potential

Information regarding Sowerby's beaked whale reproductive interval was not found in the literature. Taylor et al. (2007) reported age at last reproduction of 41 years.

Generation Length

Information regarding Sowerby's beaked whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding Sowerby's beaked whale breeding season, location, and habitat was not found in the literature.

Migration

No information specifically describing Sowerby's beaked whale migratory behavior was found in the literature; however, passive acoustic monitoring has shown that Sowerby's beaked whales inhabit the Gully off Nova Scotia year-round (Stanistreet et al. 2017).

Home Range

Information regarding individual Sowerby's beaked whale home range was not found in the literature. Beaked whales in general inhabit continental slope and deep oceanic waters (Waring et al. 2001; Cañadas et al. 2002; MacLeod et al. 2004; Ward et al. 2005; MacLeod and Mitchell 2006; Stanistreet et al. 2017; Pitman 2018).

Stock Abundance

Sowerby's beaked whale abundance has not been estimated due to difficulty differentiating beaked whales to the species level in shipboard and aerial surveys. The abundance of *Mesoplodon sp.* beaked whales in the western North Atlantic is estimated to be 10,107 individuals (CV=0.27) based on 2016 surveys (Hayes et al. 2020).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Hayes et al. 2020). However, Whitehead (2013) noted an increase in Sowerby's beaked whale sightings in Scotian Shelf waters between 1988 and 2011.

Cumulative Stressors

Sowerby's beaked whales in the western North Atlantic had an estimated annual fishing-related mortality of zero during the period 2013–2017 (Hayes et al. 2020). During the same period, three Sowerby's beaked whales stranded along the U.S. Atlantic coast (NOAA National Marine Mammal Health and Stranding Response Database, as cited in Hayes et al. 2020).

Beaked whales generally are considered sensitive to anthropogenic noise, with multiple events worldwide resulting in injury, mortality, or mass stranding (D'Amico et al. 2009; Filadelfo et al. 2009; Frantzis 1998).

Distribution and Sightings

Palka et al. (2021a, 2021b) modeled the density of Sowerby's beaked whales. Density model results for all beaked whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017) and Mannocci et al. (2017).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

MacLeod, C.D. 2018. Beaked whales, overview. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 80–83. doi: 10.1016/B978-0-12-804327-1.00062-5

Pitman, R. 2018. Mesoplodon beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2008. *Mesoplodon bidens*. The IUCN Red List of Threatened Species 2008: e.T13241A3424903. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T13241A3424903.en

References

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

D'Amico, A., R.C. Gisiner, D.R. Ketten, J.A. Hammock, C. Johnson, P.L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. Aquatic Mammals 35(4):452–472. doi: 10.1578/am.35.4.2009.452

Dix, L., J. Lien, and D.E. Sergeant. 1986. A North Sea beaked whale *Mesoplodon bidens* in Conception Bay, Newfoundland, Canada. Canadian Field-Naturalist 100:389–391.

Filadelfo, R., J. Mintz, E. Michlovich, A. D'Amico, P.L. Tyack, and D.R. Ketten. 2009. Correlating military sonar use with beaked whale mass strandings: What do the historical data show? Aquatic Mammals 35(4):435–444. doi: 10.1578/am.35.4.2009.435

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Macleod, C.D. 2000. Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. Mammal Review 30(1):1–8. doi: 10.1046/j.1365-2907.2000.00057.x

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

MacLeod, C.D., M.B. Santos, and G.J. Pierce. 2003. Review of data on diets of beaked whales: Evidence of niche separation and geographic segregation. Journal of the Marine Biological Association of the United Kingdom 83(3):651–665. doi: 10.1017/S0025315403007616h

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pereira, J.N., V.C. Neves, R. Prieto, M.A. Silva, I. Cascão, C. Oliveira, M.J. Cruz, J.V. Medeiros, J.P. Barreiros, F.M. Porteiro, and D. Clarke. 2011. Diet of mid-Atlantic Sowerby's beaked whales *Mesoplondon bidens*. Deep Sea Research Part I: Oceanographic Research Papers 58(11):1084–1090. doi: 10.1016/j.dsr.2011.08.004

Pitman, R. 2018. *Mesoplodon* beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Santos, M.B., G.J. Pierce, R. H.M., R.J. Reid, and B. Wilson. 1994. Diets of small cetaceans from the Scottish coast. International Council for the Exploration of the Sea. CM 1994/N:11. 6 p.

Santos, M.B., G.J. Pierce, G. Wijnsma, H.M. Ross, and R.J. Reid. 1995. Diets of small cetaceans stranded in Scotland 1993–1995. International Council for the Exploration of the Sea, Marine Mammal Committee: Copenhagen, Denmark. CM 1995/N:6. 4 p.

Spitz, J., Y. Cherel, S. Bertin, J. Kiszka, A. Dewez, and V. Ridoux. 2011. Prey preferences among the community of deep-diving odontocetes from the Bay of Biscay, Northeast Atlantic. Deep-Sea Research Part I-Oceanographic Research Papers 58(3):273–282. doi: 10.1016/j.dsr.2010.12.009

Stanistreet, J.E., D.P. Nowacek, S. Baumann-Pickering, J.T. Bell, D.M. Cholewiak, J.A. Hildebrand, L.E.W. Hodge, H.B. Moors-Murphy, S.M. Van Parijs, and A.J. Read. 2017. Using passive acoustic monitoring to document the distribution of beaked whale species in the western North Atlantic Ocean. Canadian Journal of Fisheries and Aquatic Sciences 74(12):2098–2109. doi: 10.1139/cjfas-2016-0503

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Ward, J.A., G.H. Mitchell, A.M. Farak, and E.P. Keane. 2005. Beaked whale habitat characterization and prediction. NUWC-NPT Technical Report 11,548. Newport, RI.

Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Wenzel, F.W., P.T. Polloni, J.E. Craddock, D.P. Gannon, J.R. Nicolas, A.J. Read, and P.E. Rosel. 2013. Food habits of Sowerby's beaked whales (*Mesoplodon bidens*) taken in the pelagic drift gillnet fishery of the western North Atlantic. Fishery Bulletin 111(4):381–389. doi: 10.7755/fb.111.4.7

Whitehead, H. 2013. Trends in cetacean abundance in the Gully submarine canyon, 1988–2011, highlight a 21% per year increase in Sowerby's beaked whales (*Mesoplodon bidens*). Canadian Journal of Zoology 91(3):141–148. doi: 10.1139/cjz-2012-0293

Sperm whale − *Physeter macrocephalus*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 93% of scores ≥ 2

	Physeter macrocephalus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.2	
	Habitat Specificity	1.7	2.5	
	Site Fidelity	2.2	2.2	
	Lifetime Reproductive Potential	2.0	2.5	
	Generation Length	3.4	2.5	
	Reproductive Plasticity	1.4	2.5	
	Migration	3.8	2.8	
	Home Range	2.2	2.5	
	Stock Abundance	2.4	2.5	
	Stock Abundance Trend	1.9	1.8	
	Cumulative Stressors	2.8	1.8	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.7	2.8	
	Sea Surface Temperature (Change in variability)	1.1	2.8	
	Air Temperature (Change in mean)	3.1	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.0	2.8	
	Sea Surface Salinity (Change in mean)	2.6	2.8	
	Sea Surface Salinity (Change in variability)	1.2	2.8	
	Ocean pH (Change in mean)	3.6	2.8	
	Ocean pH (Change in variability)	1.1	2.8	
	Sea ice coverage (Change in mean)	1.0	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	3.2	2.8	
	Dissolved oxygen (Change in variability)	1.0	2.8	
	Circulation	1.9	2.5	
	Sea level rise	1.1	2.2	
	Exposure Score	High		
Overall Vulnerability Rank		High		

Low

Moderate

High

Very High

Sperm whale (Northern Gulf of Mexico Stock)

Physeter macrocephalus

CVA Results Summary

Overall Climate Vulnerability Rank: High (75% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.70), Ocean pH (Standard anomaly) (3.60), Dissolved oxygen (Standard anomaly) (3.25), and Air Temperature (Standard anomaly) (3.15).

Biological Sensitivity: High. Two sensitivity attributes scored greater than 3.0: Migration (3.75) and Generation Time (3.35).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 93% of the data quality scores were 2 or greater. 82% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The sperm whale Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Sperm whales consume diverse prey, such as large squid and other cephalopods (Ommastrephidae, Onychoteuthidae, Gonatidae, Pholidoteuthidae, Octopoteuthidae, Histioteuthidae, and Cranchiidae), demersal fish, and benthic invertebrates (Fiscus and Rice 1974; Kawakami 1980; Clarke 1987; Rice 1989; Clarke 1996).

Habitat Specificity

Generally, sperm whales show a strong preference for deep waters associated with the continental shelf break, the continental slope, and deeper waters (Hain et al. 1985; Rice 1989; Whitehead 2003).

Sperm whales in the Gulf of Mexico show a strong preference for the waters near the continental slope, canyons, and offshore in deeper waters, or near cyclonic (cold-core) eddies (Biggs et al. 2000; Davis et al. 2000; Davis et al. 2002; Biggs et al. 2005; Jochens et al. 2006).

Site Fidelity

Based on photo-identification of sperm whale flukes and acoustic analyses, some sperm whales are likely resident to the Gulf of Mexico (Weller et al. 2000; Jochens et al. 2006). Jochens et al. (2006) noted that some individuals remain within the Mississippi River Delta and Mississippi Canyon for several months.

Lifetime Reproductive Potential

Estimates of interbirth interval range from 4 to 7 years (Best et al. 1984; Taylor et al. 2007; Chiquet et al. 2013).

Females reach sexual maturity at about age 9 (Best et al. 1984). Taylor et al. (2007) reported sperm whale age at first reproduction of 12 years and age at last reproduction of 59 years (observed) and 51 years (estimated). Sperm whale reproductive rates decline with age (Whitehead 2018).

Generation Length

Taylor et al. (2007) report generation length of 26.5 years at r=0.03 and 31.9 years at r=0.0.

Reproductive Plasticity

Mating behavior is observed from winter through summer, with calving during spring through fall (Best 1984). Sperm whale calves continue suckling for several years (Whitehead 2018).

The Mississippi River Delta region appears to be an important calving and nursery area for sperm whales (Townsend 1935; Collum and Fritts 1985; Mullin et al. 1994; Weller et al. 2000; Würsig et al. 2000; Baumgartner et al. 2001; Davis et al. 2002; Mullin et al. 2004; Jochens et al. 2006).

Migration

Sperm whales are present in the northern Gulf of Mexico in all seasons (Mullin et al. 1994; Hansen et al. 1996; Mullin and Hoggard 2000; Mullin et al. 2004), with another consistent aggregation in the southeastern Gulf of Mexico (Mullin and Fulling 2004). No discernable seasonal migrations were made by satellite-tagged sperm whales in the northern Gulf, but Gulf-wide movements along the northern Gulf slope were observed (Hayes et al. 2021). A seasonal variation in occurrence has been noted, though it may be an artifact of survey effort (DoN 2007):

- Winter: patchy occurrence, with all sighting records located in deep water
- Spring: most spatially-extensive occurrence throughout the Gulf of Mexico
- Summer: occurrence in the deepest Gulf waters west of the De Soto Canyon
- Fall: patchy occurrence in waters seaward of the shelf break

Home Range

Sperm whales occur throughout the oceanic Gulf of Mexico (Jefferson and Schiro 1997; Ortega Ortiz 2002; Jefferson et al. 2008). Satellite tag tracks show sperm whales exhibit a range of movement patterns within the Gulf (Waring et al. 2015). Based on photo-identification of sperm whale flukes and acoustic analyses, some sperm whales are likely resident in the Gulf of Mexico (Weller et al. 2000;

Jochens et al. 2006). Females generally travel up to 2000 km but have been recorded up to 4000 km (Whitehead et al. 2008).

Stock Abundance

The northern Gulf of Mexico sperm whale abundance is estimated to be 1,180 individuals (CV=0.22) based on 2017 and 2018 oceanic surveys (Garrison et al. 2020; Hayes et al. 2021). Previously, the abundance was estimated to be 763 individuals (CV=0.38) based on a summer 2009 oceanic survey (Waring et al. 2016).

Stock Abundance Trend

Five point estimates of sperm whale abundance have been made based on data from surveys in 2003 (2,542 individuals; CV=0.34), 2004 (1,686 individuals; CV=0.41), 2009 (2,096 individuals; CV=0.55), 2017 (1,078 individuals; CV=0.29), and 2018 (1,307 individuals; CV=0.33). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021).

Cumulative Stressors

Sperm whales in the northern Gulf of Mexico may interact with longline fisheries. Fishery-related mortality and serious injury for sperm whales in the northern Gulf of Mexico was 0.2 individuals (CV=1.00) during the period 2014–2018 (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). Seven sperm whale strandings were reported in the northern Gulf of Mexico during the period 2014–2018 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The sperm whale stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010 that included 5 sperm whales that stranded prior to, during, and after the Deepwater Horizon oil spill (Litz et al. 2014). Ship strikes are another source of human-caused mortality, however no mortalities have been reported in recent years for the Northern Gulf of Mexico stock.

Distribution and Sightings

Density model results for sperm whales in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

National Marine Fisheries Service (NMFS). 2015. Sperm Whale (*Physeter macrocephalus*) 5-Year Review: Summary and Evaluation. Silver Spring, MD. 58 p.

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2019. *Physeter macrocephalus* (amended version of 2008 assessment). The IUCN Red List of Threatened Species 2019: e.T41755A160983555. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T41755A160983555.en

Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9

References

Baumgartner, M.F., K.D. Mullin, L.N. May, and T.D. Leming. 2001. Cetacean habitats in the northern Gulf of Mexico. Fishery Bulletin 99(2):219–239.

Best, P.B., P.A.S. Canham, and N. Macleod. 1984. Patterns of reproduction in sperm whales, *Physeter macrocephalus*. Reports of the International Whaling Commission (Special Issue) 6:51–79.

Biggs, D.C., A.E. Jochens, M.K. Howard, S.F. DiMarco, K.D. Mullin, R.R. Leben, F.E. Muller-Karger, and C. Hu. 2005. Eddy forced variations in on- and off-margin summertime circulation along the 1000-m isobath of the northern Gulf of Mexico, 2000-2003, and links with sperm whale distributions along the middle slope. Circulation in the Gulf of Mexico: Observations and Models. pp. 71–85. doi: 10.1029/161gm06

Biggs, D.C., R.R. Leben, and J.G. Ortega-Ortiz. 2000. Ship and satellite studies of mesoscale circulation and sperm whale habitats in the northeast Gulf of Mexico during GulfCet II. Gulf of Mexico Science 18(1):15–22. doi: 10.18785/goms.1801.02

Chiquet, R.A., B.L. Ma, A.S. Ackleh, N. Pal, and N. Sidorovskaia. 2013. Demographic analysis of sperm whales using matrix population models. Ecological Modelling 248:71–79. doi: 10.1016/j.ecolmodel.2012.09.023

Clarke, M.R. 1987. Cephalopod biomass—estimation from predation. In: Boyle, A.P. (Ed.), Cephalopod Life Cycles. Academic Press, London, UK. pp. 221–237.

Clarke, M.R. 1996. Cephalopods as prey. III. Cetaceans. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences 351(1343):1053–1065. doi: 10.1098/rstb.1996.0093

Collum, L.A. and T.H. Fritts. 1985. Sperm whales (*Physeter catodon*) in the Gulf of Mexico. The Southwestern Naturalist 30(1):101–104. doi: 10.2307/3670663

Davis, R.W., W.E. Evans, and B.G. Wursig. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat association. Volume III: data appendix. Habitat. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGSBRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region. 201 p.

Davis, R.W., J.G. Ortega-Ortiz, C.A. Ribic, W.E. Evans, D.C. Biggs, P.H. Ressler, R.B. Cady, R.R. Leben, K.D. Mullin, and B. Wursig. 2002. Cetacean habitat in the northern oceanic Gulf of Mexico. Deep-Sea Research Part I-Oceanographic Research Papers 49(1):121–142. doi: 10.1016/S0967-0637(01)00035-8

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Fiscus, C.H. and D.W. Rice. 1974. Giant squids, *Architeuthis* sp., from stomachs of sperm whales captured off California. California Fish and Game 60(2):91–93.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Marine Fisheries Review 47(1):13–17.

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A. and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review 27(1):27–50. doi: 10.1111/j.1365-2907.1997.tb00371.x

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world. Elsevier/Academic Press, New York. 573 p.

Jochens, A., D. Biggs, D. Engelhaupt, J. Gordon, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, J. Wormuth, and B. Würsig. 2006. Sperm whale seismic study in the Gulf of Mexico; Summary report, 2002–2004. US Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region: New Orleans, LA. OCS Study MMS 2006-034. 352 p.

