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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Hawaiian Islands Stock Complex – Kauaʻi/Niʻihau, Oʻahu, Maui Nui, Hawaiʻi Island, and Hawaiʻi Pelagic Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are widely distributed throughout the world in tropical and warm-temperate waters (Perrin *et al.* 2009). Bottlenose dolphins are common throughout the Hawaiian Islands, both in nearshore waters as well as at great distances from shore (Baird *et al*. 2013, Bradford *et al*. 2021; Figure 1).

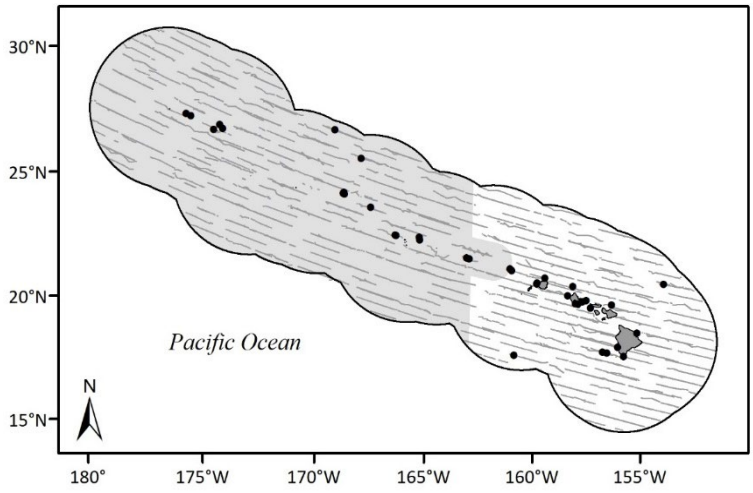


Figure 1. Bottlenose dolphin sighting locations (circles) and survey effort (gray lines) during the 2002 (Barlow 2006), 2010(Bradford *et al*. 2017), and 2017 (Yano *et al.* 2018 shipboard cetacean surveys of the U.S. EEZ around the Hawaiian Islands outer black line). The Papahānaumokuākea Marine National Monument in the western portion of the EEZ is shaded gray. Insular stock boundaries are shown in Figure 2.

Separate offshore and coastal forms of bottlenose dolphins have been identified along continental coasts (Ross and Cockcroft 1990; Van Waerebeek *et al.* 1990), and there is evidence that similar onshore-offshore forms may exist in Hawaiian waters (Baird 2016). In their analysis of sightings of bottlenose dolphins in the eastern tropical Pacific (ETP), Scott and Chivers (1990) noted a large hiatus between the westernmost sightings and the Hawaiian Islands. These data suggest that bottlenose dolphins in Hawaiian waters belong to a separate stock from those in the ETP. Furthermore, recent photo-identification and genetic studies of bottlenose dolphins sampled near each of the main Hawaiian Islands suggest limited movement of bottlenose dolphins between islands and offshore waters (Baird *et al.* 2009; Martien *et al.* 2012, Harnish 2021). These data support the existence of demographically independent resident populations at each of four main Hawaiian Island groupings – Kauaʻi and Niʻihau, Oʻahu, the Maui Nui region (Molokaʻi, Lānaʻi, Maui, Kahoʻolawe), and Hawaiʻi Island. Genetic data support inclusion of bottlenose dolphins in deeper waters surrounding the main Hawaiian Islands as part of the broadly distributed pelagic population (Martien *et al.* 2012). Over 99% of the bottlenose dolphins linked through photo-identification to one of the insular population around the main Hawaiian Islands (Baird *et al.* 2009) have been documented in waters of 1000 m or less (Martien and Baird 2009). Based on these data, Martien and Baird (2009) suggested that the boundaries between the insular stocks and the Hawaiʻi Pelagic stock be placed along the 1000 m isobath. Since that isobath does not

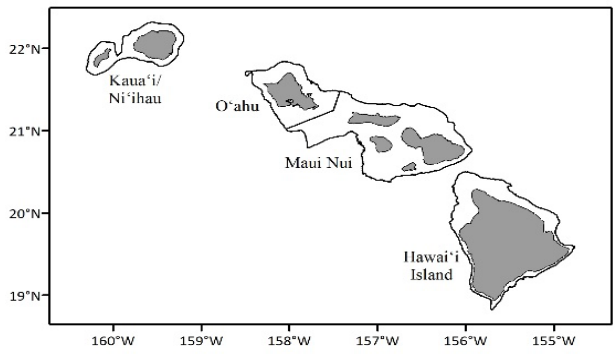


Figure 2. Main Hawaiian Islands insular bottlenose dolphin stock boundaries (gray lines).

