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Megaptera novaeangliae (Oceania subpopulation), Humpback Whale

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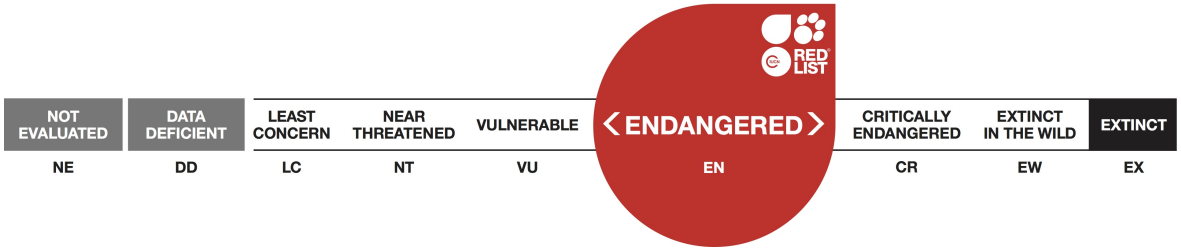

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Cetartiodactyla	Balaenopteridae

Taxon Name: *Megaptera novaeangliae (Oceania subpopulation)* (Borowski, 1781)

Parent Species: See *Megaptera novaeangliae*

Common Name(s):

- English: Humpback Whale

Taxonomic Notes:

The Humpback Whale is a cosmopolitan species and is regarded as monotypic (Rice 1998, Clapham and Mead 1999). No subspecies are recognized. Phylogenetic analyses reveal that populations in different ocean basins do not represent distinct clades, but some maternal lineages can be traced back across hemispheric boundaries, indicating some level of inter-hemispheric gene flow, perhaps in the distant past (Baker *et al*. 1994).

Population structure

The International Whaling Commission (IWC) currently recognizes four breeding stocks around the South Pacific and Australia based on Discovery mark recoveries, demographic isolation, and genetic differentiation (Olavarria *et al*. 2007):

- 1 north of feeding area IV (referred to as Stock D including Western Australia),
- 1 north of feeding Area V (referred to as Stock E including Eastern Australia, New Caledonia and Tonga),
- 1 north of feeding Area VI (Stock F including Cook Islands and French Polynesia), and
- 1 north of feeding Area I (Stock G including Colombia).

The IWC also recognizes further stock sub-division of breeding stock E and F into sub-stocks supported by demographic isolation and genetic differentiation (Olavarria *et al*. 2006). Breeding stock E is sub-divided into E1 (Eastern Australia), E2 (New Caledonia) and E3 (Tonga) and breeding stock F into F1 (Cook Islands) and F2 (French Polynesia). These breeding stocks are shown in Figure 1 (see supplementary material). We use the terminology breeding stock (e.g. D, E, F, G) to refer to breeding stocks based on demographic isolation and genetic differentiation, and sub-stock to refer to sub-divisions within these breeding stocks, as currently recognized by the IWC (e.g., E1, E2, E3, F1, F2). Olavarria *et al*. (2007) found significant differentiation of maternally inherited mitochondrial (mt) DNA at both the haplotype and nucleotide level (F_{ST} = 0.033; Φ_{ST} = 0.022), between breeding stocks D, G and four of the Oceania sub-stocks (E2, E3, F1, F2). When sub-stock E1 is included in this comparison (Olavarria *et al*. (2006)), the estimated differentiation among stocks by F_{ST} is ~0.02. Based on standard population genetic models (e.g. ,Wright 1978, Waples & Gaggiotti 2006), F_{ST} values of 0.01 correspond to approximately 25 migrant individuals per generation (or less than one migrant individual per year in the case of Humpback Whales and other long lived mammals). These breeding stock boundaries, and the sub-stocks within them, are also supported by the analysis of movements by individuals based on

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photo-identification and microsatellite genotyping (DNA profiling). An extensive comparison of photo-identification catalogues by sub-stock found only four matches between the migratory corridor of East Australia (E1 represented by Hervey Bay and Byron Bay, with a catalogue size of 1,242 individuals) and breeding grounds in Oceania (E2, E3, F1 and F2, with a catalogue size of 679 individuals) (Garrigue *et al*. 2007). This level of interchange is surprisingly small, given the relatively large catalogues used in the comparison, and provides strong evidence for sub-division within breeding stock E (Garrigue *et al*. 2007). An additional photo-identification comparison among regions of Oceania (E2, E3, F1 and F2 with a combined catalogue size of 679) documented 20 records of interchange, mostly between neighbouring regions (Garrigue *et al*. 2006). Overall, the limited movement of individuals between adjacent sites within Oceania is consistent with the significant (but low) level of differentiation observed in mtDNA from these regions (Olavarria *et al.* 2007) and suggests that humpback whales wintering in E2, E3, F1 and F2 are demographically independent and should be recognized as individual management stocks (Garrigue *et al*. 2006).