Kawakami, T. 1980. A review of sperm whale food. Scientific Reports of Whales Research Institute 32:199–218.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

Mullin, K.D., W. Hoggard, and L.J. Hansen. 2004. Abundance and seasonal occurrence of cetaceans in outer continental shelf and slope waters of the North-central and northwestern Gulf of Mexico. Gulf of Mexico Science 22(1):62–73. doi: 10.18785/goms.2201.06

Mullin, K.D., W. Hoggard, C.L. Roden, R.R. Lohoefener, C.M. Rogers, and B. Taggart. 1994. Cetaceans on the upper continental-slope in the North-Central Gulf-of-Mexico. Fishery Bulletin 92(4):773–786.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Ortega Ortiz, J.G. 2002. Multiscale analysis of cetacean distribution in the Gulf of Mexico. Texas A&M University, College Station. 170 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Rice, D.W. 1989. Sperm whale--*Physeter macrocephalus* (Linnaeus, 1758). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, San Diego, CA. pp. 177–234.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for sperm whale (*Physeter macrocephalus*) for the U.S. Gulf of Mexico version 4.2, 2015-05-14, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 63 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Townsend, C.H. 1935. The distribution of certain whales as shown by logbook records of American whale ships. Zoologica 19:1–50.
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-231. 361 p. doi: 10.7289/V5TQ5ZH0
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-238. 501 p. doi: 10.7289/V57S7KTN
Weller, D.W., B. Würsig, S.K. Lynn, and A.J. Schiro. 2000. Preliminary findings on the occurrence and site fidelity of photo-identified sperm whales (*Physeter macrocephalus*) in the northern Gulf of Mexico. Gulf of Mexico Science 18(1):35–39. doi: 10.18785/goms.1801.04
Whitehead, H. 2003. Sperm whales: Social evolution in the ocean. The University of Chicago Press, Chicago, IL. 431 p.
Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9
Whitehead, H., A. Coakes, N. Jaquet, and S. Lusseau. 2008. Movements of sperm whales in the tropical Pacific. Marine Ecology Progress Series 361:291–300. doi: 10.3354/meps07412
Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 256 p.

Sperm whale − *Physeter macrocephalus*

North Atlantic Stock

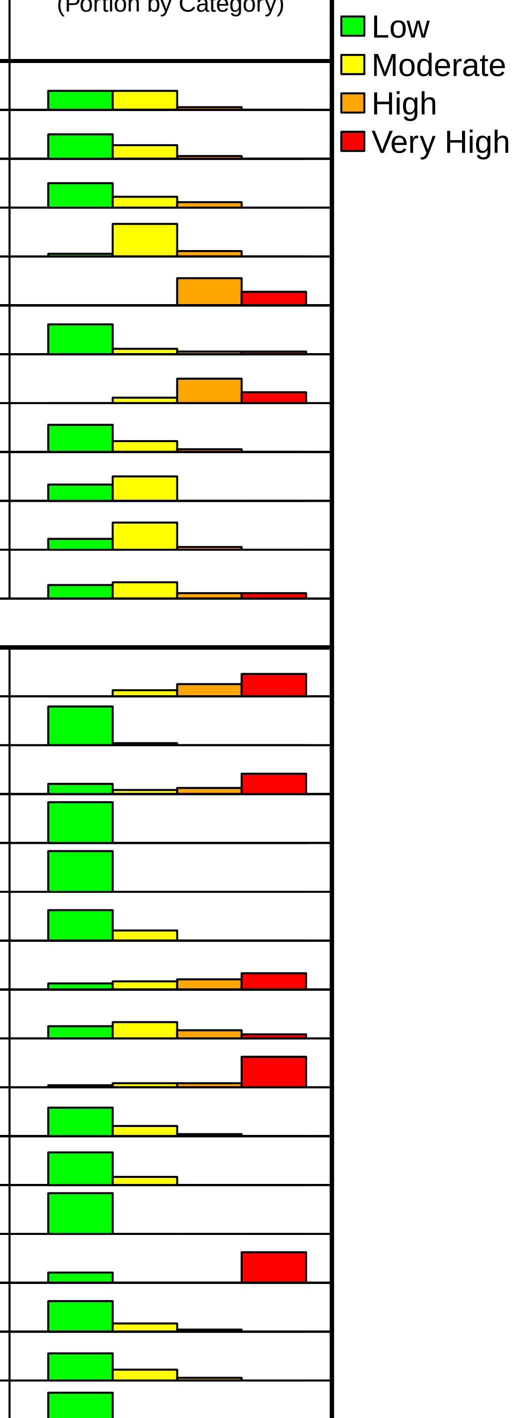
Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 96% of scores ≥ 2

	Physeter macrocephalus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.6	2.0	
	Habitat Specificity	1.5	2.3	
	Site Fidelity	1.5	2.0	
	Lifetime Reproductive Potential	2.1	2.3	
	Generation Length	3.3	2.3	
	Reproductive Plasticity	1.5	2.3	
	Migration	3.1	2.3	
	Home Range	1.4	2.3	
	Stock Abundance	1.6	2.7	
	Stock Abundance Trend	1.8	2.0	
	Cumulative Stressors	2.1	1.7	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	2.8	
	Sea Surface Temperature (Change in variability)	1.0	2.8	
	Air Temperature (Change in mean)	2.9	2.8	
	Air Temperature (Change in variability)	1.0	2.8	
	Precipitation (Change in mean)	1.0	2.8	
	Precipitation (Change in variability)	1.2	2.8	
	Sea Surface Salinity (Change in mean)	2.9	2.8	
	Sea Surface Salinity (Change in variability)	2.1	2.8	
	Ocean pH (Change in mean)	3.5	2.8	
	Ocean pH (Change in variability)	1.4	2.8	
	Sea ice coverage (Change in mean)	1.2	2.8	
	Sea ice coverage (Change in variability)	1.0	2.8	
	Dissolved oxygen (Change in mean)	3.2	2.8	
	Dissolved oxygen (Change in variability)	1.3	2.8	
	Circulation	1.4	2.3	
	Sea level rise	1.2	2.5	
	Exposure Score	High		
Overall Vulnerability Rank		High		



Sperm whale (North Atlantic Stock)

Physeter macrocephalus

CVA Results Summary

Overall Climate Vulnerability Rank: High (81% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than 3.0: Ocean pH (Standard anomaly) (3.55), Sea Surface Temperature (Standard anomaly) (3.40), and Dissolved oxygen (Standard anomaly) (3.25).

Biological Sensitivity: High. Two sensitivity attributes scored greater than 3.0: Generation Time (3.33) and Migration (3.13).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 96% of the data quality scores were 2 or greater. 91% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The North Atlantic sperm whale stock includes individuals found in the U.S. Exclusive Economic Zone from Florida to Maine and waters further offshore. Low genetic diversity is seen between the northwest and northeast Atlantic (Lyrholm and Gyllensten 1998; Lyrholm et al. 1999; Englehaupt et al. 2009) and genetic studies suggest differentiation between the North Atlantic stock and the Gulf of Mexico stock (Englehaupt et al. 2009). The North Atlantic stock is considered separate from the Puerto Rico and U.S. Virgin Islands stock for management purposes (Hayes et al. 2020).

Prey/Diet Specificity

Sperm whales consume diverse prey, such as large squid and other cephalopods (Ommastrephidae, Onychoteuthidae, Gonatidae, Pholidoteuthidae, Octopoteuthidae, Histioteuthidae, and Cranchiidae), demersal fish, and benthic invertebrates (Fiscus and Rice 1974; Kawakami 1980; Clarke 1987; Rice 1989; Clarke 1996).

Habitat Specificity

Generally, sperm whales show a strong preference for deep waters associated with the continental shelf break, the continental slope, and deeper waters (Hain et al. 1985; Rice 1989; Whitehead 2003).

Off the eastern U.S., sperm whales are found along the continental shelf edge, over the continental slope, and into mid-ocean regions where there are pronounced horizontal temperature gradients such as the Gulf Stream edge and warm-core rings (Schmidly 1981; Waring et al. 1993; Jaquet et al. 1996; Griffin 1999; Waring et al. 2001). Waring et al. (2003) found sperm whales south of Georges Bank associated with waters characterized by sea surface temperatures of 23.2 to 24.9°C and depths of 325–2,300 m. However, in waters off New England and the Scotian Shelf, sperm whales have been reported in shallower waters (CETAP 1982; Whitehead et al. 1992; Scott and Sadove 1997).

Site Fidelity

Little differentiation of mtDNA samples within ocean basins but significant differentiation between basins suggests sperm whales exhibit site fidelity at the basin-scale (Lyrholm and Gyllensten 1998; Lyrholm et al. 1999; Englehaupt et al. 2009).

Lifetime Reproductive Potential

Estimates of interbirth interval range from 4 to 7 years (Best et al. 1984; Taylor et al. 2007; Chiquet et al. 2013).

Females reach sexual maturity at about age 9 (Best et al. 1984). Taylor et al. (2007) reported sperm whale age at first reproduction of 12 years and age at last reproduction of 59 years (observed) and 51 years (estimated). Sperm whale reproductive rates decline with age (Whitehead 2018).

Generation Length

Taylor et al. (2007) reported generation length of 26.5 years at r=0.03 and 31.9 years at r=0.0.

Reproductive Plasticity

Mating behavior is observed from winter through summer, with calving during spring through fall (Best et al. 1984). Sperm whales continue suckling for several years (Whitehead 2018).

Migration

Sperm whale migrations appear to be a general seasonal north-south migration in mid-latitudes, with poleward summer movement (Whitehead 2003). Equatorial and some temperate areas show no clear seasonal migration (Whitehead 2003). In the North Atlantic, adult males migrate as far as polar regions to feed and move among female social groups to breed (Whitehead 2002; Englehaupt et al. 2009).

Sperm whales in the U.S. Atlantic EEZ waters show a distinct seasonal cycle (CETAP 1982):

- Winter: east and northeast of Cape Hatteras
- Spring: east of Delaware and Virginia; widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank
- Summer: similar distribution as spring, but includes east and north of Georges Bank, into the Northeast Channel region, and the continental shelf south of New England
- Fall: continental shelf south of New England and in the mid-Atlantic bight

Geographic distribution and migration appear linked to social structure (Best 1979; Whitehead et al. 1992; Christal et al. 1998). Females and juveniles generally are found in tropical and subtropical waters, and males more wide-ranging and occurring in higher latitudes (Reeves and Whitehead 1997; Whitehead 2002).

Home Range

The distribution of the sperm whale in the U.S. Exclusive Economic Zone includes the continental shelf edge, the continental slope, and mid-ocean regions (Waring et al. 2013). Sperm whales are capable of traveling long distances, with males traveling as far poleward as pack ice (Rice 1989; Rice 1998). Females generally travel up to 2000 km but have been recorded up to 4000 km (Whitehead et al. 2008). In the North Atlantic, one male traveled from Nova Scotia to Spain (Mitchell 1975) and others from the Azores to northern Denmark and Norway (Reeves and Whitehead 1997; Steiner et al. 2012).

Stock Abundance

Using data from 2016 surveys, the abundance of sperm whales in U.S. waters from Florida to the lower Bay of Fundy was estimated at 4,349 individuals (CV=0.28; Garrison 2020; Palka 2020). Estimates based on 2011 surveys placed the stock abundance at 2,288 individuals (CV=0.28), but did not correct for dive-time and likely represented an underestimate of actual abundance (Palka 2012; Waring et al. 2013). U.S. waters include only a small proportion of the total population range; Rice (1989) summarized information available at the time to estimate the abundance of sperm whales in the North Atlantic at 190,000 individuals.

Stock Abundance Trend

Data are insufficient to determine an abundance trend for the North Atlantic stock (Hayes et al. 2020).

Cumulative Stressors

Sperm whales in the North Atlantic are recorded interacting with the Canadian Labrador halibut longline fishery (two mortalities 2007–2011) and the monkfish fishery (one entanglement in 2011; Ledwell and Huntington 2012; Waring et al. 2013). Ship strikes are another source of human-caused mortality (Reeves and Whitehead 1997; Carrillo and Ritter 2010).

During the period 2013–2017, 12 sperm whales were reported stranded along the U.S. Atlantic coast and none of the U.S. strandings were classified as human interactions (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020). Sperm whale mass strandings have been reported in several regions (Rice et al. 1986; Kompanje and Reumer 1995; Evans et al. 2002; Fujiwara et al. 2007; Pierce et al. 2007; Mazzariol et al. 2011) with possible causes including topography, changes in geomagnetic field, solar cycles, ship strikes, global changes in water temperature and prey distribution, and pollution (Kirschvink et al. 1986; Brabyn and Frew 1994; Holsbeek et al. 1999; Mazzariol et al. 2011).

Historically, whaling impacted sperm whale populations throughout the North Atlantic (Mitchell and Kozicki 1984).

Distribution and Sightings

Density model results for sperm whales in the western North Atlantic are presented by Roberts et al. (2015, 2016a, 2016b, 2017), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

National Marine Fisheries Service (NMFS). 2015. Sperm Whale (*Physeter macrocephalus*) 5-Year Review: Summary and Evaluation. Silver Spring, MD. 58 p.

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2019. *Physeter macrocephalus* (amended version of 2008 assessment). The IUCN Red List of Threatened Species 2019: e.T41755A160983555. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T41755A160983555.en

Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9

References

Best, P.B. 1979. Social organization in sperm whales, *Physeter macrocephalus*. In: Winn, H.E. and B.L. Olla (Eds.), Behavior of Marine Animals. Plenum, New York, NY. pp. 227–289.

Best, P.B., P.A.S. Canham, and N. Macleod. 1984. Patterns of reproduction in sperm whales, *Physeter macrocephalus*. Reports of the International Whaling Commission (Special Issue) 6:51–79.

Brabyn, M. and R.V.C. Frew. 1994. New Zealand herd stranding sites do not relate to geomagnetic topography. Marine Mammal Science 10(2):195–207. doi: 10.1111/j.1748-7692.1994.tb00261.x

Carrillo, M. and F. Ritter. 2010. Increasing numbers of ship strikes in the Canary Islands: proposals for immediate action to reduce risk of vessel-whale collisions. journal of Cetacean Research and Management 11:131–138.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chiquet, R.A., B.L. Ma, A.S. Ackleh, N. Pal, and N. Sidorovskaia. 2013. Demographic analysis of sperm whales using matrix population models. Ecological Modelling 248:71–79. doi: 10.1016/j.ecolmodel.2012.09.023

Christal, J., H. Whitehead, and E. Lettevall. 1998. Sperm whale social units: variation and change. Canadian Journal of Zoology 76(8):1431–1440. doi: 10.1139/z98-087

Clarke, M.R. 1987. Cephalopod biomass—estimation from predation. In: Boyle, A.P. (Ed.), Cephalopod Life Cycles. Academic Press, London, UK. pp. 221–237.

Clarke, M.R. 1996. Cephalopods as prey. III. Cetaceans. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences 351(1343):1053–1065. doi: 10.1098/rstb.1996.0093

Engelhaupt, D., A. Rus Hoelzel, C. Nicholson, A. Frantzis, S. Mesnick, S. Gero, H.A.L. Whitehead, L. Rendell, P. Miller, R. De Stefanis, A.N.A. CaÑAdas, S. Airoldi, and A.A. Mignucci-Giannoni. 2009. Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (*Physeter macrocephalus*). Molecular Ecology 18(20):4193–4205. doi: 10.1111/j.1365-294X.2009.04355.x

Evans, K., M. Morrice, M. Hindell, and D. Thiele. 2002. Three mass strandings of sperm whales (*Physeter Macrocephalus*) in southern Australian Waters. Marine Mammal Science 18(3):622–643. doi: 10.1111/j.1748-7692.2002.tb01063.x

Fiscus, C.H. and D.W. Rice. 1974. Giant squids, *Architeuthis* sp., from stomachs of sperm whales captured off California. California Fish and Game 60(2):91–93.

Fujiwara, Y., M. Kawato, T. Yamamoto, T. Yamanaka, W. Sato-Okoshi, C. Noda, S. Tsuchida, T. Komai, S.S. Cubelio, T. Sasaki, K. Jacobsen, K. Kubokawa, K. Fujikura, T. Maruyama, Y. Furushima, K. Okoshi, H. Miyake, M. Miyazaki, Y. Nogi, A. Yatabe, and T. Okutani. 2007. Three-year investigations into sperm whale-fall ecosystems in Japan. Marine Ecology 28(1):219–232. doi: 10.1111/j.1439-0485.2007.00150.x

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Griffin, R.B. 1999. Sperm whale distributions and community ecology associated with a warm-core ring off Georges Bank. Marine Mammal Science 15(1):33–51. doi: 10.1111/j.1748-7692.1999.tb00780.x

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Marine Fisheries Review 47(1):13–17.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Holsbeek, L., C.R. Joiris, V. Debacker, I.B. Ali, P. Roose, J.-P. Nellissen, S. Gobert, J.-M. Bouquegneau, and M. Bossicart. 1999. Heavy metals, organochlorines and polycyclic aromatic hydrocarbons in sperm whales stranded in the southern North Sea during the 1994/1995 winter. Marine Pollution Bulletin 38(4):304–313. doi: 10.1016/s0025-326x(98)00150-7

Jaquet, N. 1996. How spatial and temporal scales influence understanding of sperm whale distribution: a review. Mammal Review 26(1):51–65. doi: 10.1111/j.1365-2907.1996.tb00146.x

Kawakami, T. 1980. A review of sperm whale food. Scientific Reports of Whales Research Institute 32:199–218.

Kirschvink, J.L., A.E. Dizon, and J.A. Westphal. 1986. Evidence from strandings for geomagnetic sensitivity in cetaceans. Journal of Experimental Biology 120(1):1–24. doi: 10.1242/jeb.120.1.1

Kompanje, E. and J. Reumer. 1995. Strandings of male sperm whales *Physeter macrocephalus* Linnaeus, 1758 in western Europe between October 1994 and January 1995. Deinsea 2:89–94.

Ledwell, W. and J. Huntington. 2012. Incidental entanglements of cetacean and leatherback sea turtles in fishing gear reported during 2011-2012 and a summary of the Whale Release and Strandings Group activities. A preliminary report to Fisheries and Oceans Canada: St. John's, Newfoundland, Canada. 17 p.

