F

FALSE KILLER WHALE

Pseudorca crassidens

Robin W. Baird

False killer whales are one of the larger members of the family Delphinidae. The genus *Pseudorca*, and thus the common name, came from similarity in skull morphology to that of killer whales (*Orcinus orca*), rather than any resemblance in external morphology (Fig. 1).

I. Characteristics and Taxonomy

False killer whales have a rounded head, gracile shape, a relatively small falcate dorsal fin located at the midpoint of the back (Figs 1 and 2), and flippers with a distinct bulge on the leading edge. They are dark gray in color, often appearing black, with some lighter markings on the ventral surface. In good lighting conditions a slightly darker dorsal cape can be seen. Asymptotic length varies both by sex (adult males are on average about 0.7 m longer than adult females) and by population (Ferreira et al., 2013), and the melon of adult males protrudes farther over the lower jaw than in adult females (Fig. 3). Males often have accessory mammary grooves, so care must be taken to sex individuals based on external morphology. They are about 1.5–2.1 m long at birth, and the longest recorded male was 5.96 m. Their teeth are large and conical, with 7–11 in each of the upper jaws and 8–12 in each lower jaw. False killer whales are most closely related to Risso's dolphins (*Grampus griseus*), melon-headed whales (*Peponocephala electra*), pygmy killer whales (*Feresa attenuata*), and pilot whales (*Globicephala* spp.). Although there is evidence of geographic variation in skull morphology and life history, and substantial population structuring at smaller scales based on genetics, photoidentification, and satellite tagging (Martien et al., 2014), no subspecies are currently recognized.

II. Distribution and Abundance

False killer whales are found worldwide throughout the tropics and subtropics, primarily in the open ocean but occasionally extending onto the continental shelf and in nearshore areas around tropical oceanic islands (Fig. 4). As a top predator they are naturally rare, usually one of the least common delphinids even in areas of

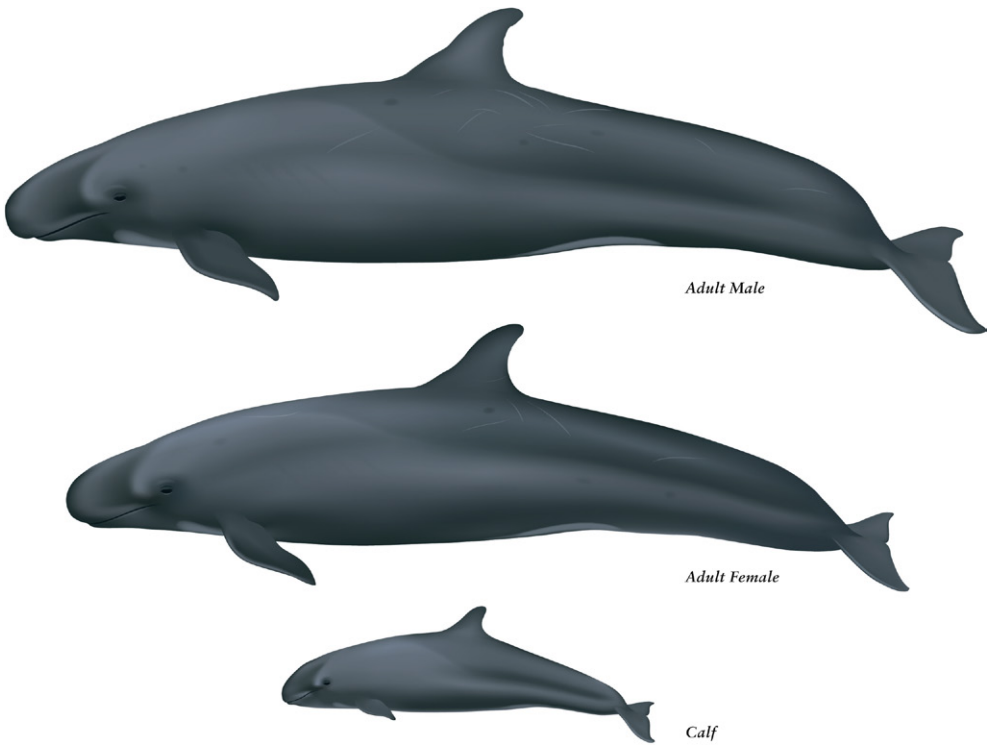


Figure 1 *False killer whale*, Pseudorca crassidens, *male, female, and calf (Illustrations by Uko Gorter).*