separate Oahu from the Maui Nui Region, the boundary between those stocks runs approximately equidistant between the 500 m isobaths around Oʻahu and the Maui Nui Region, through the middle of Kaiwi Channel. These boundaries (Figure 2) are applied in this report to recognize separate insular and pelagic bottlenose dolphin stocks for management (NMFS 2023a). These boundaries may be revised in the future as additional information becomes available. To date, no data are available regarding population structure of bottlenose dolphins in the Northwestern Hawaiian Islands (NWHI), though sightings during a shipboard survey in 2010 indicate they are commonly found close to the islands and atolls there (Bradford *et al.* 2017). Given the evidence for island resident populations in the main Hawaiian Islands, the larger distances between islands in the NWHI, and the finding of population structure within the NWHI in other dolphin species (e.g., Andrews *et al.* 2010), it is likely that additional demographically independent populations of bottlenose dolphins exist in the NWHI. However, until data become available upon which to base stock designations in this area, bottlenose dolphins in the NWHI will remain part of the Hawaiʻi Pelagic Stock.

For the Marine Mammal Protection Act (MMPA) Pacific stock assessment reports, bottlenose dolphins within the Pacific U.S. Exclusive Economic Zone (EEZ) are divided into seven stocks: 1) California, Oregon and Washington offshore stock, 2) California coastal stock, and five Pacific Islands Region management stocks (this report): 3) Kauaʻi/Niihau, 4) Oʻahu, 5) Maui Nui (Molokaʻi, Lānaʻi, Maui, Kahoʻolawe), 6) Hawaiʻi Island and 7) the Hawaiʻi Pelagic Stock, including animals found both within the U.S. EEZ around the Hawaiian Islands 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 Hawaiʻi Pelagic stock is evaluated based on data from U.S. EEZ of the Hawaiian Islands (NMFS 2023a). Estimates of abundance, potential biological removals, and status determinations for the five Hawaiian stocks are presented separately below.

HUMAN CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Information on fishery-related mortality of cetaceans in Hawaiian waters is limited, but the gear types used in Hawaiʻi fisheries are responsible for marine mammal mortality and serious injury in other fisheries throughout U.S. waters. There are at least two reports of entangled bottlenose dolphins dying in gillnets off Maui (Nitta and Henderson 1993, Maldini 2003, Bradford and Lyman 2013). Although gillnet fisheries are not observed or monitored through any State or Federal program, State regulations now ban gillnetting around Maui and much of Oʻahu and require gillnet fishermen to monitor their nets for bycatch every 30 minutes in those areas where gillnetting is permitted. In 2018, a bottlenose dolphin calf was observed with a gunshot wound through its melon, possibly as a result of a fisheries interaction (Harnish *et al.* 2019). Although the wound was initially judged to be serious, sightings of this animal since the injury was initially observed have indicated the wound is healing and the animal has survived (Harnish *et al.* 2019), such that the injury was ultimately determined to be non-serious (Bradford and Lyman 2020) under criteria for assessing serious injury in marine mammals (NMFS 2023b). In 2019, this same individual was observed hooked in the mouth and entangled around its pectoral fin by the trailing line, also initially judged to be a serious injury (Bradford and Lyman 2022). However, based on the observations in 2021 of the animal in good body condition, the injury is currently considered to be non-serious (Bradford and Lyman 2022). In 2020, an adult bottlenose dolphin was found dead as a result of an ingested circle hook piercing its esophagus, with the hook and attached monofilament line attributed to a nearshore fishery (Bradford and Lyman 2023). This recent mortality indicates that nearshore fisheries still pose a risk to bottlenose dolphins around the Hawaiian Islands. However, 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.