Lyrholm, T. and U. Gyllensten. 1998. Global matrilineal population structure in sperm whales as indicated by mitochondrial DNA sequences. Proceedings of the Royal Society of London. Series B: Biological Sciences 265(1406):1679–1684. doi: 10.1098/rspb.1998.0488

Lyrholm, T., O. Leimar, B. Johanneson, and U. Gyllensten. 1999. Sex–biased dispersal in sperm whales: contrasting mitochondrial and nuclear genetic structure of global populations. Proceedings of the Royal Society of London. Series B: Biological Sciences 266(1417):347–354. doi: 10.1098/rspb.1999.0644

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mazzariol, S., G. Di Guardo, A. Petrella, L. Marsili, C.M. Fossi, C. Leonzio, N. Zizzo, S. Vizzini, S. Gaspari, G. Pavan, M. Podestà, F. Garibaldi, M. Ferrante, C. Copat, D. Traversa, F. Marcer, S. Airoldi, A. Frantzis, Y. De Bernaldo Quirós, B. Cozzi, and A. Fernández. 2011. Sometimes sperm whales (*Physeter macrocephalus*) cannot find their way back to the high seas: A multidisciplinary study on a mass stranding. PLoS ONE 6(5):e19417. doi: 10.1371/journal.pone.0019417

Mitchell, E. 1975. Progress report on whale research, Canada. Reports of the International Whaling Commission 25:270–272.

Mitchell, E. and V.M. Kozicki. 1984. Reproductive condition of male sperm whales, *Physeter macrocephalus*, taken off Nova Scotia. Reports of the International Whaling Commission (Special Issue) 6:243–252.

Palka, D. 2012. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2011 line transect survey. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 12-29. 37 p.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pierce, G.J., M.B. Santos, C. Smeenk, A. Saveliev, and A.F. Zuur. 2007. Historical trends in the incidence of strandings of sperm whales (*Physeter macrocephalus*) on North Sea coasts: An association with positive temperature anomalies. Fisheries Research 87(2-3):219–228. doi: 10.1016/j.fishres.2007.06.001

Reeves, R.R. and H. Whitehead. 1997. Status of sperm whale, *Physeter macrocephalus*, in Canada. Canadian Field-Naturalist 111(2):293–307.

Rice, D.W. 1989. Sperm whale--*Physeter macrocephalus* (Linnaeus, 1758). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, San Diego, CA. pp. 177–234.

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Special Publication No. 4. The Society for Marine Mammalogy, Lawrence, KS. 231 p.

Rice, D.W., A.A. Wolman, B.R. Mate, and J.T. Harvey. 1986. A mass stranding of sperm whales in Oregon: Sex and age composition of the school. Marine Mammal Science 2(1):64–69. doi: 10.1111/j.1748-7692.1986.tb00027.x

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016b. Density model for sperm whale (*Physeter macrocephalus*) for the U.S. East Coast version 6.4, 2016-04-21, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 139 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016c. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. Department of the Interior, U.S. Fish and Wildlife Service: Washington, DC. 166 p.

Scott, T.M. and S.S. Sadove. 1997. Sperm whale, *Physeter macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. Marine Mammal Science 13(2):317–321. doi: 10.1111/j.1748-7692.1997.tb00636.x

Steiner, L., L. Lamoni, M. Acosta Plata, S.-K. Jensen, E. Lettevall, and J. Gordon. 2012. A link between male sperm whales, *Physeter macrocephalus*, of the Azores and Norway. Journal of the Marine Biological Association of the United Kingdom 92(8):1751–1756. doi: 10.1017/s0025315412000793

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the north-eastern USA shelf. Fisheries Oceanography 2(2):101–105. doi: 10.1111/j.1365-2419.1993.tb00126.x

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-223. 419 p.

Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. Marine Ecology Progress Series 242:295–304. doi: 10.3354/meps242295

Whitehead, H. 2003. Sperm whales: Social evolution in the ocean. The University of Chicago Press, Chicago, IL. 431 p.

Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9

Whitehead, H., S. Brennan, and D. Grover. 1992. Distribution and behaviour of male sperm whales on the Scotian Shelf, Canada. Canadian Journal of Zoology 70(5):912–918. doi: 10.1139/z92-130

Whitehead, H., A. Coakes, N. Jaquet, and S. Lusseau. 2008. Movements of sperm whales in the tropical Pacific. Marine Ecology Progress Series 361:291–300. doi: 10.3354/meps07412

Sperm Whale − *Physeter macrocephalus*

Puerto Rico and US Virgin Islands Stock

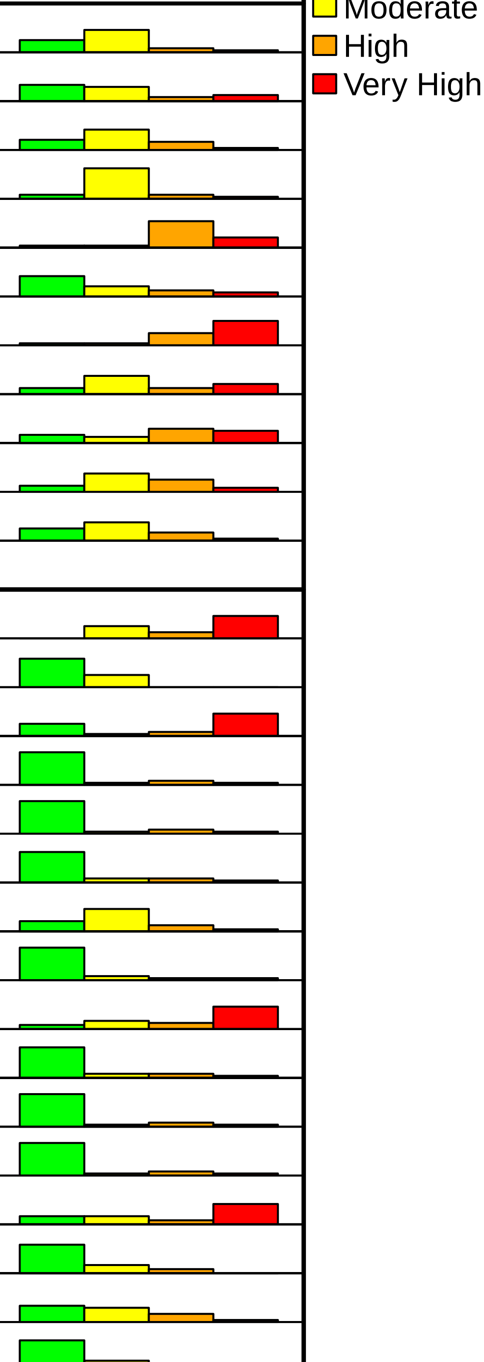
Overall Vulnerability Rank = High

Biological Sensitivity = High

Climate Exposure = High

Data Quality = 63% of scores ≥ 2

	Physeter macrocephalus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	1.8	
	Habitat Specificity	2.0	2.2	
	Site Fidelity	2.0	2.0	
	Lifetime Reproductive Potential	2.1	2.0	
	Generation Length	3.1	2.0	
	Reproductive Plasticity	1.8	1.5	
	Migration	3.4	2.0	
	Home Range	2.5	1.8	
	Stock Abundance	2.8	1.0	
	Stock Abundance Trend	2.4	0.8	
	Cumulative Stressors	2.0	1.8	
	Sensitivity Score	High		
Exposure variables	Sea Surface Temperature (Change in mean)	3.2	2.2	
	Sea Surface Temperature (Change in variability)	1.3	2.2	
	Air Temperature (Change in mean)	2.9	2.2	
	Air Temperature (Change in variability)	1.4	2.2	
	Precipitation (Change in mean)	1.4	2.2	
	Precipitation (Change in variability)	1.4	2.2	
	Sea Surface Salinity (Change in mean)	2.0	2.2	
	Sea Surface Salinity (Change in variability)	1.4	2.2	
	Ocean pH (Change in mean)	3.1	2.2	
	Ocean pH (Change in variability)	1.4	2.2	
	Sea ice coverage (Change in mean)	1.4	1.8	
	Sea ice coverage (Change in variability)	1.4	1.8	
	Dissolved oxygen (Change in mean)	2.9	2.2	
	Dissolved oxygen (Change in variability)	1.4	2.2	
	Circulation	1.9	1.8	
	Sea level rise	1.2	1.8	
	Exposure Score	High		
Overall Vulnerability Rank		High		



Sperm Whale (Puerto Rico and US Virgin Islands Stock)

Physeter macrocephalus

CVA Results Summary

Overall Climate Vulnerability Rank: High (74% certainty from bootstrap analysis).

Climate Exposure: High. Two exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.25) and Ocean pH (Standard anomaly) (3.15).

Biological Sensitivity: High. Two sensitivity attributes scored greater than 3.0: Migration (3.45) and Generation Time (3.10).

Distributional Response: Moderate

Abundance Response: Moderate

Phenology Response: Moderate

Data Quality: 63% of the data quality scores were 2 or greater. 45% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Puerto Rico and U.S. Virgin Islands sperm whale stock includes individuals found in the U.S waters around Puerto Rico and the U.S. Virgin Islands and surrounding Caribbean waters (Waring et al. 2010).

Prey/Diet Specificity

Sperm whales consume diverse prey, such as large squid and other cephalopods (Ommastrephidae, Onychoteuthidae, Gonatidae, Pholidoteuthidae, Octopoteuthidae, Histioteuthidae, and Cranchiidae), demersal fish, and benthic invertebrates (Fiscus and Rice 1974; Kawakami 1980; Clarke 1987; Rice 1989; Clarke 1996).

Habitat Specificity

Generally, sperm whales show a strong preference for deep waters associated with the continental shelf break, the continental slope, and deeper waters (Hain et al. 1985; Rice 1989; Whitehead 2003).

Off the eastern U.S., sperm whales are found in on the continental shelf edge, over the continental slope, and into mid-ocean regions where there are pronounced horizontal temperature gradients such as the Gulf Stream edge and warm-core rings (Schmidly 1981; Waring et al. 1993; Jaquet et al. 1996; Griffin 1999; Waring et al. 2001). Sperm whales are believed to inhabit continental slope and oceanic waters in the waters surrounding Puerto Rico and the U.S. Virgin Islands (Roden and Mullin 2000; Swartz and Burks 2000; Swartz et al. 2002).

Site Fidelity

Little differentiation of mtDNA samples within ocean basins but significant differentiation between basins suggests sperm whales exhibit site fidelity at the basin-scale (Lyrholm and Gyllensten 1998; Lyrholm et al. 1999; Englehaupt et al. 2009).

Lifetime Reproductive Potential

Estimates of interbirth interval range from 4 to 7 years (Best et al. 1984; Taylor et al. 2007; Chiquet et al. 2013).

Females reach sexual maturity at about age 9 (Best et al. 1984) and their reproductive rate declines with age (Whitehead 2018). Taylor et al. (2007) reported sperm whale age at first reproduction of 12 years and age at last reproduction of 59 years (observed) and 51 years (estimated).

Generation Length

Taylor et al. (2007) reported generation length of 26.5 years at r = 0.03 and 31.9 years at r = 0.0.

Reproductive Plasticity

Mating behavior is observed from winter through summer, with calving during spring through fall (Best et al. 1984). Sperm whales continue suckling for several years (Whitehead 2018).

Migration

Sperm whales occur in waters of Puerto Rico, U.S. Virgin Islands and British Virgin Islands from late fall through winter and early spring but are rare from April to September (Erdman 1970; Erdman et al. 1973; Taruski and Winn 1976; Mignucci-Giannoni 1988). However, movement between the adjacent areas of the Caribbean Sea, Gulf of Mexico, and Atlantic may be uncommon (Gero et al. 2007).

Home Range

Sperm whales of the Puerto Rico and U.S. Virgin Islands stock are likely trans-boundary with waters near adjacent Caribbean islands (Gero et al. 2007; Waring et al. 2010). Female home ranges generally span 2000 km but have been recorded up to 4000km (Whitehead et al. 2008).

Stock Abundance

The current abundance for the Puerto Rico and U.S. Virgin Islands stock of sperm whales is unknown. Several line-transect surveys have been conducted in this area, however, due to few sightings and limitations of the survey vessel, it has not been possible to estimate abundance from these surveys (Waring et al. 2010).

During January–March 1995, a line-transect survey designed to cover a wide range of water depths surrounding the Virgin Islands and Puerto Rico was conducted, primarily in waters >200m deep, that sighted eight sperm whales, six of which were in or near U.S. waters (Roden and Mullin 2000; Waring et al. 2010). During February-March 2000, a line-transect survey in the eastern and southern Caribbean Sea sighted eight of sperm whales in and near U.S. waters (Swartz and Burks 2000; Waring et al. 2010).

During February-March 2001, a line-transect survey in the eastern Bahamas, eastern Dominican Republic, and Puerto Rico and Virgin Islands was conducted and sighted five sperm whales in and near U.S. waters (Swartz et al. 2002; Waring et al. 2010).

Stock Abundance Trend

Data are insufficient to evaluate population trends for the Puerto Rico and US Virgin Islands stock (Waring et al. 2010).

Cumulative Stressors

Although no fishing-related mortality or serious injury of a sperm whale was reported during the period 2001-2015 in the waters of Puerto Rico or the U.S. Virgin Islands (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010, 2012a, 2012b, 2013, 2014, 2016, 2017), the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery represents a potential fishery interaction. Lack of observer coverage within the Caribbean may contribute to an undercounting of interactions (Fairfield-Walsh and Garrison 2007; Garrison et al. 2009; Garrison and Stokes 2010, 2012b, 2013, 2016).

Two sperm whales were found stranded in U.S. waters of the Caribbean Sea during the period 2004–2008 with no evidence of human interactions (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited by Waring et al. 2010). Ship strikes are another source of human-caused mortality, with one documented mortality due to a vessel strike in 2001 (Jensen and Silber 2003). Coastal pollution may be an issue for the Puerto Rico and U.S. Virgin Islands sperm whale stock due to the U.S. Environmental Protection Agency listing portions of Vieques Island on the Superfund National Priorities List (EPA 2018).

Historically, whaling in the Caribbean Sea affected sperm whales in the waters surrounding Puerto Rico and the U.S. Virgin Islands (Price 1985; Reeves et al. 2001).

Distribution and Sightings

Density model results for sperm whales in Puerto Rico and U.S. Virgin Islands waters are presented by Mannocci et al. (2017).

Further Reading

Department of the Navy. 2002. Marine Resource Assessment for the Puerto Rico/St. Croix Operating Area, Final Report. Naval Facilities Engineering Command, Norfolk, VA. Contract #N62470-95-D-1160, CTO 0030. Prepared by Geo-Marine, Inc, Plano, TX. 273 p.

National Marine Fisheries Service (NMFS). 2015. Sperm Whale (*Physeter macrocephalus*) 5-Year Review: Summary and Evaluation. Silver Spring, MD. 58 p.

Taylor, B.L., R. Baird, J. Barlow, S.M. Dawson, J. Ford, J.G. Mead, G. Notarbartolo di Sciara, P. Wade, and R.L. Pitman. 2019. *Physeter macrocephalus* (amended version of 2008 assessment). The IUCN Red List of Threatened Species 2019: e.T41755A160983555. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T41755A160983555.en

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2010. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2010. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-219. 598 p.

Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9

References

Best, P.B., P.A.S. Canham, and N. Macleod. 1984. Patterns of reproduction in sperm whales, *Physeter macrocephalus*. Reports of the International Whaling Commission (Special Issue) 6:51–79.

Chiquet, R.A., B.L. Ma, A.S. Ackleh, N. Pal, and N. Sidorovskaia. 2013. Demographic analysis of sperm whales using matrix population models. Ecological Modelling 248:71–79. doi: 10.1016/j.ecolmodel.2012.09.023

Clarke, M.R. 1987. Cephalopod biomass—estimation from predation. In: Boyle, A.P. (Ed.), Cephalopod Life Cycles. Academic Press, London, UK. pp. 221–237.

Clarke, M.R. 1996. Cephalopods as prey. III. Cetaceans. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences 351(1343):1053–1065. doi: 10.1098/rstb.1996.0093

Engelhaupt, D., A. Rus Hoelzel, C. Nicholson, A. Frantzis, S. Mesnick, S. Gero, H.A.L. Whitehead, L. Rendell, P. Miller, R. De Stefanis, A.N.A. CaÑAdas, S. Airoldi, and A.A. Mignucci-Giannoni. 2009. Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (*Physeter macrocephalus*). Molecular Ecology 18(20):4193–4205. doi: 10.1111/j.1365-294X.2009.04355.x

Environmental Protection Agency (EPA). 2018. Atlantic Fleet Weapons Training Area, Vieques, PR. 28 August 2018, https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR

Erdman, D.S. 1970. Marine mammals from Puerto Rico to Antigua. Journal of Mammalogy 51(3):636. doi: 10.2307/1378416

Erdman, D.S., J. Harms, and M. Marcial-Flores. 1973. Cetacean records from the northeastern Caribbean region. Cetology 17:1–14.

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Fiscus, C.H. and D.W. Rice. 1974. Giant squids, *Architeuthis* sp., from stomachs of sperm whales captured off California. California Fish and Game 60(2):91–93.

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.

Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2010. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2009. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-607. 64 p.

Garrison, L.P. and L. Stokes. 2012a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.

Garrison, L.P. and L. Stokes. 2012b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-632. 61 p.

Garrison, L.P. and L. Stokes. 2013. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-655. 62 p.

Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.

Gero, S., J. Gordon, C. Carlson, P. Evans, and H. Whitehead. 2007. Population estimate and inter-island movement of sperm whales, *Physeter macrocephalus*, in the eastern Caribbean Sea. Journal of Cetacean Research and Management 9(2):143–150.