Encyclopedia of Marine Mammals. DOI: http://dx.doi.org/10.1016/B978-0-12-804327-1.00006-6

Figure 2 *An adult female and calf from the endangered main Hawaiian Islands insular population. The female was first documented in 1990 and seen most recently in 2011 (Photo by Robin W. Baird).*

Figure 3 *An adult male from the endangered main Hawaiian Islands insular population, showing the protrusion of the rostrum over the lower jaw typical of adult males (Photo by Robin W. Baird).*

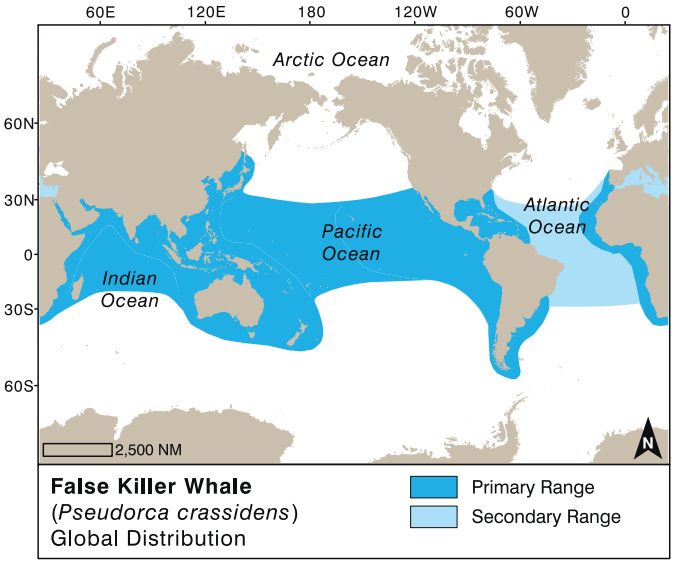


Figure 4 *False killer whale distribution. Adapted by Nina Lisowski from Jefferson, T.A., Webber, M.A., and Pitman, R.L. (2015). "Marine Mammals of the World: A Comprehensive Guide to Their Identification," 2nd ed. Elsevier, San Diego.*

highest abundance. Density is much higher in lower latitudes; in the North Pacific density drops by an order of magnitude north of ~15°N. The combination of oceanic habits and rarity has limited studies of this species.

Abundance estimates exist for a number of areas, although some of them are quite dated, and the estimates for larger areas may represent more than one population. The only area with both recent abundance estimates and a good idea of population structure is in Hawaiian waters, where there are three recognized populations with partially overlapping ranges. The main Hawaiian Islands insular population uses an area around the main Hawaiian Islands out to approximately 120 km from shore, and numbers between 150 and 200 individuals (Baird, 2016). The Northwestern Hawaiian Islands insular population numbers about 550 individuals. The pelagic population extends offshore at least 1700 km from Hawai'i, and the abundance of that population within the U.S. Exclusive Economic Zone is about 1550 individuals (Bradford et al., 2014).

III. Ecology

False killer whales are active both during the day and at night. They are high on the food web, feeding in some areas on large pelagic game fish, and occasionally on large squid. They are cooperative hunters and if one individual captures a large fish others will usually converge and they will share prey. They have been known to feed on injured dolphins after these were released from tuna purse seine nets in the eastern tropical Pacific—this behavior likely reflects their ability to adapt to new food sources, like taking fish off longlines, rather than a particular tendency to feed on other marine mammals. They are regularly documented associating with other delphinids in nonaggressive contexts, particularly common bottlenose dolphins (*Tursiops truncatus*) and rough-toothed dolphins (*Steno bredanensis*), and long-term associations with bottlenose dolphins have been documented (Zaeschmar et al., 2014). Although there is one report of them feeding on a humpback whale calf, that report is unsubstantiated. They have been documented harassing sperm whales, most likely as a form of kleptoparasitism, feeding on squid that the sperm whales regurgitated. There has been one documented attack by killer whales off New Zealand, and they are at least occasionally attacked by large sharks, based on shark bite scars on living individuals.

