

FALSE KILLER WHALE (*Pseudorca crassidens*): Hawaiian Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

False killer whales are found worldwide mainly in tropical and warm-temperate waters (Stacey et al. 1994). In the North Pacific, this species is well known from southern Japan, Hawaii, and the eastern tropical Pacific. Most knowledge about this species comes from outside Hawaiian waters (Stacey et al. 1994). There are six stranding records from Hawaiian waters (Nitta 1991; Maldini 2005). Two sightings of false killer whales were made during a 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands (Figure 1; Barlow 2003). Smaller-scale surveys conducted around the Main Hawaiian Islands (Figure 2) show that false killer whales are also commonly encountered in nearshore waters (Baird et al. 2005, Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004).

Genetic analyses of tissue samples collected near the main Hawaiian Islands indicate that Hawaiian false killer whales are reproductively isolated from false killer whales found in the eastern tropical Pacific Ocean (S. Chivers, NMFS/SWFSC, unpublished data); however, the offshore range of this Hawaiian population is unknown. Fishery interactions with false killer whales demonstrate that this species also occurs in U.S. EEZ waters around Palmyra Atoll (Figure 2), but it is not known whether these animals are part of the Hawaiian stock or whether they represent a separate stock of false killer whales. Based on patterns of movement and population structure

observed in other island-associated cetaceans (Norris and Dohl 1980; Norris et al. 1994; Baird et al. 2001, 2003; S. Chivers, pers. comm.), the animals around Palmyra Atoll may represent a separate stock. Unconfirmed sightings of false killer whales have also been reported near Johnston Atoll and require further investigation (NMFS/PIR, unpublished data). Efforts are currently underway to obtain additional tissue samples of false killer whales for

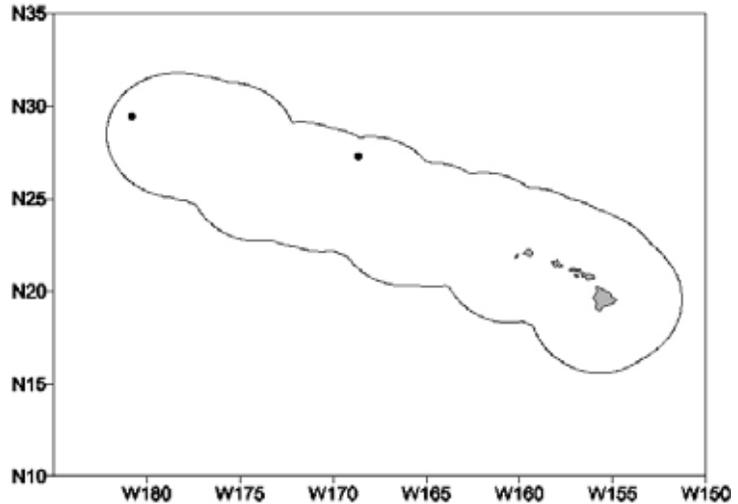


Figure 1. False killer whale sighting locations during the 2002 shipboard survey of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2003; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ.

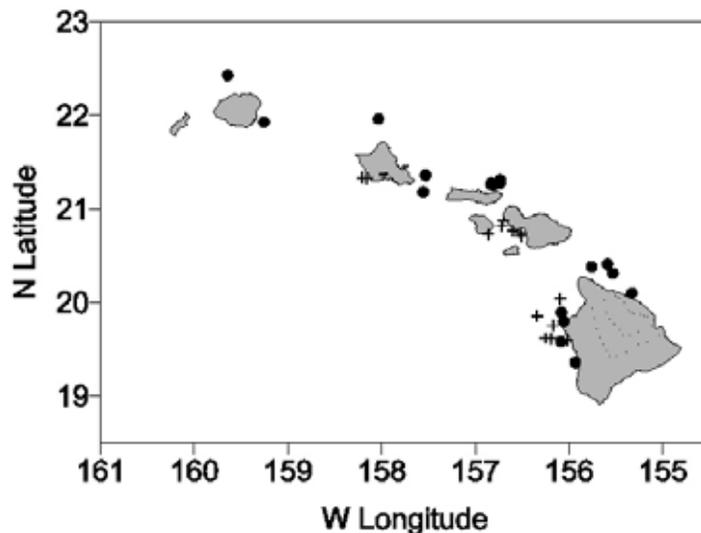


Figure 2. False killer whale sighting locations during 2000-2004 boat-based surveys (+) (Baird et al. 2005) and 1993-2003 aerial surveys (•) (Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004) around the Main Hawaiian Islands. See Appendix 2 for details on timing and location of survey effort.