Griffin, R.B. 1999. Sperm whale distributions and community ecology associated with a warm-core ring off Georges Bank. Marine Mammal Science 15(1):33–51. doi: 10.1111/j.1748-7692.1999.tb00780.x

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Marine Fisheries Review 47(1):13–17.

Jaquet, N. 1996. How spatial and temporal scales influence understanding of sperm whale distribution: a review. Mammal Review 26(1):51–65. doi: 10.1111/j.1365-2907.1996.tb00146.x

Jensen, A.S. and G.K. Silber. 2003. Large whale ship strike database. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources: Silver Spring, MD. NOAA Technical Memorandum NMFS-OPR-25. 37 p.

Kawakami, T. 1980. A review of sperm whale food. Scientific Reports of Whales Research Institute 32:199–218.

Lyrholm, T. and U. Gyllensten. 1998. Global matrilineal population structure in sperm whales as indicated by mitochondrial DNA sequences. Proceedings of the Royal Society of London. Series B: Biological Sciences 265(1406):1679–1684. doi: 10.1098/rspb.1998.0488

Lyrholm, T., O. Leimar, B. Johanneson, and U. Gyllensten. 1999. Sex–biased dispersal in sperm whales: contrasting mitochondrial and nuclear genetic structure of global populations. Proceedings of the Royal Society of London. Series B: Biological Sciences 266(1417):347–354. doi: 10.1098/rspb.1999.0644

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mignucci-Giannoni, A.A. 1988. A stranded sperm whale, *Physeter catodon*, at Cayo Santiago, Puerto Rico. Caribbean Journal of Science 24(3-4):213–215.

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Reeves, R.R., S.L. Swartz, S.E. Wetmore, and P.J. Clapham. 2001. Historical occurrence and distribution of humpback whales in the eastern and southern Caribbean Sea, based on data from American whaling logbooks. Journal of Cetacean Research and Management 3(2):117–129.

Rice, D.W. 1989. Sperm whale--*Physeter macrocephalus* (Linnaeus, 1758). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. Academic Press, San Diego, CA. pp. 177–234.

Roden, C.L. and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, winter 1995. Caribbean Journal of Science 36(3-4):280–288.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. Department of the Interior, U.S. Fish and Wildlife Service: Washington, DC. 166 p.

Swartz, S.L. and C. Burks. 2000. Cruise results, Windwards humpback (*Megaptera novaeangliae*) survey: NOAA ship Gordon Gunter cruise GU-00-01, 9 February to 3 April 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-438. 31 p.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.

Taruski, A.G. and H.E. Winn. 1976. Winter sightings of odontocetes in the West Indies. Cetology 22:1–12.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the north-eastern USA shelf. Fisheries Oceanography 2(2):101–105. doi: 10.1111/j.1365-2419.1993.tb00126.x

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-219. 598 p.

Whitehead, H. 2003. Sperm whales: Social evolution in the ocean. The University of Chicago Press, Chicago, IL. 431 p.

Whitehead, H. 2018. Sperm whale: *Physeter macrocephalus*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 919–925. doi: 10.1016/B978-0-12-804327-1.00242-9

Whitehead, H., A. Coakes, N. Jaquet, and S. Lusseau. 2008. Movements of sperm whales in the tropical Pacific. Marine Ecology Progress Series 361:291–300. doi: 10.3354/meps07412

Spinner dolphin − *Stenella longirostris*

Northern Gulf of Mexico Stock

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 85% of scores ≥ 2

	Stenella longirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.7	2.0	
	Habitat Specificity	1.8	2.3	
	Site Fidelity	1.7	1.7	
	Lifetime Reproductive Potential	2.3	2.3	
	Generation Length	1.9	2.3	
	Reproductive Plasticity	1.4	2.3	
	Migration	3.1	2.0	
	Home Range	1.9	1.7	
	Stock Abundance	1.4	2.7	
	Stock Abundance Trend	2.1	1.3	
	Cumulative Stressors	2.1	1.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	3.0	
	Sea Surface Temperature (Change in variability)	1.5	3.0	
	Air Temperature (Change in mean)	3.9	3.0	
	Air Temperature (Change in variability)	2.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	2.7	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	3.5	3.0	
	Ocean pH (Change in variability)	1.7	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.5	3.0	
	Dissolved oxygen (Change in variability)	1.7	3.0	
	Circulation	2.0	2.7	
	Sea level rise	1.1	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

Spinner dolphin (Northern Gulf of Mexico Stock)

Stenella longirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (50% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (3.87), Dissolved oxygen (Standard anomaly) (3.53), and Ocean pH (Standard anomaly) (3.53).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Migration (3.13).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 85% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The spinner dolphin Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Spinner dolphins feed primarily on small mesopelagic fishes, squids, and sergestid shrimps, following both vertical and horizontal diel prey migrations (Perrin and Gilpatrick 1994; Benoit-Bird et al. 2001; Benoit-Bird and Au 2003; Benoit-Bird and Au 2004). Pauly et al. (1998) reported species-level diet composition of 20% small squids, 20% large squids, 40% mesopelagic fishes, and 20% miscellaneous fishes.

Habitat Specificity

Spinner dolphins in the northern Gulf of Mexico occur in oceanic and continental slope waters, generally east of the Mississippi River Delta along the Florida Escarpment (Davis et al. 1998; Mullin and Fulling 2004; Maze-Foley and Mullin 2006; Schick et al. 2011; Waring et al. 2013; Garrison and Aichinger Dias 2020).

Worldwide, the majority of spinner dolphin sightings occur in continental shelf waters (Perrin and Gilpatrick 1994; Mignucci-Giannoni 1998), though sightings occasionally occur in waters deeper than 800m (Jefferson and Lynn 1994; Swartz and Burks 2000; Swartz et al. 2002; Yoshida et al. 2010). Coastal populations are usually associated with island archipelagos (Norris and Dohl 1980; Poole 1995). Oceanic populations are often found associated with a shallow thermocline (Au and Perryman 1985; Reilly 1990; Reeves et al. 1999). Moreno et al. (2005) reported that in the Southwest Atlantic, spinner dolphins were found in waters over the outer continental shelf and beyond the continental slope in waters from 170 to 2,700 m deep, with an average SST ranging from 22 to 27.5°C.

Site Fidelity

Information regarding spinner dolphin site fidelity in the Gulf of Mexico was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 3.00 years based on values reported by Perrin and Gilpatrick (1994). Taylor et al. (2007) reported spinner dolphin age at first reproduction of 7 years and age at last reproduction of 26 years (observed) and 30 years (estimated) based on values reported by Miyazaki (1984). Sexual maturity occurs at an age of 4 to 7 years for females and 7 to 10 years for males (Jefferson et al. 2015).

Generation Length

Taylor et al. (2007) report generation length of 13.3 years at $r = 0.01$ and 13.7 years at $r = 0.0$.

Reproductive Plasticity

Calving peaks range from late spring to fall (Jefferson et al. 1993). An analysis of a mass stranding in west Florida suggested calving dates in mid-June and mid-May (Mead et al. 1980).

Migration

Spinner dolphins are seen in all seasons in the northern Gulf of Mexico (Hansen et al. 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004). During winter and spring, they occur seaward of the shelf break including waters over the continental slope, primarily east of the Mississippi River, although also in the Mississippi Canyon region (DoN 2007). During summer and fall, spinner dolphins may occur in the deeper waters of the north-central Gulf from the Mississippi Canyon to the Florida Panhandle (DoN 2007).

Home Range

Information regarding spinner dolphin home range in the Gulf of Mexico was not found in the literature.

Stock Abundance

The abundance of northern Gulf of Mexico spinner dolphins is estimated to be 2,991 individuals (CV=0.54) based on 2017 and 2018 surveys (Garrison et al. 2020). Previously, the stock was estimated at 11,441 individuals (CV=0.83) based on a summer 2009 oceanic survey (Waring et al. 2013).

Stock Abundance Trend

Five point estimates of spinner dolphin abundance have been made based on data from surveys in 2003 (5,160; CV=0.55), 2004 (24,535; CV=0.58), 2009 (19,678; CV=0.53), 2017 (5,982; CV=0.54), and 2018 (0). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021). The ability to detect an abundance trend for this stock is confounded by poor precision and long survey intervals (Hayes et al. 2021).

Cumulative Stressors

Spinner dolphins in the northern Gulf of Mexico interact with the pelagic longline fishery. During the period 2014–2018, annual fishing-related mortality was estimated to be zero (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the same period, 13 spinner dolphins were reported stranded along the U.S. Gulf of Mexico coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The spinner dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins but also including 12 spinner dolphin strandings, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for spinner dolphins in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Braulik, G. and R. Reeves. 2018. *Stenella longirostris* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T20733A156927622. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20733A156927622.en

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

Perrin, W.F. 2018. Spinner dolphin: *Stenella longirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 925–928. doi: 10.1016/B978-0-12-804327-1.00243-0

References

Au, D.W.K. and W.L. Perryman. 1985. Dolphin habitats in the Eastern Tropical Pacific. Fishery Bulletin 83(4):623–643.

Benoit-Bird, K.J. and W.W.L. Au. 2003. Prey dynamics affect foraging by a pelagic predator (*Stenella longirostris*) over a range of spatial and temporal scales. Behavioral Ecology and Sociobiology 53(6):364–373. doi: 10.1007/s00265-003-0585-4

Benoit-Bird, K.J. and W.W.L. Au. 2004. Diel migration dynamics of an island-associated sound-scattering layer. Deep Sea Research Part I: Oceanographic Research Papers 51(5):707–719. doi: 10.1016/j.dsr.2004.01.004

Benoit-Bird, K.J., W.W.L. Au, R.E. Brainard, and M.O. Lammers. 2001. Diel horizontal migration of the Hawaiian mesopelagic boundary community observed acoustically. Marine Ecology Progress Series 217:1–14. doi: 10.3354/meps217001

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Department of the Navy (DoN). 2007. Marine resources assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide. Marine mammals of the world. Food and Agriculture Organization of the United Nations: Rome, Italy. 320 p.

Jefferson, T.A. and S.K. Lynn. 1994. Marine mammal sightings in the Caribbean Sea and Gulf of Mexico, summer 1991. Caribbean Journal of Science 30(1-2):83–89.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Mead, J.G., D.K. Odell, R.S. Wells, and M.D. Scott. 1980. Observations on a mass stranding of spinner dolphin, *Stenella longirostris*, from the west coast of Florida. Fishery Bulletin 78(2):353–360.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Miyazaki, N. 1984. Further analyses of reproduction in the striped dolphin, *Stenella coeruleoalba*, off the Pacific coast of Japan. In: Perrin, W.F., R.L. Brownell, Jr., and D. DeMaster (Eds.), Reproduction in Whales, Dolphins and Propoises. Report of the International Whaling Commission (special issue 6). pp. 343–354.

Moreno, I.B., A.N. Zerbini, D. Danilewicz, S. de Oliveira Sa, P.C. Simões-Lopes, J. Lailson-Brito, and A.F. Azevedo. 2005. Distribution and habitat characteristics of dolphins of the genus *Stenella* (Cetacea: Delphinidae) in the Southwest Atlantic Ocean. Marine Ecology Progress Series 300:229–240. doi: 10.3354/meps300229

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996–2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical

report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.
National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.
Norris, K.S., B. Würsig, R.S. Wells, M. Würsig, S.M. Brownlee, C. Johnson, and J. Solow. 1985. The behavior of the Hawaiian spinner dolphin, *Stenella longirostris*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. NMFS-SWFSC Administrative Report LJ-85-06C. 213 p.
Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280
Perrin, W.F. and J.W. Gilpatrick, Jr. 1994. Spinner dolphin--*Stenella longirostris* (Gray, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 99–128.
Poole, M.M. 1995. Aspects of the behavioral ecology of spinner dolphins (*Stenella longirostris*) in the nearshore waters of Mo'orea, French Polynesia. University of California. Dissertation. 177 p.
Reeves, R.R., S. Leatherwood, G.S. Stone, and L.G. Eldredge. 1999. Marine mammals in the area served by the South Pacific Regional Environment Programme (SPREP). South Pacific Regional Environment Programme: Apia, Samoa. 48 p.
Reilly, S.B. 1990. Seasonal changes in distribution and habitat differences among dolphins in the eastern tropical Pacific. Marine Ecology Progress Series 66(1-2):1–11. doi: 10.3354/meps066001
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for spinner dolphin (*Stenella longirostris*) for the U.S. Gulf of Mexico version 2.3, 2015-09-29, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 68 p.
Schick, R.S., P.N. Halpin, A.J. Read, D.L. Urban, B.D. Best, C.P. Good, J.J. Roberts, E.A. LaBrecque, C. Dunn, L.P. Garrison, K.D. Hyrenbach, W.A. McLellan, D.A. Pabst, D.L. Palka, and P. Stevick. 2011. Community structure in pelagic marine mammals at large spatial scales. Marine Ecology Progress Series 434:165–U193. doi: 10.3354/meps09183
Swartz, S.L. and C. Burks. 2000. Cruise results, Windwards humpback (*Megaptera novaeangliae*) survey: NOAA ship Gordon Gunter cruise GU-00-01, 9 February to 3 April 2000. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-438. 31 p.
Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.
Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead

following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-223. 419 p.
Yoshida, H., J. Compton, S. Punnett, T. Lovell, K. Draper, G. Franklin, N. Norris, P. Phillip, R. Wilkins, and H. Kato. 2010. Cetacean sightings in the eastern Caribbean and adjacent waters, spring 2004. Aquatic Mammals 36(2):154–161. doi: 10.1578/Am.36.2.2010.154

Spinner dolphin − *Stenella longirostris*

Puerto Rico and US Virgin Islands Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 70% of scores ≥ 2

	Stenella longirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.0	
	Habitat Specificity	1.7	2.3	
	Site Fidelity	2.3	2.0	
	Lifetime Reproductive Potential	2.4	2.0	
	Generation Length	2.1	2.0	
	Reproductive Plasticity	1.7	1.7	
	Migration	3.5	2.0	
	Home Range	2.1	2.0	
	Stock Abundance	2.7	1.0	
	Stock Abundance Trend	2.4	0.7	
	Cumulative Stressors	2.0	1.7	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.5	2.3	
	Sea Surface Temperature (Change in variability)	1.5	2.3	
	Air Temperature (Change in mean)	3.1	2.3	
	Air Temperature (Change in variability)	1.1	2.3	
	Precipitation (Change in mean)	1.5	2.3	
	Precipitation (Change in variability)	1.6	2.3	
	Sea Surface Salinity (Change in mean)	2.4	2.3	
	Sea Surface Salinity (Change in variability)	1.5	2.3	
	Ocean pH (Change in mean)	3.5	2.3	
	Ocean pH (Change in variability)	1.5	2.3	
	Sea ice coverage (Change in mean)	1.5	1.7	
	Sea ice coverage (Change in variability)	1.5	1.7	
	Dissolved oxygen (Change in mean)	3.8	2.3	
	Dissolved oxygen (Change in variability)	1.8	2.3	
	Circulation	2.5	1.7	
	Sea level rise	1.7	1.7	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

Spinner dolphin (Puerto Rico and US Virgin Islands Stock)

Stenella longirostris

CVA Results Summary

Overall Climate Vulnerability Rank: High (39% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than or equal to 3.5: Dissolved oxygen (Standard anomaly) (3.80), Ocean pH (Standard anomaly) (3.53), and Sea Surface Temperature (Standard anomaly) (3.53).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Migration (3.53) and Species Abundance (2.67).

Distributional Response: Moderate

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 70% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The Puerto Rico and U.S. Virgin Islands spinner dolphin stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone surrounding Puerto Rico and the U.S. Virgin Islands, and in adjacent Caribbean waters (Waring et al. 2012). This stock is considered separate from the western North Atlantic and Gulf of Mexico stocks for management purposes (Waring et al. 2012).

Prey/Diet Specificity

Spinner dolphins feed primarily on small mesopelagic fishes, squids, and sergestid shrimps and are known to follow both vertical and horizontal diel prey migrations in some regions (Perrin and Gilpatrick 1994; Benoit-Bird et al. 2001; Benoit-Bird and Au 2003; Benoit-Bird and Au 2004). Pauly et al. (1998) reported species-level diet composition of 20% small squids, 20% large squids, 40% mesopelagic fishes, 20% miscellaneous fishes.

Habitat Specificity

Spinner dolphins occur in coastal and oceanic waters. Off Puerto Rico and the Virgin Islands, spinner dolphins occur offshore but are more often sighted in continental shelf waters (Mignucci-Giannoni 1998; Rodriguez-Ferrer et al. 2018). In the Gulf of Mexico and off the eastern U.S., spinner dolphins are generally distributed in offshore waters (CETAP 1982; Davis et al. 1998; Waring et al. 1992).

Site Fidelity

No specific site fidelity information was found for this stock.

Lifetime Reproductive Potential

Taylor et al. (2007) reported an interbirth interval of 3.00 years based on values reported by Perrin and Gilpatrick (1994). Taylor et al. (2007) reported spinner dolphin age at first reproduction of 7 years and age at last reproduction of 26 years (observed) and 30 years (estimated) based on values reported by Miyazaki (1984). Sexual maturity occurs at an age of 4 to 7 years for females and 7 to 10 years for males (Jefferson et al. 2015).

Generation Length

Taylor et al. (2007) reported a generation length of 13.3 years at r = 0.01 and 13.7 years at r = 0.0.

