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ROUGH-TOOTHED DOLPHIN (*Steno bredanensis*): Hawaii Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Rough-toothed dolphins are found throughout the world in tropical and warm-temperate waters (Perrin et al. 2009). They are present around all the main Hawaiian Islands, though are relatively uncommon near Maui and the 4-Islands region (Baird et al. 2013) and have been observed close to the islands and atolls at least as far northwest as Pearl and Hermes Reef (Bradford et al. 2017). Rough-toothed dolphins were occasionally seen offshore throughout the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands during both 2002 and 2010 surveys (Barlow 2006, Bradford et al. 2017; Figure 1).

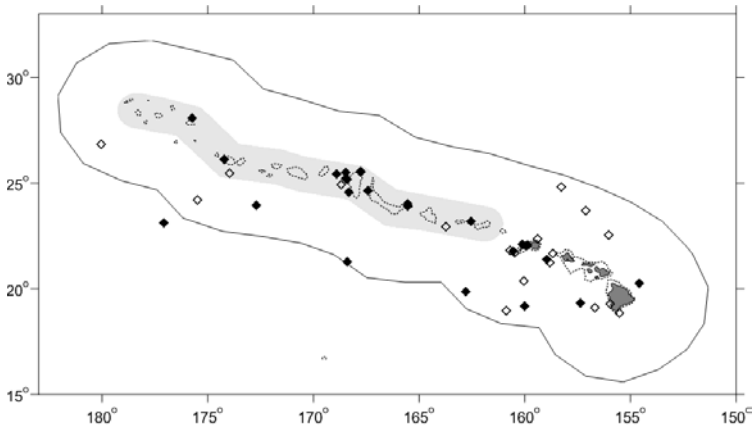

Figure 1. Rough-toothed dolphin sighting locations during the 2002 (open diamonds) and 2010 (black diamonds) shipboard cetacean surveys of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006, Bradford et al 2017; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ. Gray shading indicates area of Papahanaumokuakea Marine National Monument. Dotted line represents the 1000 m isobath.

Population structure in rough-toothed dolphins was recently examined using genetic samples from several tropical and sub-tropical island areas in the Pacific. Albertson et al. (2016) found significant differentiation in mtDNA and nuDNA from samples collected at Hawaii Island versus all other Hawaiian Island areas sampled. Estimates of differentiation among Kauai, Oahu, and the northwestern Hawaiian Islands (NWHI) were lower and not statistically significant. Based on their result, Albertson et al. (2016) suggest that Hawaii Island warrants designation as a separate island-associated stock. Evaluation of individual rough-toothed dolphin encounters indicate differences in group sizes, habitat use, and behavior between groups seen near Hawaii Island and those seen near Kauai and Niihau (Baird et al 2008).Photographic identification studies suggested that dispersal rates between the islands of Kauai/Niihau and Hawaii do not exceed 2% per year (Baird et al. 2008). Resighting rates off the island of Hawaii are high, with 75% of well-marked individuals resighted on two or more occasions, suggesting high site fidelity and low population size. Movement data from 17 individual rough-toothed dolphins tagged near Kauai and Niihau show all individuals remained associated with Kauai with exception of one individual that moved from Kauai and Oahu and back (Baird 2016). The available genetics, movements, and social affiliation data suggest that there is at least one island-associated stock in the main Hawaiian Islands (MHI). Delineation of island-associated stocks in Hawaii is under review (Martien et al. 2016). Rough-toothed dolphins have also been documented in American Samoan waters (Oleson 2009).

For the Marine Mammal Protection Act (MMPA) stock assessment reports, there are two Pacific management stocks: 1) The Hawaii Stock (this report), and 2) the American Samoa Stock. The Hawaiian stock includes animals found both within the Hawaiian Islands EEZ and in adjacent high seas waters; however, because data on abundance, distribution, and human-caused impacts are largely lacking for high seas waters, the status of this stock is evaluated based on data from the U.S. EEZ waters of the Hawaiian Islands (NMFS 2005).

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 rough-toothed dolphins, resulting in an abundance estimate of 72,528 (CV = 0.39) rough-toothed 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 8,709 (CV=0.45) rough-toothed dolphins (Barlow 2006). 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. A population estimate for this species has been made in the eastern tropical Pacific (Wade and Gerrodette 1993), but it is not known whether these animals are part of the same population that occurs around the Hawaiian Islands. Mark-recapture estimates for the islands of Kauai/Nihau and Hawaii were derived from identification photographs obtained between 2003 and 2006, resulting in estimates of 1,665 (CV=0.33) around Kauai/Niihau and 198 (CV=0.12) around the island of Hawaii (Baird *et al.* 2008). Such estimates may be representative of smaller island-assocated populations at those island areas.

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 52,833 rough-toothed dolphins within the Hawaiian Islands EEZ.

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 rough-toothed dolphins is calculated as the minimum population size within the U.S. EEZ of the Hawaiian Islands (52,833) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.4 (for a stock of unknown status with a Hawaiian Islands EEZ fishery mortality and serious injury rate CV > 0.8 ; Wade and Angliss 1997), resulting in a PBR of 423 rough-toothed 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. Rough-toothed dolphins are known to take bait and catch from several Hawaiian sport and commercial fisheries operating near the main islands (Shallenberger 1981; Schlais 1984; Nitta and Henderson 1993). They have been specifically reported to interact with the day handline fishery for tuna (palu-ahi), the night handline fishery for tuna (ika-shibi), and the troll fishery for

