

PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata attenuata*): Hawaiian Islands Stock Complex – Oahu, 4-Islands, Hawaii Island, and Hawaii Pelagic Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Pantropical spotted dolphins are primarily found in tropical and subtropical waters worldwide (Perrin et al. 2009). Much of what is known about the species in the North Pacific has been learned from specimens obtained in the large directed fishery in Japan and in the eastern tropical Pacific (ETP) tuna purse-seine fishery (Perrin et al. 2009). Spotted dolphins are common and abundant throughout the Hawaiian archipelago, including nearshore where they are the second most frequently sighted species during nearshore surveys (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 14 sightings in 2002 and 49 sightings in 2010 (Barlow 2006, Bradford et al. 2013; Figure 1). Fourteen strandings of this species have been documented in Hawaii since 1975 (Nitta 1991, Maldini et al. 2005, NMFS PIR Marine Mammal Response Network database), including two since 2007. Morphological differences and distribution patterns indicate that the spotted dolphins around the Hawaiian Islands belong to a stock that is distinct from those in the ETP (Perrin 1975; Dizon et al. 1994; Perrin et al. 1994b). Their possible affinities with other stocks elsewhere in the Pacific have not been investigated.

Pantropical spotted dolphins have been observed in all months of the year around the main Hawaiian Islands, and in areas ranging from shallow near-shore water to depths of 5,000 m, although they peak in sighting rates in depths from 1,500 to 3,500 m (Baird et al. 2013). Although they represent from 22.9 to 26.5% of the odontocete sightings from Oahu, the 4-islands, and Hawaii Island, they are largely absent from the nearshore waters around Kauai and Niihau,

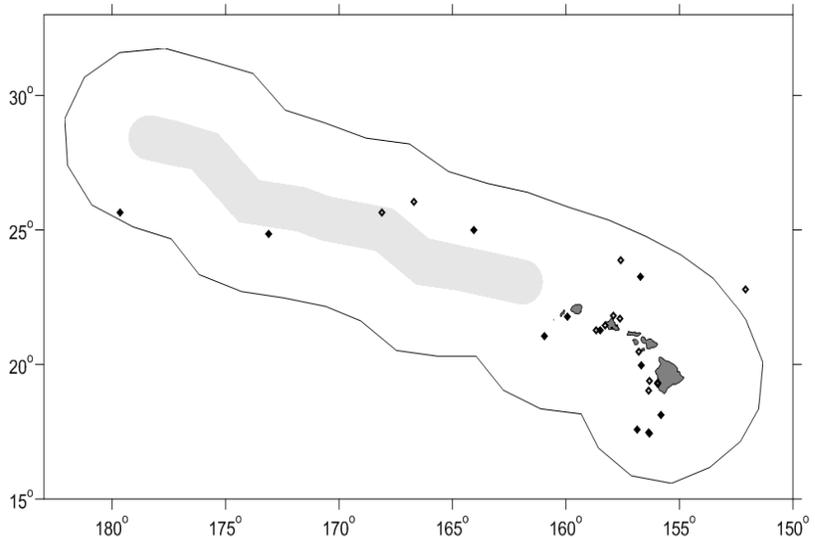


Figure 1. Pantropical spotted dolphin sighting locations during the 2002 (open diamonds) and 2010 (black diamonds) shipboard surveys of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006, Bradford et al. 2013; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ. Gray shading indicates area of Papahānaumokuākea Marine National Monument. Dotted line represents the 1000m isobath. Insular stock boundaries are shown in Figure 2.