Reproductive Plasticity

Calving peaks range from late spring to fall (Jefferson et al. 2015). An analysis of a mass stranding in west Florida suggested calving dates in mid-June and mid-May (Mead et al. 1980).

Migration

Off Puerto Rico and the U.S. Virgin Islands, spinner dolphins occur year round and seasonal inshore-offshore movement is suspected (Mignucci-Giannoni 1998; Rodriguez-Ferrer et al. 2018).

Home Range

Spinner dolphins have been reported for various locations in the Caribbean, such as Bequia, the Grenadines, Tobago, St. Vincent, Cuba, Puerto Rico, the Virgin Islands, Guadeloupe, Dominica, Curacao, and Martinique (Caldwell et al. 1971; Mignucci-Giannoni 1989; Perrin et al. 1981; Jefferson and Lynn 1994; Mignucci-Giannoni 1998; Jérémie 2005; Rinaldi et al. 2006; Whitt et al. 2011).

Stock Abundance

An abundance estimate for this stock is unavailable due to few sightings during surveys (Swartz et al. 2002; Waring et al. 2012).

Stock Abundance Trend

Data are insufficient to determine the population trends for this stock (Waring et al. 2012).

Cumulative Stressors

Spinner dolphins in the waters off Puerto Rico and the U.S. Virgin Islands interact with pelagic longline fisheries. However, annual fishing-related mortality is unknown due to low levels of observer coverage (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison et al. 2009; Garrison and Stokes 2010).

Although no longer present in U.S. waters, dolphin fisheries continue to exist elsewhere in the Caribbean (e.g., Caldwell et al. 1971; Caldwell and Caldwell 1975; Price 1985; Reeves 1988; Romero et al. 2001; Hoyt and Hvenegaard 2002; Mohammed et al. 2003; Vail 2005; World Council of Whalers 2008) and also in Venezuela (Romero et al. 2001). Live-capture fisheries for use in captivity exist or have existed recently in the Dominican Republic, Haiti, Cuba, and Honduras (van Waerebeek et al. 2006; Espinosa and Orta 2007; Parsons et al. 2010; Waring et al. 2012).

Legacy impacts on spinner dolphins from naval operations at Roosevelt Roads in Puerto Rico that ceased in 2004 are unknown (Waring et al. 2012).

Coastal pollution may be an issue for the common bottlenose dolphin Puerto Rico and U.S. Virgin Islands stock. Parts of Vieques Island, Puerto Rico are listed on the U.S. Environmental Protection Agency's (EPA) Superfund National Priorities List due to unexploded ordnance and associated hazardous materials (Whitall et al. 2016; EPA 2018).

Distribution and Sightings

Density model results for spinner dolphins in Puerto Rico and U.S. Virgin Islands waters are presented by Mannocci et al. (2017).

Further Reading

Braulik, G. and R. Reeves. 2018. *Stenella longirostris* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T20733A156927622. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20733A156927622.en

Department of the Navy (DoN). 2002. Marine resource assessment for the Puerto Rico/St. Croix Operating Area, Final Report. Naval Facilities Engineering Command, Norfolk, VA. Contract #N62470-95-D-1160, CTO 0030. Prepared by Geo-Marine, Inc, Plano, TX. 273 p.

Perrin, W.F. 2018. Spinner dolphin: *Stenella longirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 925–928. doi: 10.1016/B978-0-12-804327-1.00243-0

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

References

Benoit-Bird, K.J. and W.W.L. Au. 2003. Prey dynamics affect foraging by a pelagic predator (*Stenella longirostris*) over a range of spatial and temporal scales. Behavioral Ecology and Sociobiology 53(6):364–373. doi: 10.1007/s00265-003-0585-4

Benoit-Bird, K.J. and W.W.L. Au. 2004. Diel migration dynamics of an island-associated sound-scattering layer. Deep Sea Research Part I: Oceanographic Research Papers 51(5):707–719. doi: 10.1016/j.dsr.2004.01.004

Benoit-Bird, K.J., W.W.L. Au, R.E. Brainard, and M.O. Lammers. 2001. Diel horizontal migration of the Hawaiian mesopelagic boundary community observed acoustically. Marine Ecology Progress Series 217:1–14. doi: 10.3354/meps217001

Caldwell, D.K. and M.C. Caldwell. 1975. Dolphin and small whale fisheries of the Caribbean and West Indies: Occurrence, history, and catch statistics — with special reference to the Lesser Antillean island of St. Vincent. Journal of the Fisheries Research Board of Canada 32(7):1105–1110. doi: 10.1139/f75-132

Caldwell, D.K., M.C. Caldwell, W.F. Rathjen, and J.R. Sullivan. 1971. Cetaceans from the Lesser Antillean island of St. Vincent. Fishery Bulletin 69:303–312.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitat of cetaceans along the continental slope in the northcentral and western Gulf of Mexico. Marine Mammal Science 14(3):490–507. doi: 10.1111/j.1748-7692.1998.tb00738.x

Environmental Protection Agency (EPA). 2018. Atlantic Fleet Weapons Training Area, Vieques, PR. 28 August 2018, https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#PR

Espinosa, J. and J. Orta. 2007. Biota marina. In: González, H.A. (Ed.), Biodiversidad de Cuba. Ediciones Polymita, S.A., Ciudad de Guatemala. pp. 72–141.

Fairfield, C.P. and L.P. Garrison. 2008. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2007. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-572. 62 p.

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-539. 52 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-560. 54 p.

Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-515. 52 p.

Garrison, L.P. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-531. 57 p.

Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-527. 57 p.

Garrison, L.P. and L. Stokes. 2012. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2010. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-624. 59 p.

Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. National Oceanic and Atmospheric

Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-591. 63 p.

Hoyt, E. and G.T. Hvenegaard. 2002. A review of whale-watching and whaling with applications for the Caribbean. Coastal Management 30(4):381–399. doi: 10.1080/089207502900273

Jefferson, T.A. and S.K. Lynn. 1994. Marine mammal sightings in the Caribbean Sea and Gulf of Mexico, summer 1991. Caribbean Journal of Science 30(1-2):83–89.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Jérémie, S., A. Gannier, S. Bourreau, and J.-C. Nicolas. 2006. Cetaceans of Martinique Island (Lesser Antilles): Occurrence and distribution obtained from a small boat dedicated survey. Paper SC/58/SM23. 58th Annual Meeting of the International Whaling Commission, June 2006, St. Kitts and Nevis, West Indies.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Mead, J.G., D.K. Odell, R.S. Wells, and M.D. Scott. 1980. Observations on a mass stranding of spinner dolphin, *Stenella longirostris*, from the west coast of Florida. Fishery Bulletin 78(2):353–360.

Mignucci-Giannoni, A.A. 1989. Zoogeography of marine mammals in Puerto Rico and the Virgin Islands. University of Rhode Island. Thesis. 448 p.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34(3-4):173–190.

Miyazaki, N. 1984. Further analyses of reproduction in the striped dolphin, *Stenella coeruleoalba*, off the Pacific coast of Japan. In: Perrin, W.F., R.L. Brownell, Jr., and D. DeMaster (Eds.), Reproduction in Whales, Dolphins and Propoises. Report of the International Whaling Commission (special issue 6). pp. 343–354.

Mohammed, E., L.E. Straker, and C. Jardine. 2003. St. Vincent and the Grenadines: Reconstructed fisheries catches and fishing effort, 1942-2001. Fisheries Centre Research Reports 11(6):95–116.

Parsons, E.C.M., I. Bonnelly de Calventi, A. Whaley, N.A. Rose, and S. Sherwin. 2010. A note on illegal captures of wild bottlenose dolphins (*Tursiops truncatus*) from the coastal waters of the Dominican Republic. Journal of International Wildlife Law and Policy 13(3):240–244. doi: 10.1080/13880292.2010.503123

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perrin, W.F. and J.W. Gilpatrick, Jr. 1994. Spinner dolphin--*Stenella longirostris* (Gray, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 99–128.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, and P.J.H. Vanbree. 1981. *Stenella-clymene*, a rediscovered tropical dolphin of the Atlantic. Journal of Mammalogy 62(3):583–598. doi: 10.2307/1380405

Price, W.S. 1985. Whaling in the Caribbean: Historical perspective and update. Reports of the International Whaling Commission 35:413–420.

Reeves, R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. Reports of the International Whaling Commission 38(445-447).

Rinaldi, C., R. Rinaldi, and P. Sahagian. 2006. Report of surveys conducted on small cetaceans off Guadeloupe 1998 to 2005. SC/58/SM17. Reports of the International Whaling Commission:1–4.

Rodriguez-Ferrer, G., R. Reyes, N.M. Hammerman, and J.E. García-Hernández. 2018. Cetacean sightings in Puerto Rican waters: including the first underwater photographic documentation of a minke whale (*Balaenoptera acutorostrata*). Latin American Journal of Aquatic Mammals 13(1-2):26–36. doi: 10.5597/00246

Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo di Sciara. 2001. Cetaceans of Venezuela: Their distribution and conservation status. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS 151. 60 p.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February–March 2001. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-463. 62 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Vail, C. 2005. Socio-economic assessment of marine mammal utilization in the wider Caribbean region: Captivity, viewing and hunting. Information paper presented at the United Nations Environment Programme Regional Workshop of Experts on the Development of the Marine Mammal Action Plan for the Wider Caribbean Region, Barbados, 18-21 July 2005.

van Waerebeek, K., M. Sequeira, C. Williamson, G.P. Sanino, P. Gallego, and P. Carmo. 2006. Live-captures of common bottlenose dolphins *Tursiops truncatus* and unassessed bycatch in Cuban waters: Evidence of sustainability found wanting. Latin American Journal of Aquatic Mammals 5(1):39–48. doi: 10.5597/lajam00090

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2011. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-221. 319 p.

Whitall, D.R., A.L. Mason, M.H. Fulton, E.F. Wirth, D. Wehner, A. Ramos, A.S. Pait, B. West, E. Pisarski, B. Shaddrix, and L.A. Reed. 2016. Chemical contaminants in the marine resources of Vieques, Puerto Rico. National Oceanic Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science: Silver Spring, MD. NOAA Technical Memorandum NOS-NCCOS-223. 70 p. doi: 10.7289/V5/TM-NOS-NCCOS-223

Whitt, A.D., T.A. Jefferson, M. Blanco, D. Fertl, and D. Rees. 2011. A review of marine mammal records of Cuba. Latin American Journal of Aquatic Mammals 9(2):65–122. doi: 10.5597/lajam00175

World Council of Whalers. 2008. World whaling – Caribbean. http://www.worldwhalers.com/whaling_around_the_world/caribbean.htm

Stenella sp. − *Stenella sp.*

Western North Atlantic Stock Group

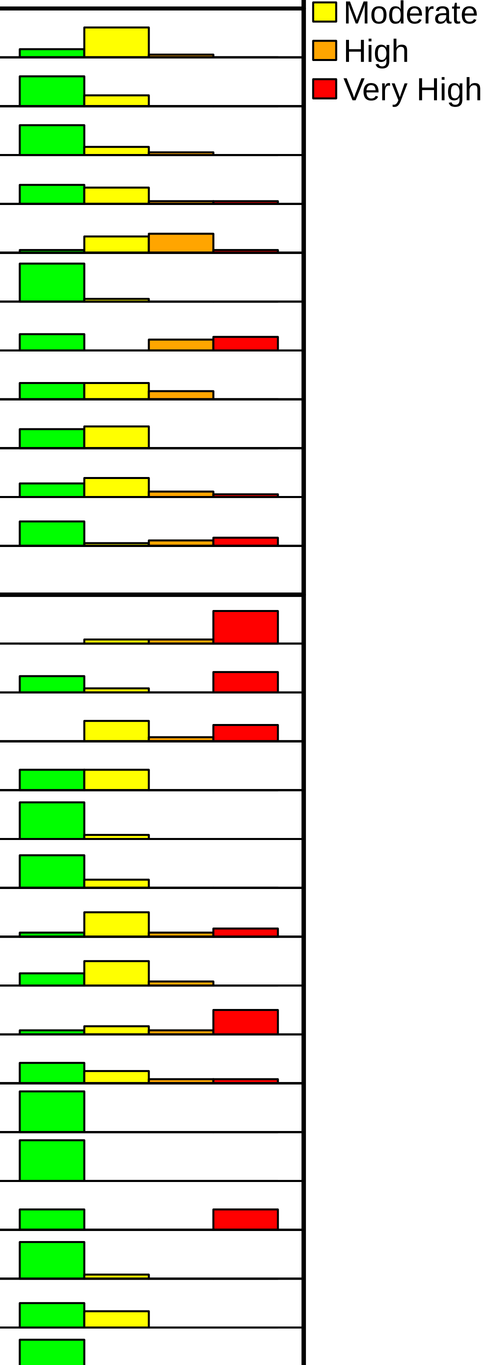
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = High

Data Quality = 74% of scores ≥ 2

	Stenella sp.	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.9	2.3	
	Habitat Specificity	1.3	2.0	
	Site Fidelity	1.3	1.7	
	Lifetime Reproductive Potential	1.7	2.0	
	Generation Length	2.5	2.0	
	Reproductive Plasticity	1.1	1.7	
	Migration	2.5	1.0	
	Home Range	1.8	2.0	
	Stock Abundance	1.5	2.3	
	Stock Abundance Trend	1.9	0.0	
	Cumulative Stressors	1.9	2.3	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.7	2.5	
	Sea Surface Temperature (Change in variability)	2.6	2.5	
	Air Temperature (Change in mean)	2.9	2.0	
	Air Temperature (Change in variability)	1.5	2.5	
	Precipitation (Change in mean)	1.1	1.5	
	Precipitation (Change in variability)	1.2	1.5	
	Sea Surface Salinity (Change in mean)	2.4	2.5	
	Sea Surface Salinity (Change in variability)	1.8	2.5	
	Ocean pH (Change in mean)	3.2	2.5	
	Ocean pH (Change in variability)	1.8	2.0	
	Sea ice coverage (Change in mean)	1.0	2.5	
	Sea ice coverage (Change in variability)	1.0	2.5	
	Dissolved oxygen (Change in mean)	2.5	2.0	
	Dissolved oxygen (Change in variability)	1.1	1.5	
	Circulation	1.4	2.0	
	Sea level rise	1.1	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		Moderate		



Stenella sp. (Western North Atlantic Stock Group)

Stenella clymene; Stenella attenuata; Stenella longirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (34% certainty from bootstrap analysis).

Climate Exposure: High. Two exposure factors scored greater than 3.0: Sea Surface Temperature (Standard anomaly) (3.7) and Ocean pH (Standard anomaly) (3.2).

Biological Sensitivity: Moderate. Two sensitivity attributes scored greater than 2.5: Generation Time (2.53) and Migration (2.53).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 74% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The *Stenella* sp. group in the Western North Atlantic includes Clymene dolphins (*Stenella clymene*), pantropical spotted dolphins (*Stenella attenuata*), and spinner dolphins (*Stenella longirostris*) that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020). Atlantic spotted dolphins (*Stenella frontalis*) and striped dolphins (*Stenella coeruleoalba*) in the western North Atlantic are considered separately in this assessment.

Prey/Diet Specificity

Based on stomach content analysis of two individuals and one observation of feeding free-ranging dolphins, Clymene dolphins feed on small pelagic fish and squid (Perrin et al. 1981; Fertl et al. 1997).

Pantropical spotted dolphins consume a wide variety of prey that includes epipelagic fish, squid, and crustaceans (Perrin and Hohn 1994). Pauly et al. (1998) report diet composition of 30% small squids, 20% large squids, 10% small pelagic fishes, and 40% miscellaneous fishes. Studies in the Eastern Tropical Pacific and Hawaii suggest that pantropical spotted dolphins feed primarily at night on epipelagic species and species associated with the deep scattering layer (Robertson and Chivers 1997; Scott and Cattanach 1998; Baird et al. 2001).

Spinner dolphins feed primarily on small mesopelagic fishes, squids, and sergestid shrimps, following both vertical and horizontal diel prey migrations (Perrin and Gilpatrick 1994; Benoit-Bird et al. 2001; Benoit-Bird and Au 2003; Benoit-Bird and Au 2004). Pauly et al. (1998) reported species-level diet composition of 20% small squids, 20% large squids, 40% mesopelagic fishes, and 20% miscellaneous fishes.

Habitat Specificity

Stenella sp. in the western North Atlantic are most frequently found in deep offshore waters (Schmidly 1981; CETAP 1982; Waring et al. 1992; Perrin and Gilpatrick 1994; Fertl et al. 2003).

Site Fidelity

Information regarding *Stenella* sp. site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported Clymene dolphin, pantropical spotted dolphin, and spinner dolphin interbirth interval of 3.00 years based on values reported by Kasuya (1985), Perrin and Gilpatrick (1994), Myrick et al. (1986), Perrin and Hohn (1994), and Calzada et al. (1996).

Taylor et al. (2007) reported Clymene dolphin age at first reproduction of 7 years; pantropical spotted dolphin age at first reproduction of 13 years and age at last reproduction of 45 years (observed) and 33 years (estimated) based on values reported by Myrick et al. (1986) and Perrin and Hohn (1994); and spinner dolphin age at first reproduction of 7 years and age at last reproduction of 26 years (observed) and 30 years (estimated) based on values reported by Miyazaki (1984).

Generation Length

Taylor et al. (2007) reported Clymene dolphin generation length of 14.0 years at $r = 0.02$ and 14.7 years at $r = 0.0$; pantropical spotted dolphin generation length of 22.7 years at $r < 0.005$ and 23.1 years at $r = 0.0$; and spinner dolphin generation length of 13.3 years at $r = 0.01$ and 13.7 years at $r = 0.0$.

