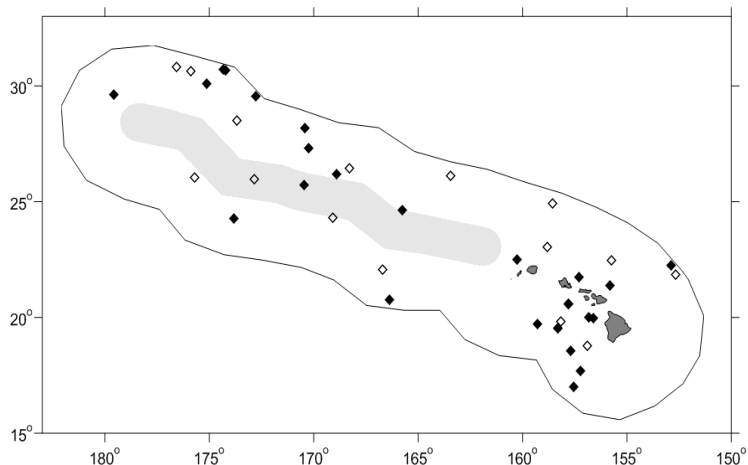


## STRIPED DOLPHIN (*Stenella coeruleoalba*): Hawaii Stock

### STOCK DEFINITION AND GEOGRAPHIC RANGE

Striped dolphins are found in tropical to warm-temperate waters throughout the world (Perrin et al. 2009). Sightings have historically been infrequent in nearshore waters (Shallenberger 1981, Mobley et al. 2000, Baird et al. 2013). Summer/fall shipboard surveys of the waters within the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands, resulted in 15 sightings of striped dolphins in 2002 and 29 in 2010 (Figure 1; Barlow 2006, Bradford et al. 2013).

Striped dolphins have been intensively exploited in the western North Pacific, where three migratory stocks are provisionally recognized (Kishiro and Kasuya 1993). In the eastern tropical Pacific all striped dolphins are provisionally considered to belong to a single stock (Dizon et al. 1994). For the Marine Mammal Protection Act (MMPA) stock assessment reports, striped dolphins within the Pacific U.S. EEZ are divided into two discrete areas: 1) waters off California, Oregon and Washington, and 2) waters around Hawaii (this report), including animals found both within the Hawaiian Islands EEZ and in adjacent high seas waters. Because data on abundance, distribution, and human-caused impacts are largely lacking for high seas waters, the status of the Hawaii stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands (NMFS 2005). Striped dolphins involved in eastern tropical Pacific tuna purse-seine fisheries are managed separately under the MMPA.



**Figure 1.** Striped dolphin sighting locations during the 2002 (open diamonds) and 2010 (black diamonds) shipboard surveys of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006, Bradford et al. 2013; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ. Gray shading indicates area of Papahānaumokuākea Marine National Monument.

### POPULATION SIZE

Population estimates are available for Japanese waters (Miyashita 1993) and the eastern tropical Pacific (Wade and Gerrodette 1993), but it is not known whether any of these animals are part of the same population that occurs around the Hawaiian Islands. A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 13,143 (CV=0.46) striped dolphins (Barlow 2006). The recent 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 20,650 (CV=0.36) striped dolphins (Bradford et al. 2013). This is currently the best available abundance estimate for this stock.

### Minimum Population Estimate

The minimum population size is calculated as the lower 20th percentile of the log-normal distribution (Barlow et al. 1995) of the 2010 abundance estimate, or 15,391 striped dolphins.

### Current Population Trend

The broad and overlapping confidence intervals around the 2002 and 2010 estimates preclude assessment of trends with the available data.

### CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate.

## POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaii stock of striped dolphins is calculated as the minimum population size within the U.S. EEZ of the Hawaiian Islands (15,391) times one half the default maximum net growth rate for cetaceans ( $\frac{1}{2}$  of 4%) times a recovery factor of 0.5 (for a stock of unknown status with no known fishery mortality and serious injury within the Hawaiian Islands EEZ ; Wade and Angliss 1997), resulting in a PBR of 154 striped dolphins per year.

## HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

### New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen et al. 2008, NMFS 2012). NMFS defines serious injury as an “*injury that is more likely than not to result in mortality*”. Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