Comparisons of historical sighting data and whaling records (Dawbin 1956, 1959, 1964) with recent sighting survey data from New Zealand, Fiji and Norfolk Island demonstrate a lack of (or at the very least a slow) recovery at these sites (Childerhouse and Gibbs 2006, Gibbs *et al*. 2006, Paton *et al*. 2006, Oosterman and Whicker 2008). These surveys returned to the same look-out sites used by Dawbin and replicated his earlier surveys as closely as possible. Results from these re-surveys include (i) sighting rates in Fiji over the period 1956-58 were between 0.15-0.58 whales per hour and were significantly higher than equivalent sighting rates observed of between 0.01-0.03 in 2002-03 (Paton *et al*. 2006) and, (ii) surveys in New Zealand indicate that between 2004-2006 sightings were 29% of what there were in 1960 (Childerhouse and Gibbs 2006). It is important to note that the baseline data for these surveys in the 1950s and 1960s were from populations that had already been whaled for more than 50 years. It is not possible to directly assess the rates of increase for these sites but what is clear is that any population increases appear to be lacking or very low. In contrast, the East Australian stock is increasing at 10-11% per annum (Noad *et al*. 2006). These indications of demographic independence are likely sufficiently strong to provide evidence for further subpopulations within the Oceania, however, such partitioning presents difficulties in assessing population status (discussed below) that have not been overcome at present. Furthermore, problems with the allocation of commercial catches on the feeding grounds to the appropriate sub-stock breeding area make the assessment even more challenging. Given that it is not possible to assess the status of each sub-stock, we have therefore used a model that can assess the South Pacific as though it is a single stock (i.e., E and F). In conclusion, the presently recognized IWC stock and sub-stock boundaries are consistent with available evidence. With respect to the South Pacific, the relevant sub-stock divisions are East Australia (E1), New Caledonia (E2), Tonga (E3), Cook Islands (F1), French Polynesia (F2), and Colombia (G). The taxon assessed here is, therefore, called the Oceania subpopulation, which consists of IWC breeding stocks E and F as a distinct subpopulation of Humpback Whales. It should be identified separately based on population isolation and a demonstrated high level of depletion (see below). We propose this subpopulation specifically for the purposes of the IUCN threat ranking process as it is consistent with the existing IWC recognized breeding stock boundaries.

For further information about this species, see Supplementary Material.

Assessment Information

Red List Category & Criteria: Endangered A1ad ver 3.1

Year Published: 2008

Date Assessed: June 30, 2008

Justification:

The Oceania subpopulation (as characterized by IWC breeding stocks E and F) is genetically and demographically isolated from the adjacent breeding stocks D (Western Australia) and G (Colombia). The assessment of the Oceania subpopulation has demonstrated that it is likely to have declined 70% in the last three generations (e.g., since 1942 using 21.5 years/generation (Taylor *et al*. 2007)). The estimated level of decline is based on the Jackson *et al*. (2006) combined assessment of E and F in which median population recovery in 2005 relative to three generations previous was estimated at 26.6% (95% probability intervals (PI) 18.2-33.5%). A 26.6% level equates to a 73.4% decline from estimated abundance prior to 1942. The range of possible outcomes spans both the Endangered and Vulnerable categories. However, in line with the Red List Guidelines calling for both precaution and credibility, the median outcome places this subpopulation in the Endangered category. It is likely that with additional analyses, the Oceania subpopulation will be split into additional subpopulations that are experiencing different levels of risk, but until historical kills can be adequately addressed, assessing E and F stocks together represents the best available science.

Geographic Range

Range Description:

Humpback Whales have a global distribution. Individual humpbacks have been observed to travel more than 8,000 km between their high-latitude summer feeding grounds and winter mating and calving range in tropical waters (Rasmussen *et al*. 2007). The Oceania subpopulation is delineated by its breeding range, with approximate boundaries in the west at 145°E (eastern Australia), in the east at 120°W (between French Polynesia and South America), in the north at the equator at 0°S, and in the south to approximately 30°S. During the austral autumn and winter, Humpback Whales in Oceania are spread across lower latitudes from approximately 30°S northwards to the equator. The South Pacific is a vast area with thousands of islands, and there has not yet been a comprehensive survey of the entire region. However, localized research by members of the South Pacific Whale Research Consortium (SPWRC 2008) has identified many island groups whose waters are host to Humpback Whales. During austral spring and summer, Humpbacks travel to Antarctic feeding grounds. These linkages have been demonstrated through Discovery tagging, photo-identification and, most recently, genotype matching and satellite telemetry (Mackintosh 1942, Chittleborough 1965, Dawbin 1966, Mikhalev 2000, Franklin *et al*. 2007).