further studies of population structure in the North Pacific Ocean. For the Marine Mammal Protection Act (MMPA) stock assessment reports, there is currently a single Pacific management stock including animals found within the U.S. EEZ of the Hawaiian Islands. Information on false killer whales around Palmyra Atoll will provisionally be included with this stock assessment report, recognizing that separate stock status may be warranted for these animals in the future. Estimates of abundance, potential biological removals, and status determinations will be presented separately for U.S. EEZ waters of the Hawaiian Islands and Palmyra Atoll.

POPULATION SIZE

Population estimates for this species have been made from shipboard surveys in Japan (Miyashita 1993) and the eastern tropical Pacific (Wade and Gerrodette 1993), but evidence suggests that false killer whales around Hawaii form a distinct population (S. Chivers, NMFS/SWFSC, unpublished data). As part of the Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate (ATOC) study, a total of twelve aerial surveys were conducted within about 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998. An abundance estimate of 121 (CV=0.47) false killer whales was calculated from the combined survey data (Mobley et al. 2000). This study underestimated the total number of false killer whales within the U.S. EEZ off Hawaii, because areas around the Northwestern Hawaiian Islands (NWHI) and beyond 25 nautical miles from the main islands were not surveyed and estimates were uncorrected for the proportion of diving animals missed from the survey aircraft. Furthermore, the data on which this estimate was based are now over 5 years old. A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 268 (CV=1.08) false killer whales (Barlow 2003). This is the best available abundance estimate for false killer whales within the Hawaiian Islands EEZ.

No abundance estimates are currently available for false killer whales in U.S. EEZ waters of Palmyra Atoll; however, density estimates for false killer whales in other Pacific regions can provide a range of likely abundance estimates in this unsurveyed region. Published estimates of false killer whale density (animals per km²) in the Pacific are: 0.0001 (CV=1.08) for the U.S. EEZ of the Hawaiian Islands (Barlow 2003); 0.0017 (CV=0.47) for nearshore waters surrounding the main Hawaiian Islands (Mobley et al. 2000), 0.0021 (CV=0.64) and 0.0016 (CV=0.31) for the eastern tropical Pacific Ocean (Wade and Gerrodette 1993; Ferguson and Barlow 2003), and 0.0033 (CV=0.56) for the eastern tropical Pacific Ocean west of 120°W and north of 5°N (Ferguson and Barlow 2003). Applying the lowest and highest of these density estimates to U.S. EEZ waters surrounding Palmyra Atoll (area size = 347,216 km²) yields a range of plausible abundance estimates of 42 - 1,160 false killer whales.

Minimum Population Estimate

The log-normal 20th percentile of the 2002 abundance estimate for the Hawaiian Islands EEZ (Barlow 2003) is 128 false killer whales. No minimum population estimate is currently available for waters surrounding Palmyra Atoll, but the false killer whale density estimates from other Pacific regions (Barlow 2003, Mobley et al. 2000, Wade and Gerrodette 1993, Ferguson and Barlow 2003; see above) can provide a range of likely values. The lognormal 20th percentiles of plausible abundance estimates for the Palmyra Atoll EEZ, based on the densities observed elsewhere, range from 20 - 746 false killer whales.

Current Population Trend

No data are available on current population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Hawaiian waters.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaiian false killer whale stock is calculated as the minimum population size (128) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.45 (for a stock of unknown status with a Hawaiian Islands EEZ mortality and serious injury rate CV between 0.60 and 0.80; Wade and Angliss 1997), resulting in a PBR of 1.2 false killer whales per year. No separate PBR can presently be calculated for false killer whales within the Palmyra Atoll EEZ, but based on the range of plausible minimum abundance estimates (20 - 746), a recovery factor of 0.48 (for a species of unknown status with a fishery mortality and serious injury rate CV between 0.30 and 0.60 within the Palmyra Atoll EEZ; Wade and Angliss 1997), and the default growth rate (½ of 4%), the PBR would likely fall between 0.2 and 7.2 false killer whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Information on fishery-related mortality of cetaceans in Hawaiian waters is limited, but the gear types used in Hawaiian fisheries are responsible for marine mammal mortality and serious injury in other fisheries throughout U.S. waters. Gillnets appear to capture marine mammals wherever they are used, and float lines from lobster traps and longlines can be expected to occasionally entangle whales (Perrin et al. 1994). In Hawaii, no mortality of false killer whales has been observed in inshore gillnets, but these fisheries are not observed or monitored.