IV. Behavior

False killer whales are typically found in groups of 5–25 individuals, but groups as large as 300–400 individuals have been documented. Groups are often spread over considerable distances (>20 km), with individuals moving through an area in an apparently coordinated fashion. Larger groups are likely temporary associations of smaller, more stable groups. Based on studies of association patterns, false killer whales have strong social bonds, with individuals remaining together for years. These smaller, more stable groups are of mixed age and sex; no obvious sex or age segregation appears to exist for this species. They have been known to

mass strand, with the largest mass stranding recorded involving an estimated 835 individuals.

V. Life History

False killer whales have a slow life history. Females first give birth between about 9 and 12 years of age, and calving interval has been estimated at between 6 and 7 years. While females may live into their early to mid-60s, they go through menopause in their early 40s. Males mature later, in their mid to late teens, and die earlier—the oldest documented male was 58 years old. Calving occurs year-round, with a peak in late winter.

VI. Interactions With Humans

Over 900 false killer whales were killed off Iki Island, Japan between 1965 and 1980 to reduce fisheries interactions. False killer whales have also been killed for food or oil in Japan, St. Vincent, and off Taiwan. Given the high degree of population structure in areas where this has been studied, such killing may have had a substantial effect on localized populations. The combination of a slow life history and natural rarity also put them at risk from indirect effects, particularly given their overlap in diet with commercially important fish populations and propensity to take bait or caught fish off lines. Bycatch likely occurs wherever they overlap with fisheries, and occurs in gill nets, purse seine nets, trawl nets, longlines, and other hook and line fisheries. In areas with both sufficient observer effort and abundance estimates, bycatch rates are likely not sustainable: in Hawaiian waters bycatch rates of the pelagic population exceed the potential biological removal level. At least in areas where commercially important fish make up a substantial proportion of their population, reduction in fish numbers and the size of fish also likely impact populations. In Hawaiian waters, 84% of sampled individuals had total PCB concentrations that exceed proposed health thresholds (Foltz et al., 2014), suggesting that immunosuppression or impacts on reproduction may be influencing populations. While listed by the IUCN as "data deficient" globally, the main Hawaiian Islands insular population is listed as endangered under the U.S. Endangered Species Act (Oleson et al., 2010).

On the bright side, there are many positive accounts of interactions between false killer whales and humans. They regularly approach boats to bowride, and often appear inquisitive to snorkelers or divers in the water. False killer whales have been documented offering fish to both boaters and divers.

References

Baird, R.W. (2016). *The Lives of Hawai'i's Dolphins and Whales: Natural History and Conservation.* University of Hawai'i Press, Honolulu.

Bradford, A.L., Forney, K.A., Oleson, E.M., and Barlow, J. (2014). Accounting for subgroup structure in line-transect abundance estimates of false killer whales (*Pseudorca crassidens*) in Hawaiian waters. *PloS One* **9**, e90464.

Ferreira, I.M., Kasuya, T., Marsh, H., and Best, P.D. (2013). False killer whales (*Pseudorca crassidens*) from Japan and South Africa: Difference in growth and reproduction. *Mar. Mamm. Sci.* doi.10.1111/mms.12021.

Foltz, K., Baird, R.W., Ylitalo, G.M., and Jensen, B.A. (2014). Cytochrome P4501A1 expression in blubber biopsies of endangered false killer whales (*Pseudorca crassidens*) and nine other odontocete species from Hawai'i. *Exotoxicology.* doi.10.1007/s10646-014-1300-0.