Country Occurrence:

Native: American Samoa (American Samoa, American Samoa); Australia; Cook Islands; Fiji; French Polynesia; Guam; Kiribati; Marshall Islands; Micronesia, Federated States of ; Nauru; New Caledonia; New Zealand; Niue; Northern Mariana Islands; Palau; Papua New Guinea; Solomon Islands; Tokelau; Tonga; Tuvalu; Vanuatu; Wallis and Futuna

FAO Marine Fishing Areas:

Native: Pacific - Antarctic, Pacific - southeast, Pacific - southwest, Pacific - western central

Population

The following population estimates are available: (i) SPWRC (2006) provided a preliminary mark-recapture estimate from photo-identification of the combined population size for E2 (New Caledonia), E3 (Tonga) and F (French Polynesia) of 3,827 (CV = 0.12) for the period 1999-2004. There are no estimates of rate of increase available for this area but it was noted that there was little indication of trend in abundance over the survey period (SPWRC 2006). (ii) Noad *et al*. (2006) estimated from land-based sighting surveys that population size of E1 (Eastern Australia) was 7,090 (95% CI ± 660) for 2004 with an annual rate of increase of 10.6 (95% CI ± 0.5%) for 1987 – 2004.

The IWC is presently engaged in a Comprehensive Assessment of Southern Hemisphere humpback whales, and research on the South Pacific breeding stocks of E1, E2, E3, and F is ongoing. The IWC (2006) Comprehensive Assessment of Southern Hemisphere Humpback workshop in 2006 agreed that, "*the situation for Breeding Stocks E and F is complex and currently unresolved, and therefore that it was not possible to construct stock structure hypotheses for assessment modelling, particularly with respect to the assignment to Breeding Stocks of catches taken on the feeding grounds*".

For example, while east Australia and New Caledonia (E1 and E2) are within the longitudinal boundaries of Antarctic Area V, and French Polynesia and the Cook Islands (F) are within the longitudinal boundaries of Area VI, Tonga (E3) falls close to the boundary between the two Areas. Thus, in the current assessment, the approach of pooling demographically independent sub-stocks was necessary for practical reasons to develop catch allocation scenarios. However, this approach is likely to be conservative in ignoring potential differences in variable rates of recovery from the regional impacts of whaling. Soviet whaling on the Antarctic feeding grounds in the early sixties was extremely intense, with over 27,300 whales taken during two summers (1959-1961) alone. Maternal site fidelity together with a hunt concentrated both in time and space may have resulted in more extreme declines in some of the far-flung wintering sub-stocks of the Southwestern Pacific.

Jackson *et al*. (2006) explored a number of catch allocation scenarios for the combined sub-stocks of Oceania and east Australia. In their combined assessment of sub-stocks E1, E2, E3 and F, median population recovery toward historical levels in 2005 was estimated at between 15.9-24.8% (95% probability intervals (PI) 11.1-30.5%; prior population growth rate mean = 6.7% after Branch *et al*. (2004)). The most appropriate interpolation between these two recovery estimates depended on the degree of interchange between east Australia and Oceania (15.9% is complete interchange, 24.8% is no interchange). Recent photo-identification surveys (Garrigue *et al*. 2007) indicate that interchange between these regions is relatively low, suggesting that the 'no interchange' scenario may be more appropriate for the region. Under this interchange scenario, estimated abundance in 1942 was 41,356 (95% PI 36,800-53,580). Recovery level of the population three generations later (in 2005) is 26.6% (95% PI 18.2-33.5%) relative to 1942. This is using an estimate of 21.5 years/generation (Taylor *et al*. 2007).