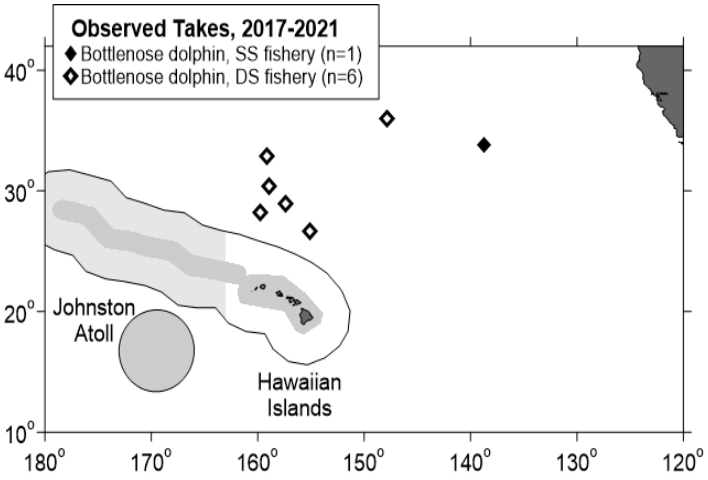


Figure 3. Locations of observed Pelagic Stock bottlenose dolphin takes within the shallow-set fishery (filled diamond) and deep-set fishery (open diamonds) in the Hawaii-based longline fishery, 2017-2021. Solid lines represent the U. S. EEZ. Gray shading notes areas closed to longline fishing.

Bottlenose dolphins are one of the species commonly reported to steal bait and catch from several Hawaiʻi

sport and commercial fisheries (Nitta and Henderson 1993, Schlais 1984). Observations of bottlenose dolphins stealing bait or catch have been made in the day handline fishery for tuna (palu-ahi), the night handline fishery for tuna (ika-shibi), the handline fishery for mackerel scad, the troll fishery for billfish and tuna, and the inshore set gillnet fishery (Nitta and Henderson 1993). Nitta and Henderson (1993) indicated that bottlenose dolphins remove bait and catch from handlines used to catch bottomfish off the island of Hawai‘i and Kaula Rock and formerly on several banks of the Northwestern Hawaiian Islands. Bottlenose dolphins were thought to interact with the bottomfish fishery in the NWHI (Kobayashi and Kawamoto 1995), though this fishery is no longer permitted for the NWHI. Fishermen around the main Hawaiian Islands claim interactions with dolphins that steal bait and catch are increasing, including anecdotal reports of bottlenose dolphins getting "snagged" (Rizzuto 2007). An assessment of the incidence of potential fishing gear-associated scarring on bottlenose dolphins near Maui Nui revealed 27% of non-calf well-marked individuals photographed between 1996 and 2020 had one or more scars that may be attributed to fishing gear (Machernis *et al.* 2021).

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 NWHI. In August, 2016, the PMNM area was expanded to extend to the 200 nmi EEZ boundary west of 163˚ W. Between 2017 and 2021, one bottlenose dolphin was observed hooked or entangled in the SSLL fishery (100% observer coverage), and six bottlenose dolphins were observed taken in the DSLL fishery (15-21% observer coverage) within the Hawaiian Islands EEZ or adjacent high-seas waters (Bradford 2018, 2020, 2021, 2023, in review). Based on the observed take locations (Figure 3), these takes are all considered to have been from the Pelagic Stock of bottlenose dolphins. All 7 dolphins were considered to have been seriously injured, based on an evaluation of the observer's description of the interaction and following the most recently developed criteria for assessing serious injury in marine mammals (NMFS 2023b).

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 U.S. EEZ), and the ratio of observed dead and seriously injured dolphins 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 the Pelagic Stock during 2017-2021 are 6.6 (CV=0.4) bottlenose dolphins outside of the Hawaiian Islands EEZ, and 0 within the Hawaiian Islands EEZ (Table 1, McCracken and Cooper 2022b). One unidentified cetacean, likely to be a bottlenose dolphin based on the observer's description, was taken in the DSLL fishery in 2017 (Bradford 2018),

Table 1. Summary of available information on incidental mortality and serious injury (MSI) of bottlenose dolphins (Hawai‘i Pelagic stock) in commercial longline fisheries, within and outside of the U.S. EEZ (McCracken and Cooper 2022b). Mean annual takes are based on 2017-2021 data unless otherwise indicated. Information on all observed takes (T) and MSI is included along with MSI estimates. Total takes were prorated to deaths, serious injuries, and non-serious injuries based on the observed proportions of each outcome.