Reproductive Plasticity

Calving peaks in range from late spring to fall (Jefferson et al. 2015). Information regarding *Stenella* sp. breeding habitat and location for the western North Atlantic was not found in the literature.

Migration

Information regarding *Stenella* sp. migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Information regarding *Stenella* sp. home range in the western North Atlantic was not found in the literature.

Stock Abundance

The abundance of western North Atlantic Clymene dolphins is estimated to be 4,237 individuals (CV=1.03), Pantropical spotted dolphins is estimated to be 6,593 individuals (CV=0.52), and spinner dolphins is estimated to be 4,102 individuals (CV=0.99), based on 2017 and 2018 surveys (Garrison 2020; Palka 2020). Previously, the stock group was estimated at 11,441 individuals (CV=0.83) based on a summer 2009 oceanic survey (Waring et al. 2013).

Stock Abundance Trend

Data are insufficient to determine the abundance trend for this stock (Hayes et al. 2020).

Cumulative Stressors

Stenella sp. in the western North Atlantic may interact with longline fisheries. During the period 2013–2017, annual fishery-related mortality was estimated to be zero; however, this may be an underestimate due to low observer coverage (Garrison and Stokes 2014, 2016, 2017, 2019, 2020; Hayes et al. 2020). During the same period, one Clymene dolphin, five pantropical spotted dolphins, and two spinner dolphins were reported stranded along the U.S. Atlantic Coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2020).

Distribution and Sightings

Density model results for *Stenella* sp*.* in the western North Atlantic are presented by Roberts et al. (2015a, 2015b, 2015c, 2016a, 2016b, 2017, 2018), Mannocci et al. (2017), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b). Additional sighting data are presented by Palka et al. (2021c).

Further Reading

Braulik, G. and R. Reeves. 2018. *Stenella longirostris* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T20733A156927622. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20733A156927622.en

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Jefferson, T.A. 2018. Clymene dolphin: *Stenella clymene*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 197–200. doi: 10.1016/B978-0-12-804327-1.00093-5

Jefferson, T.A. and G. Braulik. 2018. *Stenella clymene*. The IUCN Red List of Threatened Species 2018: e.T20730A50373865. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20730A50373865.en

Kiszka, J. and G. Braulik. 2018. *Stenella attenuata*. The IUCN Red List of Threatened Species 2018: e.T20729A50373009. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T20729A50373009.en

Perrin, W.F. 2018. Pantropical spotted dolphin: *Stenella attenuata*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 676–678. doi: 10.1016/B978-0-12-804327-1.00189-8

Perrin, W.F. 2018. Spinner dolphin: *Stenella longirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 925–928. doi: 10.1016/B978-0-12-804327-1.00243-0

References

Baird, R.W., A.D. Ligon, S.K. Hooker, and A.M. Gorgone. 2001. Subsurface and nighttime behaviour of pantropical spotted dolphins in Hawai'i. Canadian Journal of Zoology 79(6):988–996. doi: 10.1139/z01-070

Benoit-Bird, K.J. and W.W.L. Au. 2003. Prey dynamics affect foraging by a pelagic predator (*Stenella longirostris*) over a range of spatial and temporal scales. Behavioral Ecology and Sociobiology 53(6):364–373. doi: 10.1007/s00265-003-0585-4

Benoit-Bird, K.J. and W.W.L. Au. 2004. Diel migration dynamics of an island-associated sound-scattering layer. Deep Sea Research Part I: Oceanographic Research Papers 51(5):707–719. doi: 10.1016/j.dsr.2004.01.004

Benoit-Bird, K.J., W.W.L. Au, R.E. Brainard, and M.O. Lammers. 2001. Diel horizontal migration of the Hawaiian mesopelagic boundary community observed acoustically. Marine Ecology Progress Series 217:1–14. doi: 10.3354/meps217001

Calzada, N., A. Aguilar, T.B. Sorenson, and C. Lockyer. 1996. Reproductive biology of female striped dolphin (*Stenella coeruleoalba*) from the western Mediterranean. The Zoological Society of London 240:581–591.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Fertl, D., T.A. Jefferson, I.B. Moreno, A.N. Zerbini, and K.D. Mullin. 2003. Distribution of the Clymene dolphin *Stenella clymene*. Mammal Review 33(3-4):253–271. doi: 10.1046/j.1365-2907.2003.00033.x

Fertl, D., A.J. Schiro, and D. Peake. 1997. Coordinated feeding by Clymene dolphins (*Stenella clymene*) in the Gulf of Mexico. Aquatic Mammals 23(2):111–112.

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Garrison, L.P. and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-667. 61 p.

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2015. Marine mammals of the world (second edition). Academic Press, San Diego, CA. 616 p. doi: 10.1016/c2012-0-06919-0

Kasuya, T. 1985. Effect of exploitation of on reproductive parameters of the spotted and striped dolphins off the Pacific coast of Japan. Scientific Reports of the Whales Research Institute, Tokyo 36:107–138.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Miyazaki, N. 1984. Further analyses of reproduction in the striped dolphin, *Stenella coeruleoalba*, off the Pacific coast of Japan. In: Perrin, W.F., R.L. Brownell, Jr., and D. DeMaster (Eds.), Reproduction in Whales, Dolphins and Propoises. Report of the International Whaling Commission (special issue 6). pp. 343–354.

Myrick, A.C., JR., , A. Hohn, J. Barlow, and P.A. Sloan. 1986. Reproductive biology of female spotted dolphins *Stenella attenuata* from the eastern tropical Pacific. Fishery Bulletin 84:247–259.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021c. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix II species distribution maps of sightings not used in density-habitat models. US

Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perrin, W.F. and J.W. Gilpatrick, Jr. 1994. Spinner dolphin--*Stenella longirostris* (Gray, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 99–128.

Perrin, W.F. and A.A. Hohn. 1994. Pantropical spotted dolphin-*Stenella attenuata*. In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 71–98.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, and P.J.H. Vanbree. 1981. *Stenella-clymene*, a rediscovered tropical dolphin of the Atlantic. Journal of Mammalogy 62(3):583–598. doi: 10.2307/1380405

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015a. Density model for Clymene dolphin (*Stenella clymene*) for the U.S. East Coast version 1.2, 2015-09-26, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 140 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015b. Density model for pantropical spotted dolphin (*Stenella attenuata*) for the U.S. East Coast version 2.3, 2015-10-06, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 87 p.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015c. Density model for spinner dolphin (*Stenella longirostris*) for the U.S. East Coast version 1.1, 2015-05-14, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 140 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Robertson, K.M. and S.J. Chivers. 1997. Prey occurrence in pantropical spotted dolphins, *Stenella attenuata*, from the eastern tropical Pacific. Fishery Bulletin 95(2):334–348.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States coast and Gulf of Mexico. Washington, DC. FWS/OBS-80/41. 163 p.

Scott, M.D. and K.L. Cattanach. 1998. Diel patterns in aggregations of pelagic dolphins and tunas in the Eastern Pacific. Marine Mammal Science 14(3):401–422. doi: 10.1111/j.1748-7692.1998.tb00735.x

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2012. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-223. 419 p.

Striped dolphin − *Stenella coeruleoalba*

Northern Gulf of Mexico Stock

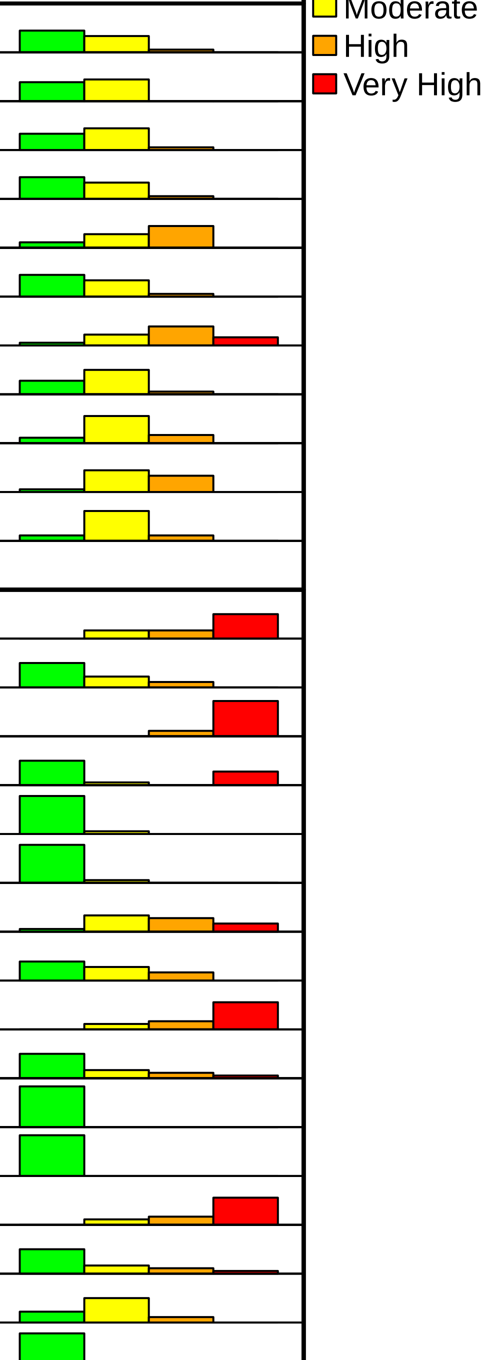
Overall Vulnerability Rank = Moderate

Biological Sensitivity = Low

Climate Exposure = Very High

Data Quality = 78% of scores ≥ 2

	Stenella coeruleoalba	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.5	2.3	
	Habitat Specificity	1.5	2.3	
	Site Fidelity	1.7	1.3	
	Lifetime Reproductive Potential	1.5	2.7	
	Generation Length	2.4	2.7	
	Reproductive Plasticity	1.5	1.7	
	Migration	2.8	1.3	
	Home Range	1.7	1.3	
	Stock Abundance	2.1	3.0	
	Stock Abundance Trend	2.3	1.7	
	Cumulative Stressors	2.0	1.7	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.4	3.0	
	Sea Surface Temperature (Change in variability)	1.5	3.0	
	Air Temperature (Change in mean)	3.9	3.0	
	Air Temperature (Change in variability)	2.1	3.0	
	Precipitation (Change in mean)	1.1	3.0	
	Precipitation (Change in variability)	1.1	3.0	
	Sea Surface Salinity (Change in mean)	2.7	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	3.5	3.0	
	Ocean pH (Change in variability)	1.7	3.0	
	Sea ice coverage (Change in mean)	1.0	3.0	
	Sea ice coverage (Change in variability)	1.0	3.0	
	Dissolved oxygen (Change in mean)	3.5	3.0	
	Dissolved oxygen (Change in variability)	1.7	3.0	
	Circulation	1.9	2.7	
	Sea level rise	1.1	2.3	
	Exposure Score	Very High		
Overall Vulnerability Rank		Moderate		



Striped dolphin (Northern Gulf of Mexico Stock)

Stenella coeruleoalba

CVA Results Summary

Overall Climate Vulnerability Rank: Moderate (50% certainty from bootstrap analysis).

Climate Exposure: Very High. Three exposure factors scored greater than or equal to 3.5: Air Temperature (Standard anomaly) (3.87), Dissolved oxygen (Standard anomaly) (3.53), and Ocean pH (Standard anomaly) (3.53).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Migration (2.80).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 78 % of the data quality scores were 2 or greater. 45 % of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The striped dolphin Northern Gulf of Mexico stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the Gulf of Mexico. However, this stock is likely transboundary and the stock area probably includes similar Mexican and Cuban Gulf of Mexico waters (Hayes et al. 2021).

Prey/Diet Specificity

Striped dolphin prey includes mid-water fishes and squids (Archer 2018). Pauly et al. (1998) reported striped dolphin diet composition of 5% benthic invertebrates, 20% small squids, 15% large squids, 5% small pelagic fishes, 30% mesopelagic fishes, and 25% miscellaneous fishes. In the Bay of Biscay, Spitz et al. (2006) reported stranded dolphin stomach contents consisted primarily of fish (91% of diet by number and 61% by mass) and included species from oceanic, neritic, and coastal environments.

Habitat Specificity

Striped dolphins in the northern Gulf of Mexico are found in oceanic waters beyond the continental shelf (Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Striped dolphins have been found associated with convergence zones and upwelling (Au and Perryman 1985). Garrison and Aichinger Dias (2020) reported an overall uniform distribution of striped dolphins in the Gulf of Mexico, with a slight concentration south of Mobile Bay, in waters over the lower slope (>1000 m depth) and abyssal plain.

Site Fidelity

Information regarding striped dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported striped dolphin interbirth interval of 3.38 years based on values reported by Kasuya (1972). Taylor et al. (2007) reported striped dolphin age at first reproduction of 11 years and age at last reproduction of 49 years (observed) and 33 years (estimated) based on values reported by Kasuya (1972) and Miyazaki (1984). However, Archer and Perrin (1999) estimated females become sexually mature between 5 and 13 years of age.

Generation Length

Taylor et al. (2007) reported generation length of 21.8 years at r = 0.01 and 22.5 years at r = 0.0 based on values reported by Kasuya (1972) and Miyazaki (1984).

Reproductive Plasticity

Information regarding specific breeding locations and habitat was not found in the literature. Perrin et al. (1994) found two calving peaks (one in summer and one in winter) in waters off Japan.

Migration

Information regarding striped dolphin migration was not found in the literature; however, striped dolphins were observed in the northern Gulf of Mexico in all seasons during GulfCet aerial surveys between 1992 and 1998 (Hansen et al. 1996; Mullin and Hoggard 2000).

Home Range

Striped dolphins in the Gulf of Mexico are typically found in oceanic waters (Mullin and Fulling 2004; Maze-Foley and Mullin 2006).

Stock Abundance

The abundance of northern Gulf of Mexico striped dolphins is estimated to be 1,817 individuals (CV=0.56), based on 2017 and 2018 oceanic surveys (Garrison et al. 2020). Previously, the stock was estimated at 1,849 individuals (CV=0.77) based on a summer 2009 oceanic survey (Waring et al. 2013).

Stock Abundance Trend

Four point estimates of striped dolphin abundance have been made based on data from surveys in 2003 5,494(; CV=0.43), 2004 (10,764; CV=0.51), 2009 (3,060; CV=0.73), and 2018 (3,633; CV=0.56). Pairwise comparisons of the log-transformed means were conducted between years, and there were no significant differences between survey years (see Garrison et al. 2020 and Hayes et al. 2021).However, the ability to detect a trend in this stock's abundance is confounded by poor precision and long survey intervals (Hayes et al. 2021).

Cumulative Stressors

Striped dolphins in the northern Gulf of Mexico may interact with longline fisheries. In the 2014–2018 time period, fishery-induced mortality was zero (Garrison and Stokes 2016, 2017, 2019, 2020a, 2020b). During the same period, one striped dolphin was reported stranded in Florida (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, as cited in Hayes et al. 2021).

The striped dolphin stock was likely exposed to oil and dispersants resulting from the Deepwater Horizon oil spill, which may result in long term chronic health effects (NOAA 2011; Helm et al. 2015; DWH NRDA 2016). An Unusual Mortality Event (UME), involving primarily bottlenose dolphins, was declared for cetaceans in the northern Gulf of Mexico from 2010 to 2014, with the Deepwater Horizon oil spill as the primary underlying cause (Litz et al. 2014; Schwacke et al. 2014; Venn-Watson et al. 2015).

Distribution and Sightings

Density model results for Atlantic spotted dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016) and Mannocci et al. (2017).

Further Reading

Archer, F.I., II. 2018. Striped dolphin: *Stenella coeruleoalba*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 954–956. doi: 10.1016/B978-0-12-804327-1.00251-X

Braulik, G. 2019. *Stenella coeruleoalba*. The IUCN Red List of Threatened Species 2019: e.T20731A50374282. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T20731A50374282.en.

Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, VA. 445 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-271. 394 p.

References

Archer, F.I., II. 2018. Striped dolphin: *Stenella coeruleoalba*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 954–956. doi: 10.1016/B978-0-12-804327-1.00251-X

Archer, F.I., II and W.F. Perrin. 1999. *Stenella coeruleoalba*. Mammalian Species 603:1–9. doi: 10.2307/3504476

Au, D.W.K. and W.L. Perryman. 1985. Dolphin habitats in the Eastern Tropical Pacific. Fishery Bulletin 83(4):623–643.

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA). 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.1659.

Garrison, L.P. and L. Aichinger Dias. 2020. Distribution and abundance of cetaceans in the northern Gulf of Mexico. National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-747. 40 p.

Garrison, L.P., J. Ortega-Ortiz, and G. Rappucci. 2020. Abundance of marine mammals in waters of the U.S. Gulf of Mexico during the summers of 2017 and 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2020-07. 56 p. doi: 10.25923/3px6-9v48

Garrison, L.P. and L. Stokes. 2016. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2014. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-696. 62 p. doi: 10.7289/V5/TM-SEFSC-696

Garrison, L.P. and L. Stokes. 2017. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2015. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. NOAA Technical Memorandum NMFS-SEFSC-709. 61 p. doi: 10.25923/kaf6-5c33

Garrison, L.P. and L. Stokes. 2019. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD-2019-01. 43 p. doi: 10.25923/d893-d142

Garrison, L.P. and L. Stokes. 2020a. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2017. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-05. 58 p. doi: 10.25923/a3hs-ea60

Garrison, L.P. and L. Stokes. 2020b. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center: Miami, FL. Southeast Fisheries Science Center Reference Document PRBD 2020-08. 44 p. doi: 10.25923/777n-w316

Hansen, L.J., K.D. Mullin, T.J. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. In: Davis, R.W. and G.S. Fargion (Eds.), Distribution and abundance of marine mammals in the northcentral and western Gulf of Mexico: Final report. Volume II: Technical report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 55–132.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2020. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-271. 394 p.