Current Population Trend: Increasing

Habitat and Ecology **(see Appendix for additional information)**

Humpback Whales have been recorded across most of the South Pacific, although densities vary from large numbers in East Australia to very low numbers in Fiji (in E3) and parts of French Polynesia. They are regularly found around island groups but also in open water away from islands. Humpbacks have been recorded throughout the southern ocean, including south to the ice edge and in the Ross Sea. Little is known regarding life history parameters for the Oceania subpopulation of Humpback Whales, although it is assumed that these rates are similar to those described from whaling records in Australia

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and New Zealand (Dawbin 1956, 1964, 1966; Chittleborough 1965). One rate that has been preliminarily investigated in the region is calving interval, which is approximately 2-3 years (consistent with that reported from other oceans). The diet of these Humpback Whales consists mainly of krill, which they consume while in Antarctic waters. They are not known to feed while in tropical breeding grounds.

Systems: Marine

Threats (see Appendix for additional information)

During the last two centuries, Humpback Whales have been hunted intensively, especially in the southern hemisphere, where it was estimated that populations were reduced to a few percent of their pre-exploitation abundance (Chapman 1974). Based on catch records corrected for illegal Soviet whaling, a total of more than 200,000 Humpback Whales were killed in the Southern Hemisphere from 1904 to 1980 (Clapham and Baker 2002). Catches during the 19th century in the South Pacific by American whalers were made mainly during winter months in three tropical breeding grounds: off Colombia and Ecuador, around the Tongan archipelago, and northwest of New Caledonia (Townsend 1935, Mackintosh 1942). During the 20th century, Humpback Whales were hunted along their migratory corridors, such as along the coasts of New Zealand and Australia, and more intensively in their feeding areas in sub-Antarctic and Antarctic waters (Mackintosh 1942, 1965). The IWC gave legal protection to Humpback Whales from commercial whaling in 1966 but they continued to be killed illegally by whalers from the Soviet Union until 1972. Illegal Soviet takes of 25,000 Humpback Whales in two seasons (1959/60 and 1960/61) precipitated a population crash and the closure of land stations in Australia and New Zealand (Mikhalev 2000, Clapham *et al.* 2005).

Recently, Japan proposed to kill 50 humpback whales as part of its programme of scientific research under special permit (scientific whaling) in the IWC management areas IV and V in the Antarctic. Areas IV and V have demonstrated links with breeding stock E. Japan postponed its proposed catch in the 2007/08 season but have not removed Humpback Whales from its future whaling programme. The continuation of this programme has the potential to slow the recovery of the Oceania subpopulation.

Mortality of Humpback Whales due to entanglements in fishing gear and collisions with ships have been reported in the Southern Hemisphere (IWC 2001). Entanglement of Humpback Whales in pot lines occurs in both New Zealand and Australia. There is little information from around the rest of the South Pacific, but a humpback mother (with calf) was reported entangled in a longline in 2007 (N. Hauser, reported in SPWRC 2008) and another Humpback was struck and killed by a vessel in 1999 in Tonga (Diver 2004).

Conservation Actions (see Appendix for additional information)

Although Humpback Whales have been legally protected from commercial whaling since 1966, they can still be killed for the purposes of scientific research under Article VIII of the International Convention for the Regulation of Whaling. The IWC's Southern Ocean Whale Sanctuary (e.g. the northern boundary of this Sanctuary follows the 40°S parallel of latitude except in the Indian Ocean sector where it joins the southern boundary of that sanctuary at 55°S, and around South America and into the South Pacific where the boundary is at 60°S) provides an additional layer of protection to Humpback Whales while on their summer feeding grounds in Antarctica, although whales inside the Sanctuary can still be killed under Article VIII. At present, more than 12 million km^2 of EEZs of more than a dozen South Pacific

countries and territories have been designated as whale sanctuaries. This provides protection from commercial whaling for Humpback Whales in some of their breeding areas. Most recently an MoU under the CMS convention has been designed to protect cetaceans and their habitats in the South Pacific. It has already been signed by several countries and territories. New Zealand and Australia have active disentanglement programmes to release any Humpback Whales captured in fishing gear.

Credits

Assessor(s): Childerhouse, S., Jackson, J., Baker, C.S., Gales, N., Clapham, P.J. & Brownell Jr., R.L.

Reviewer(s): Reeves, R.R., Reilly, S.B., Rosenbaum, H. & Taylor, B.L. (Cetacean Red List Authority)

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External Resources

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Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic	-	Suitable	Yes
10. Marine Oceanic -> 10.1. Marine Oceanic - Epipelagic (0-200m)	-	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
4. Transportation & service corridors -> 4.3. Shipping lanes	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale)	Future	Unknown	Unknown	Unknown
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.2. Intentional use: (large scale)	Past, unlikely to return	-	-	-
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale)	Ongoing	Unknown	Unknown	Unknown

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Education
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Additional Data Fields

Habitats and Ecology
Movement patterns: Full Migrant

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