				Outside U.S. EEZ		Hawaiian Islands EEZ	
Fishery Name	**Year**	**Data Type**	**Percent Observer Coverage**	**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	6 (0.9)	0	0 (-)
	2018		18%	1/1	3 (0.9)	0	0 (-)
	2019		21%	0	0 (-)	0	0 (-)
	2020		15%	1/1	10 (0.6)	0	0 (-)
	2021		18%	3/3	9 (0.6)	0	0 (-)
Mean Estimated Annual Take (CV) 2017-2021					**5.6 (0.4)**	0	**0 (-)**
Hawai‘i-based shallow-set longline fishery	2017		100%	0	0	0	0
	2018		100%	1/1	1	0	0
	2019		100%	0	0	0	0

	2020		100%	0	0	0	0
	2021		100%	0	0	0	0
Mean Annual Takes (100% coverage) 2017-2021					**1**		**0**
Minimum total annual takes within U.S. EEZ (2017-2021)							**0 (-)**

KAUA‘I / NI‘IHAU STOCK

POPULATION SIZE

Photographic data from multiple contributors spanning 2000 to 2018 were used to assess the annual abundance of each main Hawaiian Islands insular population of bottlenose dolphins using a POPAN model stratified within each stock area based on spatial gaps in sightings and significant bathymetric or geographic features (Van Cise *et al.* 2021). Annual abundance estimates for the Kaua‘i/Niihau stock of bottlenose dolphins were produced for 2003 through 2007 and 2011 through 2018. The 2018 abundance estimate for the Kaua‘i/Ni‘ihau stock was 112 (CV=0.24) bottlenose dolphins.

Minimum Population Estimate

The minimum population estimate for the Kaua‘i/Ni‘ihau stock of bottlenose dolphins is calculated as the lower 20th percentile of the log-normal distribution (Barlow *et al.* 1995) of the 2018 abundance estimate (from Van Cise *et al.* 2021), or 92 bottlenose dolphins.

Current Population Trend

Annual abundance estimates derived in Van Cise *et al.* (2021) suggest that the Kaua‘i/Ni‘ihau stock of bottlenose dolphins may have declined over the nearly 20-year period of the study, with a high of 193 (CV=0.25) dolphins in 2003 to the low of 112 (CV=0.24) in 2018, representing an overall average annual decline of 2.6% (95% CI -6.9% to -1.7%). However, the annual estimates did not differ significantly throughout the study period and varied only by a few individuals between 2011 and 2018, such that the trends are not considered reliable (Van Cise *et al*. 2021). Further, while survey effort was most consistent for the Kaua‘i/Ni‘ihau stock, sampling variability was not fully accounted for in the estimates of abundance and trend.

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 this stock is calculated as the minimum population size (92) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a stock of unknown status with no reported fishery mortality or serious injury within the Kaua‘i/Ni‘ihau stock range; Wade and Angliss 1997), resulting in a PBR of 0.9 bottlenose dolphins per year.

STATUS OF STOCK

The Kaua‘i/Ni‘ihau Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in the Kaua‘i/Ni‘ihau stock relative to OSP is unknown. Although recent analyses suggest this stock may be declining (Van Cise *et al.* 2021), sampling limitations increase uncertainty around this conclusion. Bottlenose dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. There have been no reports of recent mortality or serious injuries; however, there is no systematic monitoring for interactions with protected species within nearshore fisheries that may take this species, thus mean annual takes are undetermined. Insufficient information is available to determine whether the total fishery mortality and serious injury for Kaua‘i/Ni‘ihau bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate. One stranded bottlenose dolphin from the Kaua‘i/Ni‘ihau stock tested positive for *Morbillivirus* (Jacob *et al.* 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters (Jacob *et al.* 2016), raises concerns about the history and prevalence of this disease in Hawai‘i and the potential population impacts, including the cumulative impacts of disease with other stressors.

O‘AHU STOCK

POPULATION SIZE

Photographic data from multiple contributors spanning 2000 to 2018 was used to assess the annual abundance of each main Hawaiian Islands insular population of bottlenose dolphins using a POPAN model stratified within each stock area based on spatial gaps in sightings and significant bathymetric or geographic features (Van Cise *et al.* 2021). Annual abundance estimates for the O‘ahu stock of bottlenose dolphins were produced for 2002 through 2018, except for 2005. The 2018 abundance estimate for the O‘ahu stock was 112 (CV=0.17) bottlenose dolphins.

Minimum Population Estimate

The minimum population estimate for the O‘ahu stock of bottlenose dolphins is calculated as the lower 20th percentile of the log-normal distribution (Barlow *et al.* 1995) of the 2018 abundance estimate (from Van Cise *et al.* 2021), or 97 bottlenose dolphins.