Interactions with cetaceans have been reported for all Hawaiian pelagic fisheries, and false killer whales have been identified in fishermen's logs and NMFS observer records as taking catches from pelagic longlines (Nitta and Henderson 1993, NMFS/PIR unpublished data). They have also been observed feeding on mahi mahi, *Coryphaena hippurus*, and yellowfin tuna, *Thunnus albacares*, and frequently steal large fish (up to 70 pounds) (Shallenberger 1981) from the trolling lines of both commercial and recreational fishermen (S. Kaiser, pers. comm.).

Between 1994 and 2003, 12 false killer whales were observed hooked in the Hawaii-based longline fishery with approximately 4-25% of all effort observed (Table 1; Forney and Kobayashi 2005). Eleven additional unidentified cetaceans, which may have been false killer whales, were also taken in this fishery (Figure 3, Forney and Kobayashi 2005). During the 15,859 observed sets, the average interaction rate of false killer whales was 1.01 false killer whales per 1000 sets. All false killer whales caught were considered seriously injured (Forney and Kobayashi 2005), based on an evaluation of the observer's description of the interaction and following established guidelines for assessing serious injury in marine mammals (Angliss and DeMaster 1998). Average 5-yr estimates of annual mortality and serious injury for 1999-2003 are 4.2 (CV = 0.45) false killer whales outside of U.S. EEZs, 1.6 (CV = 0.71) within the Hawaiian Islands EEZ, and 1.8 (CV = 0.59) within the EEZ of Palmyra Atoll (Table 1). Total estimated annual mortality and serious injury for all U.S. EEZs combined averaged 3.4 (CV = 0.33) between 1999 and 2003. Since 2001, the Hawaii-based longline fishery has undergone a series of regulatory changes, primarily to protect sea turtles (NMFS 2001). Potential impacts of these regulatory changes on the rate of false killer whale interactions are unknown.

Interaction rates between dolphins and the NWHI bottomfish fishery have been estimated based on studies conducted in 1990-1993, indicating that an average of 2.67 dolphin interactions, most likely involving bottlenose and rough-toothed dolphins, occurred for every 1000 fish brought on board (Kobayashi and Kawamoto 1995). Fishermen claim interactions with dolphins that steal bait and catch are increasing. It is not known whether these interactions result in serious injury or mortality of dolphins, nor whether false killer whales are involved.

STATUS OF STOCK

The status of false killer whales in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this species. They are not listed as "threatened" or "endangered" under the Endangered Species Act (1973), nor as "depleted" under the MMPA. Because the rate of mortality and serious injury to false killer whales within the Hawaiian Islands EEZ in the Hawaii-based longline fishery (1.6 animals per year) exceeds the PBR (1.2), this stock is considered a strategic stock under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Hawaiian false

