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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. 2017).

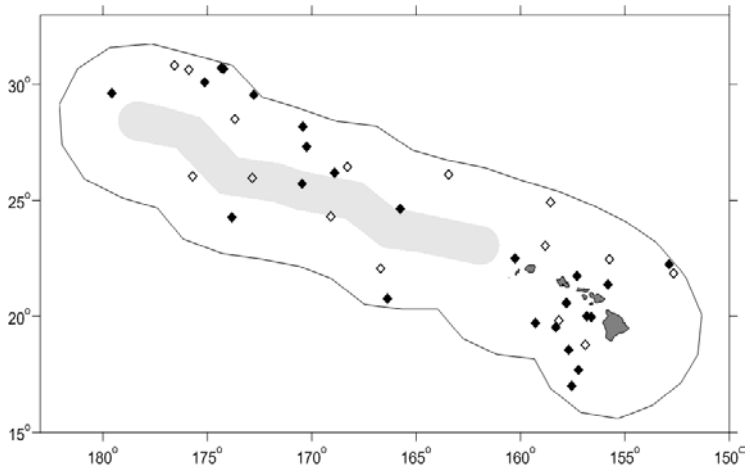

Figure 1. Striped dolphin sighting locations during the 2002 (open diamonds) and 2010 (black diamonds) shipboard surveys of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006, Bradford et al. 2017; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ. Gray shading indicates area of Papahanaumokuakea Marine National Monument.

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). There is insufficient data to examine finer stock structure within Hawaiian waters, though data available to date do not suggest island-associated populations for this species (Baird 2016).

For the Marine Mammal Protection Act (MMPA) stock assessment reports, striped dolphins within the Pacific U.S. EEZ are divided into two discrete, non-contiguous 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.

POPULATION SIZE

Encounter data from a 2010 shipboard line-transect survey of the entire Hawaiian Islands EEZ was recently evaluated using Beaufort sea-state-specific trackline detection probabilities for striped dolphins, resulting in an abundance estimate of 61,021 (CV = 0.38) striped dolphins (Bradford et al. 2017) in the Hawaii stock. A 2002 shipboard line-transect survey of the same area resulted in an abundance estimate of 13,143 (CV=0.46) striped dolphins (Barlow 2006). Abundance analyses of the 2002 and 2010 datasets used different g(0) values. Species abundances estimated from the 2002 HICEAS survey used pooled small dolphin, large dolphin, and large whale g(0) (the probability of sighting and recording an animal directly on the track line) estimates stratified by group size (Barlow 1995). Since then, Barlow (2015) developed a more robust method for estimating species-specific g(0) values that are adjusted for the Beaufort sea states that are encountered during a survey. This new method was used for analyzing the data from the 2010 survey, but has not yet been used to analyze the 2002 data. 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.

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 44,922 striped dolphins.

Current Population Trend

Abundance analyses of the 2002 and 2010 datasets used different g(0) values. The 2002 survey data have not been reanalyzed using this method. This change precludes evaluation of population trends at this time. Assessment of population trend will likely require additional survey data and reanalysis of all datasets using comparable methods.

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 (44,922) times one half the default maximum net growth rate for cetaceans (½ 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 449 striped dolphins per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

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.

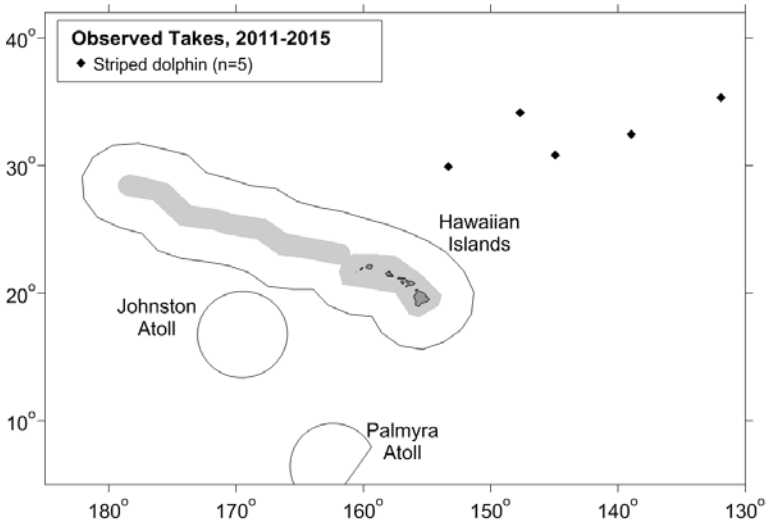

Figure 2. Locations of striped dolphin takes (filled diamonds) in Hawaii-based longline fisheries, 2011-2015. Solid lines represent the U.S. EEZs. Gray shading notes areas closed to longline fishing. Fishery descriptions are provided in Appendix 1.

There are currently two distinct longline fisheries based in Hawaii: a deep-set longline (DSLL) fishery that targets primarily tunas, and a shallow-set longline fishery (SSLL) that targets swordfish. Both fisheries operate within U.S. waters and on the high seas. Between 2011 and 2015, one striped dolphin was seriously injured, one not seriously injured, and one could not be determined based on the information provided by the observer in the SSLL fishery (100% observer coverage), and one striped dolphin was killed and one not seriously injured in the DSLL fishery (20-21% observer coverage) (Figure 2, Bradford 2017, Bradford and Forney 2017, McCracken 2017). All striped dolphin interactions occurred outside of the U.S. EEZs. Average 5-yr estimates of annual mortality and serious injury for 2011-2015 are 1.7 (CV = 1.0) dolphins outside of U.S. EEZs, and zero within the Hawaiian Islands EEZ (Table 1). Four additional unidentified cetaceans were taken in the DSLL fishery, and one unidentified cetacean was taken in the SSLL fishery, some of which may have been striped dolphins.

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 2017). Mean annual takes are

based on 2011-2015 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	2011	Observer data	20%	1/1	3 (0.8)	0	0 (-)
	2012		20%	0	0 (-)	0	0 (-)
	2013		20%	0	0 (-)	0	0 (-)
	2014		21%	0	0 (-)	0	0 (-)
	2015		21%	1/0	3 (1.1)	0	0 (-)
Mean Estimated Annual Take (CV)					**1.1 (1.0)**		**0 (-)**
Hawaii-based shallow-set longline fishery	2011	Observer data	100%	0	0	0	0
	2012		100%	1/0	0	0	0
	0213		100%	0	0	0	0
	2014		100%	2/2[†]	2	0	0
	2015		100%	0	0	0	0
Mean Annual Takes (100% coverage)					**0.6**		**0**
Minimum total annual takes within U.S. EEZ							**0 (-)**

[†] Injury status could not be determined based on information collected by the observer. Injury status is prorated (see text).

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 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 two for *Morbillivirus* (Jacob et al. 2016). *Brucella* is a bacterial infection that if common in the population may limit recruitment by compromising male and female reproductive systems, and can also cause neurological disorders that may result in death (Van Bressem et al. 2009). Although *morbillivus* is known to trigger lethal disease in cetaceans (Van Bressem et al. 2009), its impact on the health of the stranded animals is not known as it was found in only a one tested tissue within each animal (Jacob et al. 2016). The presence of *Morbillivirus* in 10 species (Jacob et al. 2016) 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.

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