Gestation duration

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Preamble

This is an Electronic Supplement to the manuscript Marques et al. "Quantifying Deepwater Horizon oil spill induced injury on pelagic cetaceans" submitted to Marine Ecology Progress Series (MEPS).

The master file containing links to all supplementary files related to this paper is ES0_ElectronicSupplements.

This pdf is generated in RMarkdown by compiling a .Rmd file. The figures and results are generated using code that is not shown in this pdf but is available in the corresponding .Rmd files stored at the github repository https://github.com/TiagoAMarques/CARMMHApapersSI

If you make use of any of this material in your work, it would be appreciated if you would contact Tiago Marques to let him know.

Version history

- 1.0 [date] Version included as an html Electronic supplement in the MEPS submission - *note to co-authors: this note will be deleted when we submit and we are not tracking versions prior to submitting to MEPS, that will be version 1.0 by definition*

Background

Species-specific gestation duration was used as a scaling factor for reproduction and survival parameters. To obtain suitable scaling factor estimates, a review of grey and published literature was carried out to determine the most appropriate estimate of the length of gestation. Given the focus on the Gulf of Mexico, information close to the study region (e.g. East coast USA, Caribbean and Atlantic Ocean), where available, were favoured over estimates from other geographic regions (e.g. NW Pacific). Where no information was available to estimate gestation period for a species of interest, the value from closely related proxy species was used.

Results

The best estimates of gestation duration for each taxonomic unit considered in the paper are shown below (Table S4.1). Each section below describes the supporting information behind its selection or estimation.

Note these are the values present in the column for gestation duration (gd) in the master file (SpeciesDefinitionFile4offshore.xlsx) that defines all parameters used in the simulations.

Table 1: Gestation duration (gd), in days, for each of the taxonomic units considered

Species	latin	gd
Bwsp	Beaked whales spp	342
Fatt	Feresa attenuata	424
Ggri	Grampus griseus	418

Species	latin	gd
Gmac	Globicephala macrorhynchus	453
Kosp	Kogia sp.	348
Pele	Peponocephala electra	383
Pmac	Physeter macrocephalus	483
Satt	Stenella attenuata	345
Sbre	Steno bredanensis	376
Scly	Stenella clymene	346
Scoe	Stenella coeruleoalba	365
Sfro	Stenella frontalis	365
Slon	Stenella longirostris	327
Ttro	Tursiops truncatus	375
Ttrs	Tursiops truncatus	375
Ttru	Tursiops truncatus	375

Justification for values considered

Bottlenose dolphins (offshore and shelf stocks)

Schwake, et al (2021) undertook a comprehensive review of the available data and literature on gestation duration in wild bottlenose dolphins and indicated a best estimate of 375 days We used that estimate in this study.

Beaked whales spp

New et al. (2013) reviewed the biology of a wide range of beaked whale species and provided a best estimate for most species of 12 months (citing Christensen (1973)). This is very likely a generalisation, but remains a best estimate given the paucity of data on beaked whale reproductive biology. While the much larger Baird's beaked whale is estimated to have a gestation of approximately 17 months (Kasuya, 1977) from whaling records, we considered it is unlikely this applies to the beaked whale species sighted in the Gulf of Mexico (which are more in line with the best estimates of New et al (2013). We therefore used a gestation duration of 365 days for Beaked whale spp.

Kogia spp.

A limited number of studies have estimated gestation length in the Kogia spp. Much of the literature (e.g. textbooks, summary papers) speculate that gestation length is possibly around 9.5 months (e.g. Ross, 1979; Pinedo, 1987; Willis and Baird, 1998) but few present the data to support this estimate. The best empirical estimates for *Kogiasima* and *Kogiabreviceps* available were in work by Plön (2004) suggesting gestation durations of 338 and 359 days (n: 25 and 26 females respectively). Consequently we took the mean of the two best estimates, resulting in a gestation duration of 348 used in the models.

Melon-headed whale

The only published estimate of gestation duration for this species is from Amano et al. (2014), based on a sample of 291 individuals from stranding events. This estimate is of 383 days and is broadly in line with more coarse estimates (Ridgway and Harrison, 1994; Bannister et al., 1996).

Pygmy killer whale

There are no data to inform this parameter in Pygmy killer whale. They are considered to be closest biologically to melon-headed whale, pilot whales and false killer whales (Baird, 2018), therefore we took

the average of these three gestation durations (383, 453 and 437 days (derived from Ferreira et al., 2014) respectively) as 424 days.

Risso's dolphin

The gestation duration has been estimated to be 13-14 months in the NW Pacific (Kasuya, 1985b)(estimates derived from 23 examined females) and 13.9 months in the Mediterranean Sea (based on 51 stranded specimens)(Raduán et al., 2007). We have used an estimate of 417 days averaging across these studies.

Rough-toothed dolphin

The reproductive biology of the rough-toothed dolphin species is poorly understood. Two females were in long-term human care in North America since 1996 and two females became sexually mature, resulting in four separate pregnancies. Mean gestation duration across the four pregnancies was 376 days (Staggs and Holmes, 2015).

Short-finned pilot whale

Limited information are available on the reproductive biology of short-finned pilot whales. Kasuya and Marsh (1984) provide an gestation duration estimate based on the examination of 373 females of 453 days (estimated as 14.9 months). In the absence of other estimates, we used that value in models.

Sperm whale

A wide range of estimates are available for sperm whales globally. An exploration of geographic variation indicated a dimorphism between northern and southern hemisphere animals (slightly longer gestation in the southern hemisphere (Huggett and Widdas, 1951;Laws, 1959). We took the average gestation across appropriate northern hemisphere studies where the rationale for calculations was available for assessment (Clarke, 1956;Laws, 1959;Chuzhakina, 1961;Ohsumi, 1965;Gambell, 1966). The resulting mean gestation duration estimate was 483 days.

Stenella dolphin species

Almost all information informing the reproductive biology of other *Stenella* spp. comes from the Eastern Tropical Pacific bycatch records and from animals taken in drive fisheries in the NW Pacific (e.g. Japan). The best estimates for pantropical spotted dolphin (*Stenella attenuata*) were of 342 (Kasuya, 1977), 345 (Perrin et al., 1976) and 349 days (Perrin and Hohn, 1994), resulting in an average of 345 days used for the species in this study. Gestation duration in striped dolphins (*Stenella coeruleoalba*) was estimated to be 365 days by Kasuya (1985a). For spinner dolphins (*Stenella longirostris*) estimates of 10.6 and 10.9 months (322 and 331 days) were available – and so the average was taken as 327 days (Perrin et al., 1977;Larese and Chivers, 2009). For Atlantic spotted dolphin, few records existed on their reproductive biology. Herzing (1997) suggested gestation would be similar to pantropical spotted dolphins and we use that value here (345 days). Similarly, no suitable records were found for the Clymene dolphin (*Stenella clymene*) so following Amaral et al. (2014) we took the average of striped and spinner dolphin gestation duration. This resulted in an estimated gestation duration of 346 days.

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