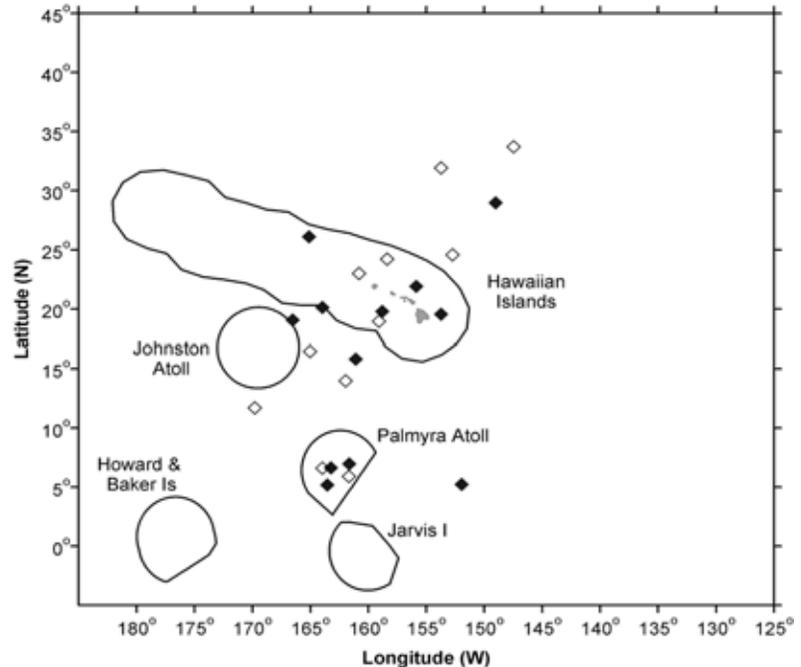


Figure 3. Locations of observed false killer whale takes (filled diamonds) and possible takes of this species (open diamonds) in the Hawaii-based longline fishery, 1994-2003. Solid lines represent the U.S. EEZ. Set locations in this fishery are summarized in Appendix 1.

killer whales cannot be considered to be insignificant and approaching zero, because it exceeds the PBR. Although no estimates of abundance or PBR are currently available for false killer whales around Palmyra Atoll, the average rate of mortality and serious injury within the Palmyra Atoll EEZ (1.8 animals per year) falls within the range of likely PBRs (0.2 to 7.2) for this region.

Table 1. Summary of available information on incidental mortality and serious injury of false killer whales (Hawaiian stock) in commercial fisheries, within and outside of U.S. EEZs (Forney and Kobayashi 2005). Mean annual takes are based on 1999-2003 data unless otherwise indicated.

Fishery Name	Year	Data Type	Percent Observer Coverage	Observed and estimated mortality and serious injury of false killer whales, by EEZ region								
				Outside of U.S. EEZs			Hawaiian Islands EEZ			Palmyra Atoll EEZ		
				Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)
Hawaii-based longline fishery	1999	observer data	3.6%	0	0 (-)		0	0 (-)		0	0 (-)	
	2000		11.1%	0	0 (-)		0	0 (-)		0	0 (-)	
	2001		23.0%	2	10 (0.71)	4.2	0	0 (-)	1.6	1	4 (1.00)	1.8
	2002		24.8%	3	11 (0.58)	(0.45)	0	0 (-)	(0.71)	2	5 (0.71)	(0.59)
	2003		21.9%	0	0 (-)		2	8 (0.71)		0	0 (-)	
Minimum total annual takes within U.S. EEZ waters							3.4 (0.33)					

REFERENCES

- Angliss, R. P. and D. P. DeMaster. 1998. Differentiating Serious and Non_Serious Injury of Marine Mammals Taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop 1_2 April 1997, Silver Spring, Maryland. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-13. 48 pp.
- Baird, R. W., Ligon, A. D., Hooker, S. K., and A. M. Gorgone. 2001. Subsurface and nighttime behaviour of pantropical spotted dolphins in Hawai'i. *Can. J. Zool.* 79:988-996.
- Baird, R.W., McSweeney D.J., Webster, D.L., Gorgone, A.M., and Ligon, A.D. 2003. Studies of odontocete population structure in Hawaiian waters: Results of a survey through the main Hawaiian Islands in May and June 2003. Report prepared under contract #AB133F-02-CN-0106 to the Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037, USA. 10p.
- Baird, R.W., A.M. Gorgone, D.L. Webster, D.J. McSweeney, J.W. Durban, A.D. Ligon, D.R. Salden, and M.H. Deakos. 2005. False killer whales around the Main Hawaiian Islands: An assessment of inter-island movements and population size using individual photo-identification. Contract Report JJ133F04SE0120 prepared for the Pacific Islands Fisheries Science Center, National Marine Fisheries Service, 2570 Dole Street, Honolulu, Hawaii, 96822. 24pp.
- Barlow, J. 2003. Cetacean abundance in Hawaiian waters during summer/fall 2002. Admin. Rep. LJ-03-13. Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037.
- Chivers, S. NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037.
- Ferguson, M. C. and J. Barlow. 2003. Addendum: Spatial distribution and density of cetaceans in the eastern tropical Pacific Ocean based on summer/fall research vessel surveys in 1986-96. Administrative Report LJ-01-04 (addendum), Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037.
- Forney, K.A. and D. Kobayashi. 2005. Updated estimates of mortality and injury of cetaceans in the Hawaii-based longline fishery, January 1994 – June 2004. Draft report. Document PSRG-07 presented to the Pacific Scientific Review Group, January 4-6, 2005. Available from Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037.
- Kobayashi, D. R. and K. E. Kawamoto. 1995. Evaluation of shark, dolphin, and monk seal interactions with Northwestern Hawaiian Island bottomfishing activity: a comparison of two time periods and an estimate of economic impacts. *Fisheries Research* 23: 11-22.
- Maldini, D., L. Mazzuca, and S. Atkinson. 2005. Odontocete stranding patterns in the Main Hawaiian Islands (1937-2002): How do they compare with live animal surveys? *Pacific Science* 59(1):55-67.
- Miyashita, T. 1993. Abundance of dolphin stocks in the western North Pacific taken by the Japanese drive fishery. *Rep. Int. Whal. Commn.* 43:417-437.
- Mobley, J.R. , Jr, S. S. Spitz, K. A. Forney, R. A. Grotefendt, and P. H. Forestall. 2000. Distribution and