Current Population Trend

Annual abundance estimates derived in Van Cise *et al.* (2021) suggest that the O‘ahu stock of bottlenose dolphins may have declined over the nearly 20-year period of the study, with a high of 193 (CV=0.31) dolphins in 2002 to the low of 112 (CV=0.17) in 2018, representing an overall average annual decline of 3% (95% CI -10.3% to +2.7%). However, the annual estimates did not differ significantly throughout the study period and varied by only a few individuals over the last half of the study period, such that the trends are not considered reliable (Van Cise *et al*. 2021). Similar to other stocks, sampling variability was not fully accounted for in the estimates of abundance and trend, but particularly for the O‘ahu stock, it is possible that the apparent decline is an artifact of increased citizen science contributions in one subarea and contracted survey effort over the study period.

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 this stock is calculated as the minimum population size (97) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a stock of unknown status with no reported fishery mortality in the stock range (Wade and Angliss 1997), resulting in a PBR of 1.0 bottlenose dolphins per year.

STATUS OF STOCK

The O‘ahu stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in O‘ahu waters relative to OSP is unknown. Although recent analyses suggest this stock may be declining (Van Cise *et al.* 2021), sampling limitations increase uncertainty around this conclusion. Bottlenose dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. There have been no reports of recent mortality or serious injuries, though there is evidence of a bottlenose dolphin that was shot in the head off O‘ahu (Harnish *et al.* 2019) that later became hooked and entangled in fishing gear (Bradford and Lyman 2022). There is no systematic monitoring for interactions with protected species within nearshore fisheries that may take this species, thus mean annual takes are undetermined. Insufficient information is available to determine whether the total fishery mortality and serious injury for O‘ahu bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate. *Morbilivirus* has been detected within other insular stocks of bottlenose dolphins in Hawai‘i (Jacob *et al.* 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters raises concerns about the history and prevalence of this disease in Hawai‘i and the potential population impacts, including the cumulative impacts of disease with other stressors.

MAUI NUI STOCK

POPULATION SIZE

Photographic data from multiple contributors spanning 2000 to 2018 was used to assess the annual abundance of each main Hawaiian Islands insular population of bottlenose dolphins using a POPAN model stratified within each stock area based on spatial gaps in sightings and significant bathymetric or geographic features (Van Cise *et al.* 2021). Annual abundance estimates for the Maui Nui stock of bottlenose dolphins were produced for all years except 2008.

The 2018 abundance estimate for the Maui Nui stock was 64 (CV=0.15) bottlenose dolphins.

Minimum Population Estimate

The minimum population estimate for the Maui Nui stock of bottlenose dolphins is calculated as the lower 20th percentile of the log-normal distribution (Barlow *et al.* 1995) of the 2018 abundance estimate (from Van Cise *et al.* 2021), or 56 bottlenose dolphins.

Current Population Trend

Annual abundance estimates derived in Van Cise *et al.* (2021) suggest that the Maui Nui stock of bottlenose dolphins has declined over the nearly 20-year period of the study, with a high of 288 (CV=0.17) dolphins in 2000 to the low of 64 (CV=0.15) in 2018, representing an overall average annual decline of 8.6% (95% CI -13% to -6%). While the analysis suggests a statistically significant decline in this stock (Van Cise *et al*. 2021), similar to other stocks, sampling variability was not fully accounted for in the estimates of abundance and trend. Particularly for the Maui Nui stock, it is possible that the apparent decline is an artifact of increased citizen science contributions in one subarea and contracted survey effort over the study period.

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 this stock is calculated as the minimum population size (56) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a stock of unknown status with no reported fishery mortality in the Maui Nui stock area (Wade and Angliss 1997), resulting in a PBR of 0.6 bottlenose dolphins per year.

STATUS OF STOCK

The Maui Nui Region Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in Maui Nui waters relative to OSP is unknown. Although recent analyses suggest this stock may be declining (Van Cise *et al.* 2021), sampling limitations increase uncertainty around this conclusion. Bottlenose dolphins are not listed as "threatened" or "endangered" under the Endangered Species Act (1973), nor as "depleted" under the MMPA. There have been no reports of recent mortality or serious injuries of this stock; however, there is no systematic monitoring for interactions with protected species within nearshore fisheries that may take this species, thus mean annual takes are undetermined. Insufficient information is available to determine whether the total fishery mortality and serious injury for Maui Nui bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate. *Morbilivirus* has been detected within other insular stocks of bottlenose dolphins in Hawai'i (Jacob *et al.* 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters raises concerns about the history and prevalence of this disease in Hawai'i and the potential population impacts, including the cumulative impacts of disease with other stressors.