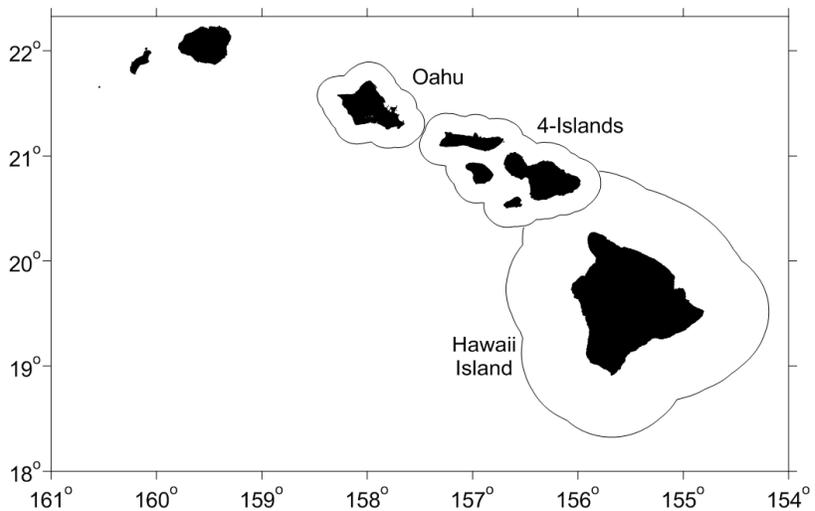


Figure 2. Main Hawaiian Islands insular spotted dolphin stock boundaries (gray lines). Oahu and 4-Islands stocks extend 20km from shore. Hawaii Island stock extends to 65km from shore based on distance of furthest encounter.

representing only 3.9% of sightings in that area (Baird et al. 2013). Genetic analyses of 176 unique samples of pantropical spotted dolphins collected during near-shore surveys off each of the main Hawaiian Islands from 2002 to 2003, and near Hawaii Island from 2005 through 2008 suggest three island-associated stocks are evident (Courbis 2011). The results of the Courbis (2011) study indicate that pantropical spotted dolphins in Hawaii’s nearshore waters have low haplotypic diversity with haplotypes unique to each of the island areas. Courbis (2011) conducted extensive tests on the relatedness of individuals among islands using the microsatellite dataset and found significant differences in haplotype frequencies between islands, suggesting genetic differentiation in spotted dolphins among islands. Genetic differentiation is supported by the results of assignments tests, which indicate support for 3 island-associated populations: Hawaii Island, the 4-Islands region, and Oahu. Samples from Kauai and Niihau did not cluster together, but instead were spread among the Hawaii and Oahu clusters. Analysis of migration rate further support the separation of pantropical spotted dolphins into three island-associated stocks, with migration between regions on the order of a few individuals per generation. Based on an overview of all available information on pantropical spotted dolphins in Hawaiian waters, and NMFS guidelines for assessing marine mammal stocks (NMFS 2005), Oleson et al. (2013) proposed designation of three new island associated stocks in Hawaiian waters, as well as recognition of a fourth broadly distributed spotted dolphin stock, given the frequency of sightings in pelagic waters. Fishery interactions with pantropical spotted dolphins and sightings near Palmyra and Johnston Atolls (NMFS PIR unpublished data) demonstrate that this species also occurs in U.S. EEZ waters there, but it is not known whether these animals are part of the Hawaiian population or are a separate stock(s) of pantropical spotted dolphins.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, there are four Pacific management stocks within the Hawaiian Islands EEZ (Oleson et al. 2013): 1) the Oahu stock, which includes spotted dolphins within 20km of Oahu, 2) the 4-Island stock, which includes spotted dolphins within 20 km of Maui, Molokai, Lanai, and Kahoolawe collectively, 3) the Hawaii Island stock, which includes spotted dolphins found within 65km from Hawaii Island, and 4) the Hawaii pelagic stock, which includes spotted dolphins inhabiting the waters throughout the Hawaiian Islands EEZ, outside of the insular stock areas, but including 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 pelagic stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands (NMFS 2005). Spotted dolphins involved in eastern tropical Pacific tuna purse-seine fisheries are managed separately under the MMPA.

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 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