- abundance of odontocete species in Hawaiian waters: preliminary results of 1993-98 aerial surveys Admin. Rep. LJ-00-14C. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 26 pp.
- Mobley, J.R. 2001. Results of 2001 aerial surveys north of Kauai. Report to North Pacific Acoustic Laboratory program. 20 pp. Available as downloadable pdf file at:
<http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/2001NPAL.pdf>
- Mobley, J.R. 2002. Results of 2002 aerial surveys north of Kauai. Report to North Pacific Acoustics Laboratory program. 20 pp. Available as downloadable pdf file at:
<http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/2002NPAL.pdf>
- Mobley, J.R. 2003. Results of 2003 aerial surveys north of Kauai. Report to North Pacific Acoustics Laboratory program. 20 pp. Available as downloadable pdf file at:
<http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/2003NPAL.pdf>
- Mobley, J.R. 2004. Results of 2004 aerial surveys north of Kauai. Report to North Pacific Acoustics Laboratory program. 25 pp. Available as downloadable pdf file at:
<http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/2004NPAL.pdf>
- Nitta, E. 1991. The marine mammal stranding network for Hawaii: an overview. *In*: J.E. Reynolds III, D.K. Odell (eds.), Marine Mammal Strandings in the United States, pp.56-62. NOAA Tech. Rep. NMFS 98, 157 pp.
- Nitta, E. and J. R. Henderson. 1993. A review of interactions between Hawaii's fisheries and protected species. *Mar. Fish. Rev.* 55(2):83-92.
- NMFS, Pacific Islands Region, Observer Program, 1602 Kapiolani Blvd, Suite 1110, Honolulu, HI 96814.
- NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92027.
- NMFS Western Pacific Pelagic Fisheries Biological Opinion 2001. Available from Pacific Islands Region, 1602 Kapiolani Blvd, Suite 1110, Honolulu, HI 96814 (<http://swr.nmfs.noaa.gov/pir>).
- Norris, K. S., B. Würsig, R. S. Wells, and M. Würsig. 1994. The Hawaiian Spinner Dolphin. University of California Press, 408 pp.
- Norris, K. S. and T. P. Dohl. 1980. Behavior of the Hawaiian spinner dolphin, *Stenella longirostris*. *Fish. Bull.* 77:821-849.
- Perrin, W.F., G. P. Donovan and J. Barlow. 1994. Gillnets and Cetaceans. *Rep. Int. Whal. Commn.*, Special Issue 15, 629 pp.
- Shallenberger, E.W. 1981. The status of Hawaiian cetaceans. Final report to U.S. Marine Mammal Commission. MMC-77/23, 79pp.
- Stacey, P. J., S. Leatherwood, and R. W. Baird. 1994. *Pseudorca crassidens*. *Mamm. Spec.* 456:1-6.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for Assessing Marine Mammal Stocks: Report of the GAMMS Workshop April 3-5, 1996, Seattle, Washington. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12. 93 pp.
- Wade, P. R. and T. Gerrodette. 1993. Estimates of cetacean abundance and distribution in the eastern tropical Pacific. *Rep. Int. Whal. Commn.* 43:477-493.