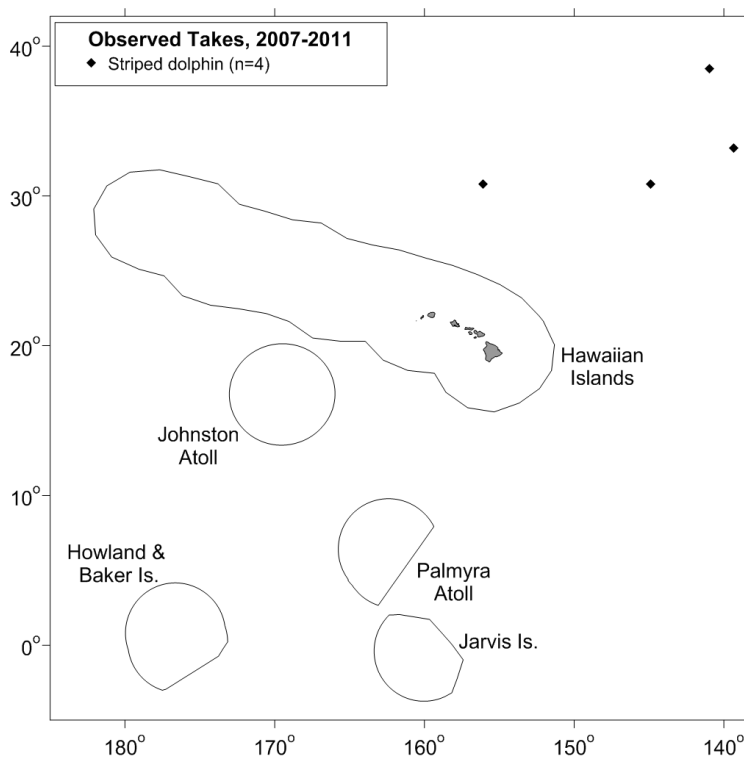
### Fishery Information

Information on fishery-related mortality and serious injury 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. Entanglement in gillnets and hooking or entanglement in various hook and line fisheries have been reported for small cetaceans in Hawaii (Nitta & Henderson, 1993). One striped dolphin stranded entangled in fishing gear in 2005, but the responsible fishery cannot be determined, as the entangled gear was not described (NMFS PIR MMRN). No estimates of human-caused mortality or serious injury are currently available for nearshore hook and line or gillnet fisheries because these fisheries are not observed or monitored for protected species bycatch.

There are currently two distinct longline fisheries based in Hawaii: a deep-set longline (DSL) fishery that targets primarily tunas, and a shallow-set longline fishery (SSL) that targets swordfish. Both fisheries operate within U.S. waters and on the high seas. Between 2007 and 2011, one striped dolphin was killed and two seriously injured on the high seas in the SSL fishery (100% observer coverage), and one striped dolphin was killed on the high seas in the DSL fishery (20-22% observer coverage) (Figure 2, Bradford & Forney 2013, McCracken 2013). Average 5-yr estimates of annual mortality and serious injury for 2007-2011 are 1.4 (CV = 0.9) dolphins outside of U.S. EEZs, and zero within the Hawaiian Islands EEZ (Table 1). Eight unidentified cetaceans were taken in the DSL fishery, and two unidentified cetaceans were taken in the SSL fishery, some of which may have been striped dolphins.

## STATUS OF STOCK

The Hawaii stock of striped dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of striped dolphins in Hawaiian waters relative to OSP is unknown, and there are insufficient data to



**Figure 2.** Locations of striped dolphin takes (filled diamonds) in Hawaii-based longline fisheries, 2007-2011. Solid lines represent the U.S. EEZs. Fishery descriptions are provided in Appendix 1.

evaluate trends in abundance. Striped dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. Given the absence of recent recorded fishery-related mortality or serious injuries in U.S. EEZ waters, total fishery mortality and serious injury for striped dolphins can be considered insignificant and approaching zero. One striped dolphin stranded in the main Hawaiian Islands tested positive for *Brucella* (Chernov, 2010) and another for *Morbillivirus* (Jacob 2012). *Brucella* is a bacterial infection that may limit recruitment by compromising male and female reproductive systems if it is common in the population, and can also cause neurological disorders that may result in death (Van Bressem et al. 2009). Although *morbillivirus* is known to trigger lethal disease in cetaceans (Van Bressem et al. 2009), its impact on the health of the stranded animal is not known as it was found in only a few tested tissues (Jacob 2012). The presence of *Morbillivirus* in 10 species (Jacob 2012) and *Brucella* in 3 species (Cherbov 2010, West unpublished data) raises concerns about the history and prevalence of these diseases in Hawaii and the potential population impacts on Hawaiian cetaceans. It is not known if *Brucella* or *Morbillivirus* are common in the Hawaii stock.

**Table 1.** Summary of available information on incidental mortality and serious injury of striped dolphin (Hawaii stock) in commercial longline fisheries, within and outside of U.S. EEZs (McCracken & Forney 2010). Mean annual takes are based on 2007-2011 data unless otherwise indicated. Information on all observed takes (T) and combined mortality events & serious injuries (MSI) is included. Total takes were prorated to deaths, serious injuries, and non-serious injuries based on the observed proportions of each outcome.

