Revised 5/31/2024

RISSO'S DOLPHIN (*Grampus griseus*): Hawai‘i Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are found in tropical to warm-temperate waters worldwide (Perrin *et al*. 2009). Risso's dolphins represent less than 1% of all odontocete sightings in leeward surveys of the main Hawaiian Islands from 2000 to 2012 (Baird *et al*. 2013); however, they are regularly sighted during periodic shipboard surveys of the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands (Figure 1). Most sightings of Risso's dolphins occur in deep waters offshore. A single satellite tagged animal moved broadly between offshore waters off Kona, Koho‘olawe, and Lāna‘i over a 2-week period (Baird 2016). Sighting, habitat, and limited movement data do not appear to support finer population structure in Hawaiian waters, though differences in the spectral characteristics of Risso's dolphin echolocation clicks between Hawai‘i and the U.S. West Coast suggest there may be an indication of population differentiation within the ocean basin (Soldevilla *et al.* 2017).

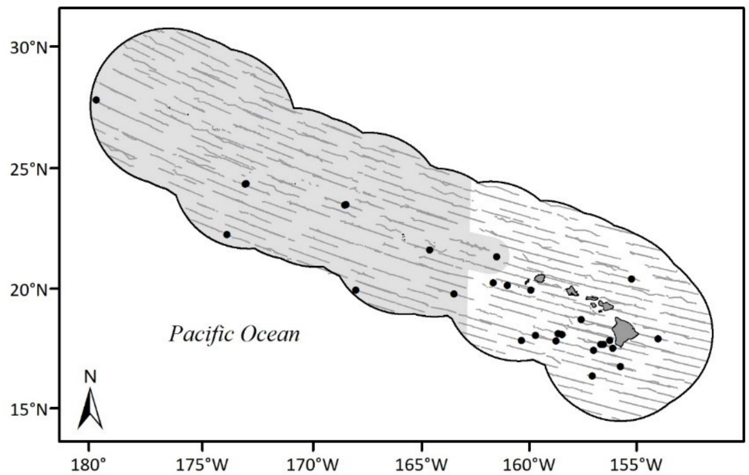

Figure 1. Risso's dolphin sighting locations (circles) and survey effort (gray lines) during the 2002 (Barlow 2006), 2010 (Bradford *et al.* 2017), and 2017 (Yano *et al.* 2018) shipboard cetacean surveys of the U.S. EEZ around the Hawaiian Islands (outer black line). The Papahānaumokuākea Marine National Monument in the western portion of the EEZ is shaded gray.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, Risso's dolphins within the Pacific U.S. EEZ are divided into two discrete, non-contiguous areas: 1) Hawaiian waters (this report), and 2) waters off California, Oregon and Washington. The Hawai‘i 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 U.S. EEZ of the Hawaiian Islands (NMFS 2023).

POPULATION SIZE

Encounter data from shipboard line-transect surveys of the Hawaiian Islands EEZ were recently reevaluated for each survey year, resulting in updated model-based abundance estimates of Risso's dolphins in the entirety of the Hawaiian Islands EEZ (Becker *et al*. 2021, 2022; Table 1).

Sighting data from 2002 to 2020 within the Hawaiian Islands EEZ were used to derive habitat-based models of animal density for two periods: 2002-2017 (Becker *et al.* 2021) and 2017-2020 (Becker *et al.* 2022). The most recent set of models include three notable changes from the 2002-2017 models: use of calibrated group size estimates, as in Bradford *et al.* (2021), exclusion of a spatial term on model selection, requiring more explicit reliance on environmental variables, and incorporating new approaches (Miller *et al.* 2022) for more comprehensively estimating uncertainty in model predictions that account for the combined uncertainty around all parameter estimates. The modeling framework incorporated Beaufort-specific trackline detection probabilities for Risso's dolphins from Barlow *et al*. (2015). Models were used to predict density and abundance for each survey year based on the environmental conditions within that year (see Forney *et al*. 2015, Becker *et al*. 2016). Bradford *et al*. (2021) produced design-based abundance estimates for Risso's dolphins in 2002, 2010, and 2017 that can be used as a point of comparison to the model-based estimates for those years. While on average, the estimates are broadly similar between the two approaches, the annual design-based estimates show much greater variability between years than do the model-based estimates (Figure 2). The model-based approach reduces variability through explicit examination of habitat relationships across the full dataset, while the design-based approach evaluates encounter data for each year separately and thus is more susceptible to the effects of encounter rate variation.