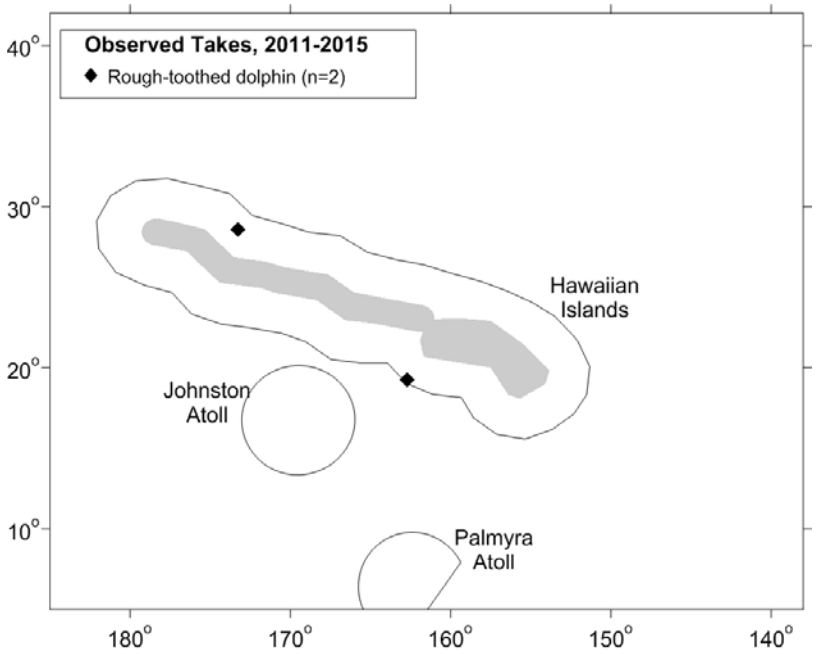

Figure 3. Locations of observed rough-toothed dolphin takes (filled diamonds) in the Hawaii-based longline fishery, 2011-2015. Solid lines represent the U. S. EEZ. Gray shading notes areas closed to longline fishing. Fishery descriptions are provided in Appendix 1.

billfish and tuna (Schlais 1984; Nitta and Henderson 1993). Baird et al. (2008) reported increased vessel avoidance of boats by rough-toothed dolphins off the island of Hawaii relative to those off Kauai or Niihau and attributed this to possible shooting of dolphins that are stealing bait or catch from recreational fisherman off the island of Hawaii (Kuljis 1983). One rough-toothed dolphin was observed off the Kona coast trailing 25-30 ft. of heavy line with two plastic jugs attached to the end of the line (Bradford and Lyman in review). The jugs were cut from the gear when other attempts (through pressure on the line) did not result in the removal of any other line or hooks, though all other trailing gear remained on the dolphin. This dolphin was considered seriously injured based on the amount of trailing gear. The source of the gear is not known. No estimates of human-caused mortality or serious injury are currently available for nearshore hook and line fisheries because these fisheries are not observed or monitored for protected species bycatch.

Table 1. Summary of available information on incidental mortality and serious injury of rough-toothed McCracken 2017). Mean annual takes are based on 2011-2015 data unless indicated otherwise. Information on all observed takes (T) and combined mortality events and 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 rough-toothed 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%	0	0 (-)	0	0 (-)
	2012		20%	0	0 (-)	0	0 (-)
	2013		20%	0	0 (-)	1/1	5 (0.9)
	2014		21%	0	0 (-)	0	0 (-)
	2015		21%	0	0 (-)	0	0 (-)
Mean Estimated Annual Take (CV)					0 (-)		**1.1 (1.1)**
Hawaii-based shallow-set longline fishery	2011	Observer data	100%	0	0	0	0
	2012		100%	0	0	0	0
	2013		100%	0	0	1/1	1
	2014		100%	0	0	0	0
	2015		100%	0	0	0	0
Mean Annual Takes (100% coverage)					**0**		**1**
Minimum total annual takes within U.S. EEZ							**2.1 (1.1)**

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. Between 2011 and 2015, one rough-toothed dolphin was observed hooked or entangled in the SSLL fishery (100% observer coverage) and one in the DSLL fishery (20-21% observer coverage) (Bradford 2017, Bradford and Forney 2017, McCracken 2017). Both of these interactions occurred inside the Hawaiian Islands EEZ and both dolphins were observed dead (Bradford 2017, Bradford and Forney 2017). Average 5-yr estimates of annual mortality and serious injury for rough-toothed dolphins during 2011-2015 are 2.1 (CV = 1.1) rough-toothed dolphins within the Hawaiian Islands EEZ and 0 dolphins outside of U.S. EEZs (Table 1, McCracken 2017). 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 rough-toothed dolphins.

STATUS OF STOCK

The Hawaii stock of rough-toothed dolphins is not considered strategic under the 1994 amendments to the MMPA, The status of rough-toothed dolphins in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. Rough-toothed dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. One rough-toothed dolphin has been observed entangled in gear and a 5-yr average of 2.1 dolphins have been killed or seriously injured in the deep-set longline fishery. There is no systematic monitoring for interactions with protected species within near-shore fisheries that may take this species, thus total mean annual takes are undetermined.

However, the total number of killed or seriously injured (2.3) is significantly lower than PBR (423), such that the fishery-related mortality or serious injuries rate for the entire Hawaii stock can be considered to be insignificant and approaching zero. Island-associated populations of rough-toothed dolphins may experience relatively greater rates of fisheries mortality and serious injury. One rough-toothed 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 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 animal is not known as it was found in only a few tested tissues (Jacob et al. 2016). The presence of *morbillivirus* in 10 species (Jacob et al. 2016) and *Brucella* in 3 species (Chernov 2010, West unpublished data) raises concerns about the history and prevalence of these diseases in Hawaii and the potential population impacts, including cumulative impacts of disease with other stressors. It is not known if *Brucella or Morbillivirus* are common in the Hawaii stock.

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