HAWAI'I ISLAND STOCK

POPULATION SIZE

Photographic data from multiple contributors spanning 2000 to 2018 was used to assess the annual abundance of each main Hawaiian Islands insular population of bottlenose dolphins using a POPAN model stratified within each stock area based on spatial gaps in sightings and significant bathymetric or geographic features (Van Cise *et al.* 2021). Annual abundance estimates for the Hawai'i Island stock of bottlenose dolphins were produced for all years from 2002 to 2018. The 2018 abundance estimate for the Hawai'i Island stock was 136 (CV=0.43) bottlenose dolphins.

Minimum Population Estimate

The minimum population estimate for the Hawai'i Island stock of bottlenose dolphins is calculated as the lower 20th percentile of the log-normal distribution (Barlow *et al.* 1995) of the 2018 abundance estimate (from Van Cise *et al.* 2021), or 96 bottlenose dolphins.

Current Population Trend

Annual abundance estimates derived in Van Cise et al. (2021) suggest that the Hawai'i Island stock of

bottlenose dolphins has increased over the nearly 20-year period of the study, with a low of 10 (CV=0.17) in 2000 to the high of 136 (CV=0.43) in 2018, representing an overall average annual increase of 10.5% (95% CI 0.94% to 15.31%). This estimated annual growth rate is greater than the species maximum expected growth rate of 4% and was driven largely by influxes of new individuals during the study period. Similar to other stocks, sampling variability was not fully accounted for in the estimates of abundance and trend, but particularly for the Hawai‘i Island stock, the abundance estimates likely underestimate true stock size because sampling for this stock was entirely on the leeward side of Hawai‘i Island (Van Cias *et al*. 2021). Thus, the increasing trend may be an artifact of variability in sampling and individual habitat use.

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 this stock is calculated as the minimum population size (96) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a stock of unknown status with no reported fishery mortality in the Hawai‘i Islands stock area (Wade and Angliss 1997), resulting in a PBR of 1.0 bottlenose dolphins per year.

STATUS OF STOCK

The Hawai‘i Island stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in waters around Hawai‘i Island relative to OSP is unknown. Although recent analyses suggest this stock may be increasing (Van Cise *et al.* 2021), sampling limitations increase uncertainty around this conclusion. Bottlenose dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. In the past 5 years, one bottlenose dolphin was found dead on Hawai‘i Island as a result of an ingested circle hook piercing its esophagus (Bradford and Lyman 2023). There is no systematic monitoring of takes in nearshore fisheries that may take this species, thus the single observed mortality may be an underestimate of the total fishery mortality for this stock. Total fishery mortality and serious injury for Hawai‘i Island bottlenose dolphins is not approaching zero mortality and serious injury rate. Hawai’i Island bottlenose dolphins are regularly seen near aquaculture pens off the Kona coast, and aquaculture workers have been observed feeding bottlenose dolphins. Bottlenose dolphins in this region are also known to interact with divers. Since 2007, about one quarter (36) of Hawai‘i Islands bottlenose dolphins have been observed associated with a pelagic mariculture operation for kanpachi off the Kona coast of Hawai‘i Island, with 22 of those individuals seen at the farm on more than one occasion (Harnish *et al.* 2023). Farm-associated dolphins are weakly linked to the rest of the Hawai‘i Island population, and are seen in smaller groups near the farm than those groups seen away from the farm, factors that have been linked to lower survival in other populations (Stanton and Mann, 2012). *Morbillivirus* has been detected within other insular stocks of bottlenose dolphins in Hawai‘i (Jacob *et al.* 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters raises concerns about the history and prevalence of this disease in Hawai‘i and the potential population impacts, including the cumulative impacts of disease with other stressors.