Helm, R.C., D.P. Costa, T.D. DeBruyn, T.J. O'Shea, R.S. Wells, and T.M. Williams. 2015. Overview of effects of oil spills on marine mammals. In: Fingas, M. (Ed.), Handbook of oil spill science and technology, First edition. John Wiley & Sons, Inc., Hoboken, NJ. pp. 455–475.

Kasuya, T. 1972. Growth and reproduction of *Stenella coeruleoalba* based on the age determination by means of dentinal growth layers. Scientific Reports of the Whales Research Institute, Tokyo 24:57–79.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990–2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112(2):161–175. doi: 10.3354/dao02807

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203–213.

Miyazaki, N. 1984. Further analyses of reproduction in the striped dolphin, *Stenella coeruleoalba*, off the Pacific coast of Japan. In: Perrin, W.F., R.L. Brownell, Jr., and D. DeMaster (Eds.), Reproduction in Whales, Dolphins and Propoises. Report of the International Whaling Commission (special issue 6). pp. 343–354.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996-2001. Marine Mammal Science 20(4):787–807. doi: 10.1111/j.1748-7692.2004.tb01193.x

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. In: Davis, R.W., W.E. Evans, and B. Würsig (Eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. pp. 111–172.

National Oceanic and Atmospheric Administration (NOAA). 2011. Public scoping for preparation of a programmatic environmental impact statement for the Deepwater Horizon BP Oil Spill. 9 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perrin, W.F., C.E. Wilson, and F.I. Archer, II. 1994. Striped dolphin--*Stenella coeruleoalba* (Meyen, 1833). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 129–159.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for striped dolphin (*Stenella coeruleoalba*) for the U.S. Gulf of Mexico version 2.3, 2015-10-05, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 65 p.

Spitz, J., E. Richard, L. Meynier, C. Pusineri, and V. Ridoux. 2006. Dietary plasticity of the oceanic striped dolphin, *Stenella coeruleoalba*, in the neritic waters of the Bay of Biscay. Journal of Sea Research 55(4):309–320. doi: 10.1016/j.seares.2006.02.001

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5):e0126538. doi: 10.1371/journal.pone.0126538

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2012. National Oceanic and Atmospheric Administration, National

Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-223. 419 p.

Striped dolphin − *Stenella coeruleoalba*

Western North Atlantic Stock

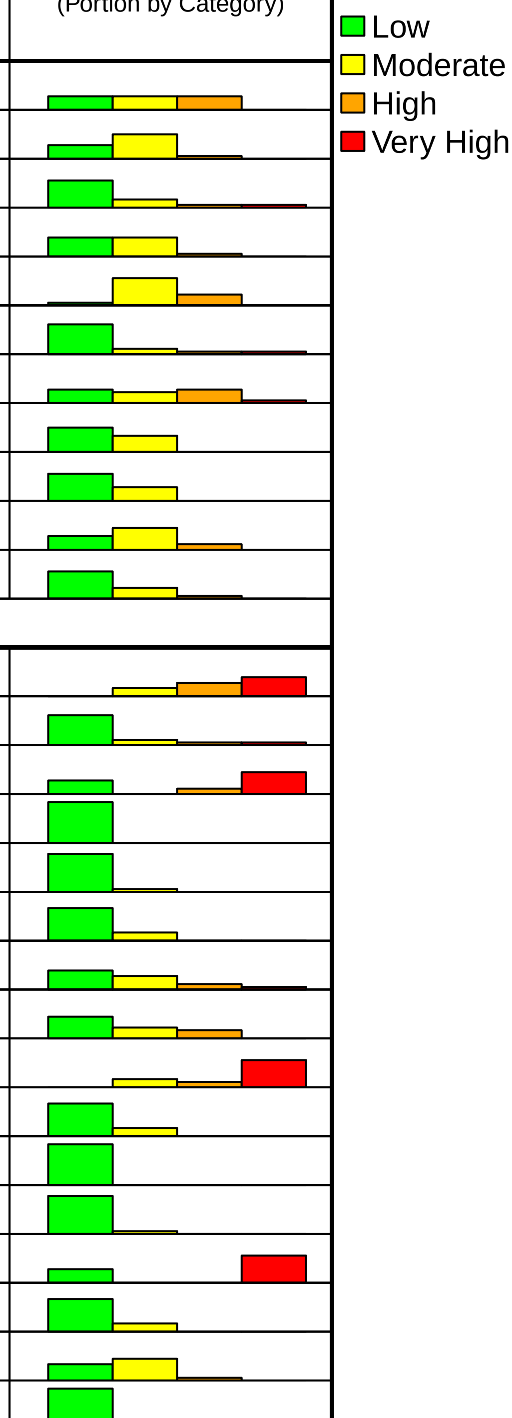
Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = High

Data Quality = 85% of scores ≥ 2

	Stenella coeruleoalba	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.0	2.0	
	Habitat Specificity	1.7	2.3	
	Site Fidelity	1.5	1.7	
	Lifetime Reproductive Potential	1.6	2.3	
	Generation Length	2.2	2.0	
	Reproductive Plasticity	1.5	2.0	
	Migration	2.1	1.7	
	Home Range	1.4	1.7	
	Stock Abundance	1.3	3.0	
	Stock Abundance Trend	1.8	1.3	
	Cumulative Stressors	1.4	2.3	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.3	2.7	
	Sea Surface Temperature (Change in variability)	1.5	2.0	
	Air Temperature (Change in mean)	2.9	2.7	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.1	2.0	
	Precipitation (Change in variability)	1.2	2.0	
	Sea Surface Salinity (Change in mean)	1.8	2.7	
	Sea Surface Salinity (Change in variability)	1.7	2.7	
	Ocean pH (Change in mean)	3.5	3.0	
	Ocean pH (Change in variability)	1.2	2.7	
	Sea ice coverage (Change in mean)	1.0	2.7	
	Sea ice coverage (Change in variability)	1.1	2.7	
	Dissolved oxygen (Change in mean)	3.0	3.0	
	Dissolved oxygen (Change in variability)	1.2	2.7	
	Circulation	1.7	2.3	
	Sea level rise	1.0	2.3	
	Exposure Score	High		
Overall Vulnerability Rank		Low		



Striped dolphin (Western North Atlantic Stock)

Stenella coeruleoalba

CVA Results Summary

Overall Climate Vulnerability Rank: Low (99% certainty from bootstrap analysis).

Climate Exposure: High. Three exposure factors scored greater than or equal to 3.0: Ocean pH (Standard anomaly) (3.47), Sea Surface Temperature (Standard anomaly) (3.27), and Dissolved oxygen (Standard anomaly) (3.00).

Biological Sensitivity: Low. No sensitivity attributes scored greater than 2.5.

Distributional Response: High

Abundance Response: Low

Phenology Response: Moderate

Data Quality: 85% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The striped dolphin western North Atlantic stock includes individuals found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic. However, this stock is likely transboundary and the stock area probably includes similar adjacent offshore, Canadian, and Caribbean waters (Hayes et al. 2020).

Prey/Diet Specificity

Striped dolphin prey includes mid-water fishes and squids (Archer 2018). Pauly et al. (1998) reported striped dolphin diet composition of 5% benthic invertebrates, 20% small squids, 15% large squids, 5% small pelagic fishes, 30% mesopelagic fishes, and 25% miscellaneous fishes. In the Bay of Biscay, Spitz et al. (2006) reported stranded dolphin stomach contents consisted primarily of fish (91% of diet by number and 61% by mass) and included species from oceanic, neritic, and coastal environments.

Habitat Specificity

Striped dolphins in the Western North Atlantic are found most often in waters offshore of the continental shelf edge (Leatherwood et al. 1976; Schmidly 1981; CETAP 1982; Perrin et al. 1994; Mullin and Fulling 2003). Striped dolphins have been found associated with the Gulf Stream and warm-core rings (Waring et al. 1992), often in waters between 20˚ and 27˚ C and deeper than 900m (Palka 1997). Striped dolphins have been observed in the deeper and warmer waters of the Gully off the eastern Nova Scotia shelf (Gowans and Whitehead 1995; Baird et al. 1997).

Site Fidelity

Information regarding striped dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported striped dolphin interbirth interval of 3.38 years based on values reported by Kasuya (1972). Taylor et al. (2007) reported striped dolphin age at first reproduction of 11 years and age at last reproduction of 49 years (observed) and 33 years (estimated) based on values reported by Kasuya (1972) and Miyazaki (1984). However, Archer and Perrin (1999) estimated females become sexually mature between 5 and 13 years of age.

Generation Length

Taylor et al. (2007) reported generation length of 21.8 years at r = 0.01 and 22.5 years at r = 0.0 based on values reported by Kasuya (1972) and Miyazaki (1984).

Reproductive Plasticity

Information regarding specific breeding locations and habitat was not found in the literature. Perrin et al. (1994) found two calving peaks (one in summer and one in winter) in waters off Japan.

Migration

Information regarding striped dolphin migration was not found in the literature.

Home Range

Striped dolphins in the Western North Atlantic are typically found in oceanic waters (Leatherwood et al. 1976; Schmidly 1981; CETAP 1982; Perrin et al. 1994; Mullin and Fulling 2003).

Stock Abundance

The most recent abundance estimate for this stock is 67,036 individuals (CV=0.29), based on 2016 surveys from Florida to the lower Bay of Fundy (Garrison 2020; Palka 2020). Previously, the best abundance estimate of 54,807 individuals (CV=0.3) was derived from 2011 survey estimates (Waring et al. 2014).

Stock Abundance Trend

Insufficient data exist to calculate a stock abundance trend (Hayes et al. 2020).

Cumulative Stressors

Striped dolphins in the western North Atlantic may interact with gillnet and longline fisheries (Perrin et al. 1994). However, in the 2007-2011 time period, fishery-induced mortality was zero (Waring et al. 2014). During the same period, 19 Atlantic spotted dolphins were reported stranded between New York and Florida, one of which had documented signs of human interactions with propeller wounds (Waring et al. 2014).

Distribution and Sightings

Density model results for Atlantic spotted dolphin in the Gulf of Mexico are presented by Roberts et al. (2015, 2016a, 2016b, 2017, 2018), Mannocci et al. (2017), Chavez-Rosales et al. (2019), and Palka et al. (2021a, 2021b).

Further Reading

Archer, F.I., II. 2018. Striped dolphin: *Stenella coeruleoalba*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 954–956. doi: 10.1016/B978-0-12-804327-1.00251-X

Braulik, G. 2019. *Stenella coeruleoalba*. The IUCN Red List of Threatened Species 2019: e.T20731A50374282. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T20731A50374282.en.

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Literature Cited

Archer, F.I., II. 2018. Striped dolphin: *Stenella coeruleoalba*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 954–956. doi: 10.1016/B978-0-12-804327-1.00251-X

Archer, F.I., II and W.F. Perrin. 1999. *Stenella coeruleoalba*. Mammalian Species 603:1–9. doi: 10.2307/3504476

Baird, R.W., S.K. Hooker, H. Whitehead, and R. Etcheberry. 1997. A review of records of striped dolphins (*Stenella coeruleoalba*) from Canadian waters. International Whaling Commission Scientific Committee. IWC Doc. SC/49/SM4. 10 p.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Chavez-Rosales, S., D.L. Palka, L.P. Garrison, and E.A. Josephson. 2019. Environmental predictors of habitat suitability and occurrence of cetaceans in the western North Atlantic Ocean. Scientific Reports 9(1):5833. doi: 10.1038/s41598-019-42288-6

Garrison, L.P. 2020. Abundance of marine mammals in waters of the U.S. southeastern Atlantic during summer 2016. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Protected Resources and Biodiversity Division: Miami, FL. PRBD-2020-04. 17 p.

Gowans, S. and H. Whitehead. 1995. Distribution and habitat partitioning by small odontocetes in the Gully, a submarine-canyon on the Scotian-Shelf. Canadian Journal of Zoology 73(9):1599–1608. doi: 10.1139/z95-190

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Kasuya, T. 1972. Growth and reproduction of *Stenella coeruleoalba* based on the age determination by means of dentinal growth layers. Scientific Reports of the Whales Research Institute, Tokyo 24:57–79.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic: A guide to their identification. National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Seattle, WA. NOAA Technical Report NMFS CIRC-396. 176 p.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Miyazaki, N. 1984. Further analyses of reproduction in the striped dolphin, *Stenella coeruleoalba*, off the Pacific coast of Japan. In: Perrin, W.F., R.L. Brownell, Jr., and D. DeMaster (Eds.), Reproduction in Whales, Dolphins and Propoises. Report of the International Whaling Commission (special issue 6). pp. 343–354.

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603–613.

Palka, D. 2020. Cetacean abundance estimates in US northwestern Atlantic Ocean waters from summer 2016 line transect surveys conducted by the Northeast Fisheries Science Center. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 20-05. 60 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D.L. 1997. A review of striped dolphins (*Stenella coeruleoalba*) in U.S. Atlantic waters. IWC Doc. SC/49/SM26. 13 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Perrin, W.F., C.E. Wilson, and F.I. Archer, II. 1994. Striped dolphin--*Stenella coeruleoalba* (Meyen, 1833). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of marine mammals. Volume 5: The first book of dolphins. Academic Press, San Diego, CA. pp. 129–159.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for striped dolphin (*Stenella coeruleoalba*) for the U.S. East Coast version 3.3, 2015-10-05, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 150 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Roberts, J.J., L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 113 p.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States coast and Gulf of Mexico. Washington, DC. FWS/OBS-80/41. 163 p.

Spitz, J., E. Richard, L. Meynier, C. Pusineri, and V. Ridoux. 2006. Dietary plasticity of the oceanic striped dolphin, *Stenella coeruleoalba*, in the neritic waters of the Bay of Biscay. Journal of Sea Research 55(4):309–320. doi: 10.1016/j.seares.2006.02.001

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Van Waerebeek, K., F. Félix, B. Haase, D.M. Palacios, D.M. Mora-Pinto, and M. Muñoz-Hincapié. 1998. Inshore records of the striped dolphin, *Stenella coeruleoalba*, from the Pacific coast of South America. Reports of the International Whaling Commission 48:525–532.

Waring, G., E. Josephson, K. Maze-Foley, and P. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-228. 464 p. doi: 10.7289/V51G0J70

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

True's beaked whale − *Mesoplodon mirus*

Western North Atlantic Stock

Overall Vulnerability Rank = High

Biological Sensitivity = Moderate

Climate Exposure = Very High

Data Quality = 44% of scores ≥ 2

	Mesoplodon mirus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	2.5	1.4	
	Habitat Specificity	2.0	1.6	
	Site Fidelity	2.6	0.8	
	Lifetime Reproductive Potential	2.5	0.4	
	Generation Length	2.4	0.6	
	Reproductive Plasticity	1.9	0.2	
	Migration	2.8	0.6	
	Home Range	2.6	0.8	
	Stock Abundance	2.4	1.2	
	Stock Abundance Trend	2.3	0.8	
	Cumulative Stressors	2.2	1.6	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature (Change in mean)	3.6	1.8	
	Sea Surface Temperature (Change in variability)	1.0	2.0	
	Air Temperature (Change in mean)	4.0	2.0	
	Air Temperature (Change in variability)	1.0	2.2	
	Precipitation (Change in mean)	1.1	2.0	
	Precipitation (Change in variability)	1.6	2.0	
	Sea Surface Salinity (Change in mean)	2.6	1.8	
	Sea Surface Salinity (Change in variability)	2.1	1.6	
	Ocean pH (Change in mean)	4.0	2.2	
	Ocean pH (Change in variability)	1.4	2.0	
	Sea ice coverage (Change in mean)	1.1	2.0	
	Sea ice coverage (Change in variability)	1.0	2.0	
	Dissolved oxygen (Change in mean)	4.0	2.2	
	Dissolved oxygen (Change in variability)	1.4	2.0	
	Circulation	2.0	1.6	
	Sea level rise	1.6	2.6	
	Exposure Score	Very High		
Overall Vulnerability Rank		High		

Low
Moderate
High
Very High

True's beaked whale (Western North Atlantic Stock)

Mesoplodon mirus

CVA Results Summary

Overall Climate Vulnerability Rank: High (96% certainty from bootstrap analysis).

Climate Exposure: Very High. Four exposure factors scored greater than 3.5: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Air Temperature (Standard anomaly) (3.96), and Sea Surface Temperature (Standard anomaly) (3.60).

Biological Sensitivity: Moderate. Three sensitivity attributes scored greater than 2.5: Migration (2.80), Site Fidelity (2.64), and Home Range (2.60).

Distributional Response: Low

Abundance Response: Moderate

Phenology Response: Low

Data Quality: 44% of the data quality scores were 2 or greater. 0% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

True's beaked whale western North Atlantic stock includes individuals that reside in or visit waters of the U.S. Exclusive Economic Zone in the western North Atlantic and adjacent offshore waters (Hayes et al. 2020).

Prey/Diet Specificity

Pauly et al. (1998) reported species-level diet composition estimates of 50% small squids and 50% large squids.