Fishery Name	Year	Data Type	Percent Observer Coverage	Observed total interactions (T) and mortality events, and serious injuries (MSI), and total estimated mortality and serious injury (M&SI) of striped dolphins			
				Outside U.S. EEZs		Hawaiian EEZ	
				Obs. T/MSI	Estimated M&SI (CV)	Obs. T/MSI	Estimated M&SI (CV)
Hawaii-based deep-set longline fishery	2007	Observer data	20%	0	0 (-)	0	0 (-)
	2008		22%	0	0 (-)	0	0 (-)
	2009		21%	0	0 (-)	0	0 (-)
	2010		21%	0	0 (-)	0	0 (-)
	2011		20%	1/1	4 (1.5)	0	0 (-)
<b>Mean Estimated Annual Take (CV)</b>				<b>0.8 (0.9)</b>		<b>0 (-)</b>	
Hawaii-based shallow-set longline fishery	2007	Observer data	100%	0	0	0	0
	2008		100%	1/1	1	0	0
	2009		100%	0	0	0	0
	2010		100%	2/2	2	0	0
	2011		100%	0	0	0	0
<b>Mean Annual Takes (100% coverage)</b>				<b>0.6</b>		<b>0</b>	
<b>Minimum total annual takes within U.S. EEZ</b>						<b>0 (-)</b>	

## REFERENCES

- Anderson, M.S., K.A. Forney, T.V.N. Cole, T. Eagle, R.P. Angliss, K. Long, L. Barre, L. VanAtta, D. Borggaard, T. Rowles, B. Norberg, J. Whaley, L. Engleby. Differentiating serious and non-serious injury of marine mammals: Report of the Serious Injury Technical Workshop 10-13 September 2007, Seattle, WA. NOAA Tech Memo NMFS-OPR-39, 94 p.
- Angliss, R.P. and D.P. DeMaster. 1997. 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, MD. NOAA Tech Memo NMFS-OPR-13, 48 p.
- Baird, R.W., D.L. Webster, J.M. Aschettino, G.S. Schorr, D.J. McSweeney. 2013. Odontocete cetaceans around the main Hawaiian Islands: Habitat use and relative abundance from small-boat sighting surveys. *Aquatic Mammals* 39:253-269.
- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 p.
- Barlow, J. 2006. Cetacean abundance in Hawaiian waters estimated from a summer/fall survey in 2002. *Marine Mammal Science* 22(2): 446-464.
- Bradford, A.L. and K.A. Forney. 2013. Injury determinations for cetaceans observed interacting with Hawaii and

- American Samoa longline fisheries during 2007-2011. PIFSC Working Paper WP-13-002.
- Bradford, A.L., K.A. Forney, E.M. Oleson, and J. Barlow. 2013. Line-transect abundance estimates of cetaceans in the Hawaiian EEZ. PIFSC Working Paper WP-13-004.
- Chernov, A. E. 2010. The identification of *Brucella ceti* from Hawaiian cetaceans M.S. Marine Science Thesis. Hawaii Pacific University, Kaneohe, HI, USA
- Dizon, A. E., W. F. Perrin, and P. A. Akin. 1994. Stocks of dolphins (*Stenella* spp. and *Delphinus delphis*) in the eastern tropical Pacific: a phylogeographic classification. NOAA Tech. Rep. NMFS 119, 20 pp.
- Jacob, J. M. 2012. Screening and characterization of morbillivirus in Hawaiian cetaceans. M.S. Marine Science Thesis. Hawaii Pacific University, Kaneohe, HI,
- Kishiro, T. and T. Kasuya. 1993. Review of Japanese dolphin drive fisheries and their status. Rep. Int. Whal. Commn. 43:439-452.
- 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.
- McCracken, M. 2013. Preliminary assessment of incidental interactions with marine mammals in the Hawaii longline deep and shallow set fisheries from 2007 to 2011. PIFSC Working Paper WP-13.
- 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.
- 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. 2005. Revisions to Guidelines for Assessing Marine Mammal Stocks. 24 pp. Available at: <http://www.nmfs.noaa.gov/pr/pdfs/sars/gamms2005.pdf>
- NMFS. 2012. NOAA Fisheries Policy Directive 02-038-01 Process for Injury Determinations (01/27/12). Available at: [http://www.nmfs.noaa.gov/pr/pdfs/serious\\_injury\\_policy.pdf](http://www.nmfs.noaa.gov/pr/pdfs/serious_injury_policy.pdf)
- Perrin, W.F., B. Würsig and J.G.M. Thewissen. 2009. Encyclopedia of Marine Mammals. Second Edition. Academic Press, Amsterdam.
- Shallenberger, E.W. 1981. The status of Hawaiian cetaceans. Final report to U.S. Marine Mammal Commission. MMC-77/23, 79pp.
- Van Bresseem, M., J.A. Raga, G. Di Guardo, D.P. Jepson, P. J. Duignan, U. Siebert, T. Barrett, M. C. de Oliveira Santos, I.B. Moreno, S. Siciliano, A. Aguilar, K. Van Waerebeek. 2009. Emerging infectious diseases in cetaceans worldwide and the possible role of environmental stressors. Diseases of Aquatic Organisms. 85:143-157.
- 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.