HAWAI’I PELAGIC STOCK

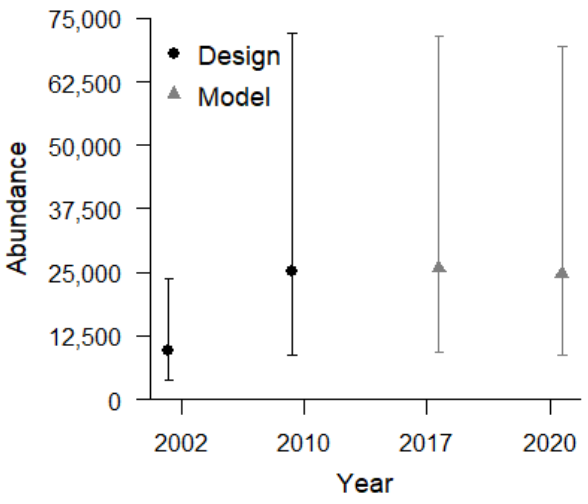
POPULATION SIZE

Encounter data from shipboard line-transect surveys of the Hawaiian Islands EEZ were recently reevaluated for each survey year, resulting in the following abundance estimates of bottlenose dolphins in the entirety of the Hawaiian Islands EEZ (Becker *et al.* 2022, Bradford *et al.* 2021; Table 2).

Table 2. Line-transect abundance estimates for bottlenose dolphins in the Hawaiian Islands EEZ in 2002, 2010, 2017, and 2020, derived from NMFS surveys in the central Pacific since 1986 (Becker *et al.* 2022, Bradford *et al.* 2021).

Year	Design-based Abundance	CV	95% Confidence Limits	Model-based Abundance	CV	95% Confidence Limits
2020	-	-	-	24,669	0.57	8,774-69,361
2017	-	-	-	25,857	0.56	9,356-71,464
2010	25,188	0.58	8,791-72,168	-	-	-
2002	9,678	0.49	3,924-23,868	-	-	-

Sighting data from 2002 to 2020 within the Hawaiian Islands EEZ were used to derive stock-specific habitat-based models of animal density for the 2017 to 2020 period. The models were then 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). The modeling framework incorporated Beaufort-specific trackline detection probabilities for bottlenose dolphins from Barlow *et al.* (2015). Although model-based estimates were previously derived for years 2002, 2010, and 2017 (Becker *et al.* 2021), those estimates were not specific to the Hawai‘i Pelagic stock and as such may have reflected both the habitat associations and abundance of the insular stocks within the main Hawaiian Islands. Stock-specific model-based estimates were derived only for the most recent years (2017-2020), such that direct comparison of model and design-based estimates for the full survey time series is not possible at this time. Bradford *et al.* (2021) produced design-based abundance estimates for bottlenose dolphins for each full EEZ survey year with bottlenose dolphin encounters, with the 2010 design-based and 2017 and 2020 model-based estimates largely similar in the mean estimate and confidence limits (Figure 4). Current model based-estimates are based on the implicit assumption that annual 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 the most recent survey year. Previously published design-based estimates for the Hawaiian Islands EEZ from 2002 and 2010 surveys (Barlow 2006, Bradford *et al.* 2017) used a subset of the dataset used by Becker *et al.* (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 24,669 (CV=0.57) bottlenose dolphins.



Bradford *et al.* 2021) and model-based (gray triangles, Becker *et al.* 2022) estimates of abundance for Hawai‘i pelagic bottlenose dolphins for each survey year (2002, 2010, 2017, 2020).

Minimum Population Estimate

The minimum population estimate for the Hawai‘i Pelagic stock of bottlenose dolphins 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 15,783 bottlenose dolphins.

Current Population Trend

The available abundance estimates for this stock have very broad and overlapping confidence intervals, precluding robust evaluation of population 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 this stock is calculated as the minimum population size within the U.S EEZ of the Hawaiian Islands (15,783) 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 a Hawaiian Islands EEZ fishery mortality and serious injury rate CV of 0; Wade and Angliss 1997), resulting in a PBR of 158 bottlenose dolphins per year.

STATUS OF STOCK

The Hawai‘i Pelagic Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. It is not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the MMPA. The estimated rate of fisheries related mortality

or serious injury within the Hawaiian Islands EEZ is zero, such that the total fishery mortality and serious injury for Hawai'i Pelagic bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate. *Morbilivirus* has been detected within insular stocks of bottlenose dolphins in Hawai'i (Jacob *et al.* 2016). The presence of *morbillivirus* in 10 species of cetacean in Hawaiian waters raises concerns about the history and prevalence of this disease in Hawai'i and the potential population impacts, including the cumulative impacts of disease with other stressors.

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