Habitat Specificity

Beaked whales off the eastern U.S. are found along the Gulf Stream and its associated warm-core rings, and the continental shelf break (Waring et al. 1992; Tove 1995; Waring et al. 2001; Hamazaki 2002; Palka 2006). Beaked whales south of Georges Bank were found in waters with a mean SST of 20.7° to 24.9°C and 500 to 2,000m depth (Waring et al. 2003). Beaked whales in general inhabit continental slope and deep oceanic waters (>200 m; Waring et al. 2001; Cañadas et al. 2002; MacLeod et al. 2004; Ward et al. 2005; Ferguson et al. 2006; MacLeod and Mitchell 2006; Pitman 2018).

Site Fidelity

Information regarding True’s beaked whale site fidelity was not found in the literature.

Lifetime Reproductive Potential

Information regarding True's beaked whale reproductive interval was not found in the literature. Taylor et al. (2007) estimated age at last reproduction of 42 years.

Generation Length

Information regarding True's beaked whale generation length was not found in the literature.

Reproductive Plasticity

Information regarding True's beaked whale breeding season, location, and habitat was not found in the literature.

Migration

No information specifically describing True's beaked whale migratory behavior was found in the literature.

Home Range

Information regarding individual True's beaked whale home range was not found in the literature. Beaked whales in general inhabit continental slope and deep oceanic waters (>200 m; Waring et al. 2001; Cañadas et al. 2002; MacLeod et al. 2004; Ward et al. 2005; Ferguson et al. 2006; MacLeod and Mitchell 2006; Pitman 2018).

Stock Abundance

True's beaked whale abundance has not been estimated due to difficulty differentiating beaked whales to the species level in shipboard and aerial surveys. The abundance of *Mesoplodon sp.* beaked whales in the western North Atlantic is estimated to be 10,107 individuals (CV=0.27) based on 2016 surveys (Hayes et al. 2020).

Stock Abundance Trend

The data are insufficient to evaluate population trends for this stock (Hayes et al. 2020).

Cumulative Stressors

True's beaked whales in the western North Atlantic had an estimated annual fishing-related mortality of 0.2 during the period 2013–2017 (Hayes et al. 2020). During the same period, six True's beaked whales stranded along the U.S. Atlantic coast (NOAA National Marine Mammal Health and Stranding Response Database, as cited in Hayes et al. 2020).

Beaked whales generally are considered sensitive to anthropogenic noise, with multiple events worldwide resulting in injury, mortality, or mass stranding (D'Amico et al. 2009; Filadelfo et al. 2009; Frantzis 1998).

Distribution and Sightings

Density model results for beaked whales in the western North Atlantic are presented by Roberts et al. (2016a, 2016b, 2017), Mannocci et al. (2017), and Palka et al. (2021a, 2021b).

Further Reading

Department of the Navy. 2008. Marine Resources Assessment Update for the Charleston/Jacksonville Operating Area. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract #N62470-D-9997, CTO 0056. Prepared by Geo-Marine, Inc., Hampton, VA. 663 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

MacLeod, C.D. 2018. Beaked whales, overview. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 80–83. doi: 10.1016/B978-0-12-804327-1.00062-5

Pitman, R. 2018. Mesoplodon beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Pitman, R.L. and R.L. Brownell, Jr. 2020. *Mesoplodon mirus*. The IUCN Red List of Threatened Species 2020: e.T13250A50367095. doi: 10.2305/IUCN.UK.2020-3.RLTS.T13250A50367095.en.

References

Cañadas, A., R. Sagarminaga, and S. García-Tiscar. 2002. Cetacean distribution related with depth and slope in the Mediterranean waters off southern Spain. Deep Sea Research Part I: Oceanographic Research Papers 49(11):2053–2073. doi: 10.1016/s0967-0637(02)00123-1

D'Amico, A., R.C. Gisiner, D.R. Ketten, J.A. Hammock, C. Johnson, P.L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. Aquatic Mammals 35(4):452–472. doi: 10.1578/am.35.4.2009.452

Ferguson, M.C., J. Barlow, S.B. Reilly, and T. Gerrodette. 2006. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the eastern tropical Pacific Ocean. Journal of Cetacean Research and Management 7(3):287–299.

Filadelfo, R., J. Mintz, E. Michlovich, A. D'Amico, P.L. Tyack, and D.R. Ketten. 2009. Correlating military sonar use with beaked whale mass strandings: What do the historical data show? Aquatic Mammals 35(4):435–444. doi: 10.1578/am.35.4.2009.435

Frantzis, A. 1998. Does acoustic testing strand whales? Nature 392(6671):29. doi: 10.1038/32068

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, North Carolina, USA to Nova Scotia, Canada). Marine Mammal Science 18(4):920–939. doi: 10.1111/j.1748-7692.2002.tb01082.x

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

MacLeod, C.D., N. Hauser, and H. Peckham. 2004. Diversity, relative density and structure of the cetacean community in summer months east of Great Abaco, Bahamas. Journal of the Marine Biological Association of the United Kingdom 84(2):469–474. doi: 10.1017/S0025315404009476h

MacLeod, C.D. and G. Mitchell. 2006. Key areas for beaked whales worldwide. Journal of Cetacean Research and Management 7(3):309–322.

Mannocci, L., J.J. Roberts, D.L. Miller, and P.N. Halpin. 2017. Extrapolating cetacean densities to quantitatively assess human impacts on populations in the high seas. Conservation Biology 31(3):601–614. doi: 10.1111/cobi.12856

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021a. Atlantic Marine Assessment Program for Protected Species: FY15 – FY19. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D., L. Aichinger Dias, E. Broughton, S. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021b. Supplement to final report BOEM 2021-051 Atlantic Marine Assessment Program for Protected Species: FY15 – FY19 Appendix I generalize additive density-habitat models and maps, by species. US Department of the Interior, Bureau of Ocean Energy Management: Washington, DC. OCS Study BOEM 2021-051. 330 p.

Palka, D.L. 2006. Summer abundance estimates of cetaceans in US North Atlantic Navy Operating Areas. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. Northeast Fisheries Science Center Reference Document 06-03. 41 p.

Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280

Pitman, R. 2018. *Mesoplodon* beaked whales: *Mesoplodon* spp. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 595–602. doi: 10.1016/B978-0-12-804327-1.00172-2

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final project report: Marine species density data gap assessments and update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 21 p.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab: Durham, NC. 76 p.

Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.

Tove, M. 1995. Live sighting of *Mesoplodon Mirus*, Trues beaked-whale. Marine Mammal Science 11(1):80–85. doi: 10.1111/j.1748-7692.1995.tb00276.x

Ward, J.A., G.H. Mitchell, A.M. Farak, and E.P. Keane. 2005. Beaked whale habitat characterization and prediction. NUWC-NPT Technical Report 11,548. Newport, RI.

Waring, G., D. Belden, M. Vecchione, and R. Gibbons. 2003. Mid-water prey in beaked whale and sperm whale deep-water habitat south of Georges Bank. Abstracts, Fifteenth Biennial Conference on the Biology of Marine Mammals. 14-19 December 2003. Greensboro, North Carolina. p. 172.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream Features off the Northeastern USA Shelf. International Council for the Exploration of the Sea: Copenhagen, Denmark. CM 1992/N:12. 28 p.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and perm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the Northeast U. S. Marine Mammal Science 17(4):703–717. doi: 10.1111/j.1748-7692.2001.tb01294.x

White−beaked dolphin − *Lagenorhynchus albirostris*

Western North Atlantic Stock

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = High

Data Quality = 81% of scores ≥ 2

	Lagenorhynchus albirostris	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Prey/Diet Specificity	1.8	2.0	
	Habitat Specificity	1.7	2.3	
	Site Fidelity	1.9	1.7	
	Lifetime Reproductive Potential	2.0	2.0	
	Generation Length	2.1	2.0	
	Reproductive Plasticity	1.6	1.0	
	Migration	3.5	1.0	
	Home Range	1.8	2.0	
	Stock Abundance	1.9	2.0	
	Stock Abundance Trend	2.3	0.7	
	Cumulative Stressors	2.1	2.0	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature (Change in mean)	3.3	3.0	
	Sea Surface Temperature (Change in variability)	1.1	3.0	
	Air Temperature (Change in mean)	3.4	3.0	
	Air Temperature (Change in variability)	1.0	3.0	
	Precipitation (Change in mean)	1.3	3.0	
	Precipitation (Change in variability)	1.7	3.0	
	Sea Surface Salinity (Change in mean)	2.0	3.0	
	Sea Surface Salinity (Change in variability)	1.7	3.0	
	Ocean pH (Change in mean)	4.0	3.0	
	Ocean pH (Change in variability)	1.3	3.0	
	Sea ice coverage (Change in mean)	1.3	2.3	
	Sea ice coverage (Change in variability)	1.0	2.3	
	Dissolved oxygen (Change in mean)	4.0	3.0	
	Dissolved oxygen (Change in variability)	1.3	3.0	
	Circulation	2.2	1.7	
	Sea level rise	1.5	2.0	
	Exposure Score	High		
Overall Vulnerability Rank		Low		

Low

Moderate

High

Very High

White-beaked dolphin (Western North Atlantic Stock)

Lagenorhynchus albirostris

CVA Results Summary

Overall Climate Vulnerability Rank: Low (40% certainty from bootstrap analysis).

Climate Exposure: High. Four exposure factors scored greater than 3.0: Dissolved oxygen (Standard anomaly) (4.00), Ocean pH (Standard anomaly) (4.00), Air Temperature (Standard anomaly) (3.40), and Sea Surface Temperature (Standard anomaly) (3.27).

Biological Sensitivity: Low. Only one sensitivity attribute scored greater than 2.5: Migration (3.53).

Distributional Response: High

Abundance Response: Low

Phenology Response: Low

Data Quality: 81% of the data quality scores were 2 or greater. 64% of sensitivity attribute data quality scores were 2 or higher.

Background Information

Stock Description

The white-beaked dolphin Western North Atlantic stock includes individuals that are found in waters of the U.S. Exclusive Economic Zone in the western North Atlantic. However, this stock is likely transboundary and the stock area probably includes similar adjacent offshore and Canadian waters (Hayes et al. 2020).

Prey/Diet Specificity

White-beaked dolphins in the eastern North Atlantic are known to prey on cod and other gadid fish as well as cephalopods (Jansen et al. 2010; Kinze et al. 1997; Kinze 2018; Santos et al. 1994). Pauly et al. (1998) reported species-level diet composition of 5% benthic invertebrates, 15% small squids, 5% large squids, 15% small pelagic fishes, and 60% miscellaneous fishes.

Habitat Specificity

White-beaked dolphins are commonly found in shelf waters ranging from 150 to 1000 m in depth and temperatures ranging from 5°C to 15°C. The species is found near physical features such as fronts and up-welling (Kinze 2018). In the western North Atlantic, white-beaked dolphins are found in coastal Canadian waters, while sparse sightings in U.S. waters are concentrated around the Gulf of Maine and Cape Cod (CETAP 1982; Reeves et al. 1999).

Site Fidelity

Information regarding white-beaked dolphin site fidelity was not found in the literature.

Lifetime Reproductive Potential

Taylor et al. (2007) reported white-beaked dolphin interbirth interval of 2.50 years. Female white-beaked dolphins reach sexual maturity at a mean age of 8.7 years (Galatius et al. 2012) and the oldest known female lived to 34 years age (Kinze 2018).

Generation Length

Taylor et al. (2007) reported white-beaked dolphin generation length of 17.2 years at r = 0.02 and 18.1 years at r = 0.0.

Reproductive Plasticity

The white-beaked dolphin mating season occurs in July and August (Kinze 2018).

Migration

Information regarding white-beaked dolphin migratory behavior in the western North Atlantic was not found in the literature.

Home Range

Information regarding white-beaked dolphin home range in the western North Atlantic was not found in the literature.

Stock Abundance

The abundance of the white-beaked dolphin in the western North Atlantic is estimated to be 536,016 individuals (CV=0.31), based on 2016 survey data from Canadian waters from the U.S. border to Labrador (Lawson and Gosselin 2018; Hayes et al. 2020).

Stock Abundance Trend

Data are insufficient to complete an abundance trend analysis for this stock (Hayes et al. 2020).

Cumulative Stressors

White-beaked dolphins interact with the cod trap and Canadian groundfish gillnet fisheries (Alling and Whitehead 1987; Read 1994; Hai et al.1996). During the period 2013–2017, estimated annual fishing-related mortality was zero (Hayes et al. 2020). During the same period, 92 strandings were reported along the U.S. and Canadian Atlantic coasts (Hayes et al. 2020).

White-beaked dolphins may become entrapped in sea ice off the coast of Newfoundland (Lien et al. 2001).

Distribution

Density model results for white-beaked dolphins in the western North Atlantic are presented by Roberts et al. (2015, 2016).

Further Reading

Department of the Navy. 2005. Marine Resource Assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Naval Facilities Engineering Command, Atlantic. Norfolk, VA. Contract #N63470-02-D-9997, Task Order 0018. Prepared by Geo-Marine Inc., Newport News, VA. 382 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. Northeast Fisheries Science Center: Woods Hole, MA. NOAA technical memorandum NMFS-NE-264. 479 p.

Kinze, C.C. 2018. White-beaked dolphin: *Lagenorhynchus albirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 1077–1079. doi: 10.1016/B978-0-12-804327-1.00274-0

Kiszka, J. and G. Braulik. 2018. *Lagenorhynchus albirostris*. The IUCN Red List of Threatened Species 2018: e.T11142A50361346. doi: 10.2305/IUCN.UK.2018-2.RLTS.T11142A50361346.en

References

Alling, A.K. and H.P. Whitehead. 1987. A preliminary study of the status of white-beaked dolphins, *Lagenorhynchus albirostris*, and other small cetaceans off the coast of Labrador. Canadian Field-Naturalist 101(2):131–135.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas of the U.S. outer continental shelf, final report. Contract AA551-CT8-48. Bureau of Land Management: Washington, DC. 538 p.

Galatius, A., C.C. Kinze, and J. Teilmann. 2012. Population structure of harbour porpoises in the Baltic region: evidence of separation based on geometric morphometric comparisons. Journal of the Marine Biological Association of the United Kingdom 92(8):1669–1676. doi: 10.1017/s0025315412000513

Hai, D.J., J. Lien, D. Nelson, and K. Curren. 1996. A contribution to the biology of the white-sided dolphin, *Lagenorhynchus albirostris*, in waters off Newfoundland. Canadian Field-Naturalist 110(1):278–287.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2019. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center: Woods Hole, MA. NOAA Technical Memorandum NMFS-NE-264. 479 p.

Jansen, O.E., M.F. Leopold, E.H.W.G. Meesters, and C. Smeenk. 2010. Are white-beaked dolphins *Lagenorhynchus albirostris* food specialists? Their diet in the southern North Sea. Journal of the Marine Biological Association of the United Kingdom 90(8):1501–1508. doi: 10.1017/s0025315410001190

Kinze, C.C. 2018. White-beaked dolphin: *Lagenorhynchus albirostris*. In: Würsig, B., J.G.M. Thewissen, and K.M. Kovacs (Eds.), Encyclopedia of Marine Mammals (Third Edition). Academic Press, London, UK. pp. 1077–1079. doi: 10.1016/B978-0-12-804327-1.00274-0

Kinze, C.C., M. Addink, C. Smeenk, M. García Hartmann, H.W. Richards, R.P. Sonntag, and H. Benke. 1997. The whitebeaked dolphin (*Lagenorhynchus albirostris*) and the white-sided dolphin

(*Lagenorhynchus acutus*) in the North and Baltic Seas: Review of available information. Reports of the International Whaling Commission 47:675−681.
Lawson, J. and J.-F. Gosselin. 2018. Estimates of cetacean abundance from the 2016 NAISS aerial surveys of eastern Canadian waters, with a comparison to estimates from the 2007 TNASS. NAMMCO SC/25/AE/09. 40 p.
Lien, J., D. Nelson, and D.J. Hai. 2001. Status of the white-beaked dolphin, *Lagenorhynchus albirostris*, in Canada. Canadian Field-Naturalist 115(1):118–126.
Pauly, D., A.W. Trites, E. Capuli, and V. Christensen. 1998. Diet composition and trophic levels of marine mammals. ICES Journal of Marine Science 55(3):467–481. doi: 10.1006/jmsc.1997.0280
Read, A.J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. Reports of the International Whaling Commission (Special Issue) 15:133–147.
Reeves, R.R., C. Smeenk, R.L. Brownell, and C.C. Kinze. 1999. Atlantic white-sided dolphin *Lagenorhynchus acutus* (Gray, 1828). In: Ridgway, S.H. and R. Harrison (Eds.), Handbook of Marine Mammals. Volume 6: The Second Book of Dolphins and the Porpoises. Academic Press, London, UK. pp. 31–56.
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.A. McLellan, D.A. Pabst, and G.G. Lockhart. 2016. Habitat-based cetacean density models for the US Atlantic and Gulf of Mexico. Scientific Reports 6:22615. doi: 10.1038/Srep22615
Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2015. Density model for white-beaked dolphin (*Lagenorhynchus albirostris*) for the U.S. East Coast version 2.2, 2015-10-06, and supplementary report. Duke University, Marine Geospatial Ecology Lab: Durham, NC. 141 p.
Santos, M.B., G.J. Pierce, R. H.M., R.J. Reid, and B. Wilson. 1994. Diets of small cetaceans from the Scottish coast. International Council for the Exploration of the Sea. CM 1994/N:11. 6 p.
Taylor, B.L., S.J. Chivers, J. Larese, and W.F. Perrin. 2007. Generation length and percent mature estimates for IUCN assessments of cetaceans. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center: La Jolla, CA. Administrative Report LJ-07-01. 24 p.