Martien, K.K., Chivers, S.J., Baird, R.W., Archer, F.I., Gorgone, A.M., Hancock-Hanser, B.L., Mattila, D., McSweeney, D.J., Oleson, E.M., Palmer, C., Pease, V.L., Robertson, K.M., Schorr, G.S., Schultz, M.B., Webster, D.L., and Taylor, B.L. (2014). Nuclear and mitochondrial patterns of population structure in North Pacific false killer whales (*Pseudorca crassidens*). *J. Heredity.* doi.10.1093/jhered/esu029.

Oleson, E.M., Boggs, C.H., Forney, K.A., Hanson, M.B., Kobayashi, D.R., Taylor, B.L., Wade, P.R., and Ylitalo, G.M. (2010). Status review of Hawaiian insular false killer whales (*Pseudorca crassidens*) under the Endangered Species Act. *NOAA Tech. Memo. NMFS-PIFSC-22.*

Zaeschmar, J.R., Visser, I.N., Fertl, D., Dwyer, S.L., Meissner, A.M., Halliday, J., Berghan, J., Donnelly, D., and Stockin, K.A. (2014). Occurrence of false killer whales (*Pseudorca crassidens*) and their association with common bottlenose dolphins (*Tursiops truncatus*) off northeastern New Zealand. *Mar. Mamm. Sci.* **30**, 594–608.

FEEDING MORPHOLOGY

Christopher D. Marshall

F

I. Functional Morphology

Functional morphology is the study of structure, its relationship to function, and organismal adaptation. Marine mammals, and their aquatic adaptations, have interested functional morphologists for hundreds of years. Accordingly, our knowledge of their anatomy is extensive for many species. Although much progress has been made recently, experimental investigations are still largely lacking relative to terrestrial mammals. This has been due to the difficulty of working with large mammals in an aquatic environment and the lack of technology that can be taken in the field. As a result, morphology has been used extensively to predict function of marine mammals. However, experimental work regarding functional and behavioral performance of marine mammals is beginning to flourish. When integrated, morphological inference and direct empirical measurements of performance greatly enrich our knowledge of how marine mammals interact with their environment. Marine mammal adaptations for feeding are especially divergent relative to terrestrial mammals, and this will be the focus of this chapter. As in any comparative study, the phylogenetic history of the organism of interest is of paramount importance. The fact that "marine mammals" are a diverse collection of nonrelated mammals that have returned to the sea is not only an important consideration for functional studies but also it makes marine mammals an interesting study group regarding convergent evolution of form and function, and phylogenetic constraint.

II. Cetacean Functional Feeding Morphology

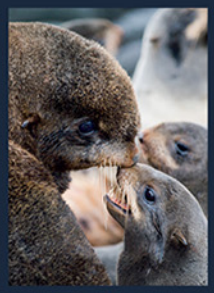
Cetaceans have developed some of the most specialized and varied feeding mechanisms among mammals. This should not be a surprise since cetaceans exhibit an amazing amount of ecological diversity and inhabit a diverse number of habitats.

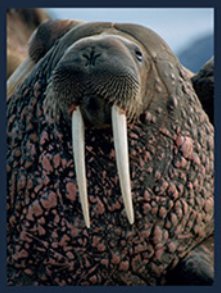
A. Odontocetes

Toothed whales have highly derived mandibles. This is reflected in the number of teeth found among odontocetes; some species may possess 200–300 homodont teeth (e.g., river dolphins) within long narrow jaws, whereas other odontocetes are characterized by drastic reduction in tooth number, tooth function, and possess blunt rostra. The delphinid jaw has often been called a pincer jaw, which refers to a raptorial biting method of prey capture (Marshall and Goldbogen, 2015). The high velocity, low mechanical advantage odontocete jaw is a modification for capturing elusive prey. River dolphins are exemplary examples of this feeding mode. The

ENCYCLOPEDIA OF MARINE MAMMALS

THIRD EDITION




EDITED BY
BERND WÜRSIG
J. G. M. THEWISSEN
KIT M. KOVACS