Table 1. Model-based line-transect abundance estimates for Risso's dolphins in the Hawaiian Islands EEZ in 2002 and 2010 (Becker *et al*. 2021) and 2017 and 2020 (Becker *et al.* 2022), derived from NMFS surveys in the central Pacific since 2000. The Becker *et al.* (2022) analysis incorporates a more comprehensive model-based approach to estimating model uncertainty, such that the CVs and 95% confidence limits for 2002/2010 and 2017/2020 are not directly comparable.

Year	Model-based Abundance	CV	95% Confidence Limits
2020	6,979	0.29	3,649-13,348
2017	7,437	0.30	4,027-13,736
2010	6,174	0.20	4,159-9,165
2002	6,916	0.21	4,623-10,346

Model based-estimates are based on the implicit assumption that changes in abundance are attributed to environmental variability alone. Explicitly incorporating a trend term into the model is not possible due to the insufficient sample size to test for temporal effects. Despite not fully accounting for inter-annual variation in total abundance, the model-based estimates are considered the best available estimate for each survey year. Becker *et al.* (2022) and Bradford *et al.* (2022) evaluated seasonal changes in the abundance of Risso's dolphins within the main Hawaiian Islands using summer-fall data from 2017 and winter survey data from 2020. Both analyses showed slightly higher densities of Risso's dolphins in the MHI in winter, with the spatially-explicit model showing marked differences in winter and non-winter distribution driven by the relationship with mixed layer depth for this species. Previously published abundance estimates for the Hawaiian Islands EEZ (Barlow 2006, Becker *et al.* 2012, Forney *et al.* 2015, Bradford *et al*. 2017) used a subset of the dataset used by Becker *et al.* (2021, 2022) and Bradford *et al*. (2021) to derive line-transect parameters, such that these estimates have been superseded by the estimates presented here. The best estimate of abundance is based on the 2020 survey, or 6,979 (CV=0.29) Risso's dolphins.

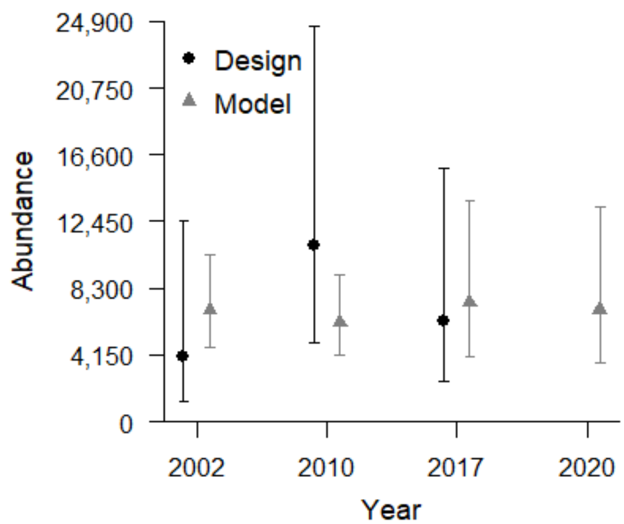

Figure 2. Comparison of design-based (black circles, Bradford *et al.* 2021) and model-based (gray triangles, Becker *et al.* 2021, 2022) estimates of abundance for Risso's dolphins for each survey year (2002, 2010, 2017, 2020).

Population estimates have been made off Japan (Miyashita 1993), in the eastern tropical Pacific (Wade and Gerrodette 1993), and off the U.S. West Coast (Barlow 2016), but it is not known whether these animals are part of the same population that occurs around the Hawaiian Islands and in the central North Pacific.

Minimum Population Estimate

The minimum population estimate is calculated as the lower 20th percentile of the log-normal distribution (Barlow *et al*. 1995) of the 2020 abundance estimate (from Becker *et al.* 2022), or 5,283 Risso's dolphins within the Hawaiian Islands EEZ.

Current Population Trend

The model-based abundance estimates for Risso's dolphins provided by Becker *et al.* (2021, 2022) do not explicitly allow for examination of population trend other than that driven by environmental factors. Model-based examination of Risso's dolphin trends including sighting data beyond the Hawaiian Islands EEZ will be required to more fully examine trend for this stock.

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 Hawaii stock of Risso's dolphins is calculated as the minimum population size within the U.S. EEZ of the Hawaiian Islands (5,283) 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 53 Risso's 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. No interactions between nearshore fisheries and Risso's dolphins have been reported in Hawaiian waters. 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.