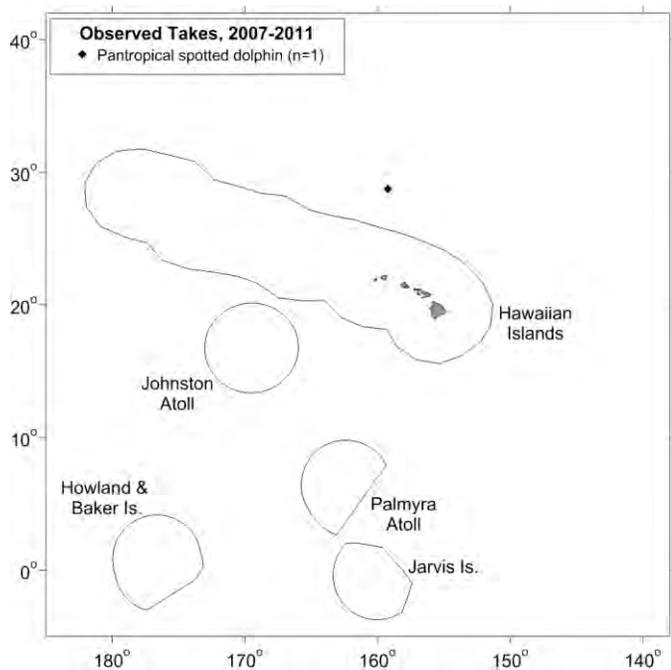


Figure 3. Locations of observed spotted dolphin takes (filled diamonds) in the Hawaii deep-set longline fishery, 2007-2011. Solid lines represent the U.S. EEZ. Set locations in this fishery are summarized in Appendix 1.

(Nitta & Henderson, 1993). 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. Commercial and recreational troll fisherman have been observed “fishing” dolphins off the islands of Hawaii, Lanai, and Oahu, including spotted dolphins, in order to catch tuna associated with the animals (Courbis et al. 2009, Rizzuto, 2007, Shallenberger 1981). Anecdotal reports from fisherman indicate that spotted dolphins are sometimes hooked (Rizzuto 1997) and photographs of dolphins suggest animals may be injured by both lines and propeller strikes (Baird unpublished data). In 2010 a spotted dolphin (4-Islands stock) was observed entangled in fishing line off Lanai. There were several wraps of line around the body and peduncle and a constricting wrap around the dorsal fin (Bradford & Lyman 2013). Based on the information provided, this entanglement is considered a serious injury under the most recently developed criteria for assessing serious injury in marine mammals (NMFS 2012). The responsible fishery is not known.

Table 1. Summary of available information on incidental mortality and serious injury of pantropical spotted dolphins (Hawaii pelagic stock) in commercial longline fisheries, within and outside of the U.S. EEZs (McCracken 2013). 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 Hawaii pelagic pantropical spotted 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%	1/1	3 (0.5)	0	0 (-)
	2009		21%	0	0 (-)	0	0 (-)
	2010		21%	0	0 (-)	0	0 (-)
	2011		20%	0	0 (-)	0	0 (-)
Mean Estimated Annual Take (CV)				0.6 (1.1)			0 (-)
Hawaii-based shallow-set longline fishery	2007	Observer data	100%	0	0	0	0
	2008		100%	0	0	0	0
	2009		100%	0	0	0	0
	2010		100%	0	0	0	0
	2011		100%	0	0	0	0
Mean Annual Takes (100% coverage)				0			0
Minimum total annual takes within U.S. EEZ							0 (-)

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 (SSLL) that targets swordfish. Both fisheries operate within U.S. waters and on the high seas. Between 2007 and 2011, no pantropical spotted dolphin were observed hooked or entangled in the SSLL fishery (100% observer coverage), and one pantropical spotted dolphin was observed incidentally killed in high seas waters in the DSLL fishery (20-22% observer coverage) (Bradford & Forney 2013, McCracken 2013) (Figure 3). Average 5-year estimates of annual mortality and serious injury for 2007-2011 are 0.6 (CV=1.1) spotted dolphins outside of U.S. EEZs, and none within the Hawaiian Islands EEZ (Table 1, McCracken 2013). Eight additional unidentified cetaceans were taken in the DSLL fishery, and two unidentified cetaceans were taken in the SSLL fishery, some of which may have been spotted dolphins.

OAHU STOCK POPULATION SIZE

The population size of the Oahu stock of spotted dolphins has not been estimated.

Minimum Population Estimate

There is no information on which to base a minimum population estimate of the Oahu stock of spotted dolphins.

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.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Oahu stock is calculated as the minimum population estimate times one half the default maximum net growth rate for cetaceans ($\frac{1}{2}$ of 4%) times a recovery factor of 0.50 (for a species of unknown status with no estimated fishery mortality or serious injury within the Oahu stock area; Wade and Angliss 1997). Because there is no minimum population estimate available the PBR for the Oahu stock of spotted dolphins is undetermined.