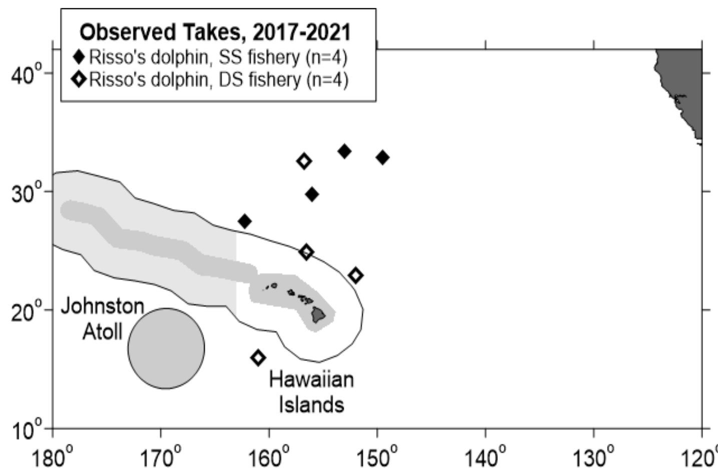

Figure 3. Locations of observed Risso's dolphin takes within the shallow-set fishery (filled diamonds) and deep-set fishery (open diamonds) in the Hawai'i-based longline fishery,2017-2021. Solid lines represent the U.S. EEZ. Gray shading notes areas closed to longline fishing.

There are currently two distinct longline fisheries based in Hawai'i: 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, but are prohibited from operating within the Papahānaumokuākea Marine National Monument (PMNM) and within the Longline Exclusion Zone around the main Hawaiian Islands and the Pacific Remote Islands and Atolls (PRIA) MNM around Johnston Atoll. The PMNM originally included the waters within a 50 nmi radius around the Northwestern Hawaiian Islands. In August, 2016, the PMNM area was expanded to extend to the 200 nmi EEZ boundary west of 163° W. Between 2017 and 2021, 4 Risso's dolphins were observed hooked or entangled in the SSLL fishery (100% observer coverage), and 4 Risso's dolphins were observed taken in the DSLL fishery (15-21% observer coverage) (Figure 3, Bradford 2018, 2020, 2021, In press, In review, McCracken and Cooper 2022b). One Risso's dolphin in the DSLL fishery was killed, 4 in the SSLL fishery and 2 in the DSLL fishery were considered to have been seriously injured, all outside the U.S. EEZ.

The total estimated number of dead or seriously injured dolphins is calculated based on observer coverage rate, the location of the observed take (inside or outside of the EEZ), and the ratio of observed dead and seriously injured whales versus those judged to be not seriously injured. Observer coverage is measured on a per-trip basis throughout the calendar year as described by McCracken (2019). In years with large fluctuations in observer coverage, such as during the early days of the COVID-19 pandemic when observer coverage dropped to less than 10% during the second quarter of the year, the annual bycatch estimation process may be subset into several periods, as described in McCracken and Cooper (2022a). Average 5-yr estimates of annual mortality and serious injury for 2017-2021 are 5.0 (CV=0.4) Risso's dolphins outside of U.S. EEZ, and 0 within the Hawaiian Islands EEZ (Table 2, McCracken and Cooper 2022b).

Table 2. Summary of available information on incidental mortality and serious injury (MSI) of Risso's dolphin (Hawaii stock) in commercial longline fisheries, within and outside of U.S. EEZ (McCracken and Cooper, 2022b). Mean annual takes are based on 2017-2021 data unless indicated otherwise. Information on all observed takes (T) and 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	Outside U.S. EEZ		Hawaiian Islands EEZ	
				Observed T/MSI	Estimated MSI (CV)	Observed T/MSI	Estimated MSI (CV)
Hawai'i-based deep-set longline fishery	2017	Observer data	20%	1/1	5 (0.9)	0	0 (-)
	2018		18%	0	0 (-)	0	0 (-)
	2019		21%	1/1	7 (0.9)	0	0 (-)
	2020		15%	2/1	16 (0.5)	0	0 (-)
	2021		18%	0/0	0 (-)	0	0 (-)
Mean Estimated Annual Take (CV) 2017-2021					**5.0 (0.4)**		**0 (-)**
Hawai'i-based shallow-set longline fishery	2017	Observer data	100%	2/2	2	0	0
	2018		100%	2/2	2	0	0
	2019		100%	0/0	0	0	0
	2020		100%	0/0	0	0	0
	2021		100%	0/0	0	0	0
Mean Annual Takes (100% coverage) 2017-2021					**0.8**	0	**0**
Minimum total annual takes within U.S. EEZ (2017-2021)							**0 (-)**

STATUS OF STOCK

The Hawai'i stock of Risso's dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of Risso's dolphins in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. Risso's 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 the Hawaiian Islands EEZ, the total fishery mortality and serious injury can be considered to be insignificant and approaching zero. One Risso's dolphin stranded on the MHI tested positive for *Morbillivirus* (Jacob *et al*. 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters, all identified as a unique strain of *morbillivirus* (Jacob *et al*. 2016), raises concerns about the history and prevalence of this disease in Hawai'i and the potential population impacts, including cumulative impacts of disease with other stressors.

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