STATUS OF STOCK

The Oahu stock of spotted dolphins is not considered a strategic stock under the MMPA. The status of Oahu spotted dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. Spotted dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. There is no information with which to determine whether the total fishery mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate.

4-ISLANDS STOCK POPULATION SIZE

The population size of 4-Islands stock of spotted dolphins has not been estimated.

Minimum Population Estimate

There is no information on which to base a minimum population estimate of the 4-Islands stock of spotted dolphins.

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.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the 4-Islands stock is calculated as the minimum population estimate times one half the default maximum net growth rate for cetaceans ($\frac{1}{2}$ of 4%) times a recovery factor of 0.50 (for a species of unknown status with no estimated fishery mortality or serious injury within the 4-Islands stock area; Wade and Angliss 1997). Because there is no minimum population estimate available for this stock the PBR for 4-Islands stock of spotted dolphins is undetermined.

STATUS OF STOCK

The 4-Islands stock of spotted dolphins is not considered a strategic stock under the MMPA. The status of 4-Islands spotted dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. Spotted dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. Although one dolphin has been considered seriously injured due to an interaction with fishing gear, insufficient data are available to determine whether the total fishery mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate.

HAWAII ISLAND STOCK POPULATION SIZE

The population size of the Hawaii Island stock of spotted dolphins has not been estimated. An extensive collection of identification photos from this population are available; however, a photo-identification catalog has not been developed. Such a catalog could serve as the basis for developing mark-recapture estimates, but no such analyses have yet been conducted.

Minimum Population Estimate

There is no information on which to base a minimum population estimate of the Hawaii Island stock of spotted dolphins.

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.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaii Island stock is calculated as the minimum population estimate times one half the default maximum net growth rate for cetaceans ($\frac{1}{2}$ of 4%) times a recovery factor of 0.50 (for a species of unknown status with no estimated fishery mortality or serious injury within the Hawaii Island stock area; Wade and Angliss 1997). Because there is no minimum population estimate available for this stock the PBR for Hawaii Island stock of spotted dolphins is undetermined.

STATUS OF STOCK

The Hawaii Island stock of spotted dolphins is not considered a strategic stock under the MMPA. The status of Hawaii Island spotted dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. Spotted dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. There are insufficient data to determine whether the total fishery mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. One spotted dolphin found stranded on Hawaii Island has tested positive for *Morbillivirus* (Jacob 2012). Although *morbillivirus* is known to trigger lethal disease in cetaceans (Van Bresse et al. 2009), its impact on the health of the stranded animal is not known (Jacob 2012). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters (Jacob 2012) raises concerns about the history and prevalence of this disease in Hawaii and the potential population impacts on Hawaiian cetaceans.

HAWAII PELAGIC STOCK POPULATION SIZE

Population estimates are available for Japanese waters (Miyashita 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 8,978 (CV=0.48) pantropical spotted dolphins (Barlow 2006). The recent 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 15,917 (CV=0.40) spotted dolphins within the pelagic stock area (Bradford et al. 2013). This is currently the best available abundance estimate for pantropical spotted dolphins within the Hawaiian Islands EEZ.

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 for the pelagic stock area or 11,508 pantropical spotted dolphins.

Current Population Trend

The broad and overlapping confidence intervals around the 2002 and 2010 abundance estimates preclude assessment of trend 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 pelagic pantropical spotted dolphin stock is calculated as the minimum population estimate within the U.S. EEZ of the Hawaiian Islands (11,508) times one half the default maximum net growth rate for cetaceans ($\frac{1}{2}$ of 4%) times a recovery factor of 0.50 (for a stock of

unknown status with no known fishery mortality within the U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997), resulting in a PBR of 115 pantropical spotted dolphins per year.

STATUS OF STOCK

The Hawaii pelagic stock of spotted dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of Hawaii pelagic pantropical spotted dolphins 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. Pantropical spotted 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 within U.S. EEZs, the total fishery mortality and serious injury can be considered to be insignificant and approaching zero.

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