

## **COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Hawaiian Islands Stock Complex- Kauai/Niihau, Oahu, 4-Islands, Hawaii Island, Hawaii Pelagic**

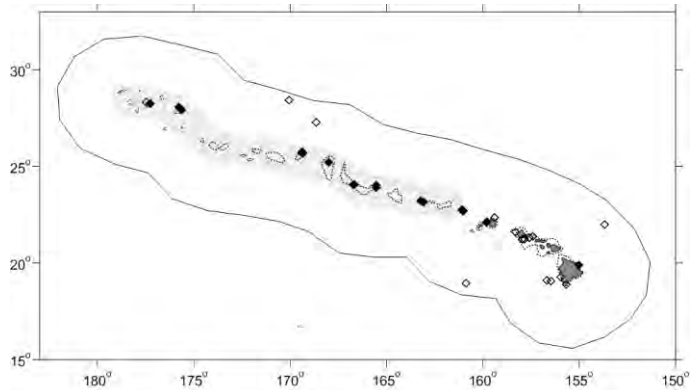
### **STOCK DEFINITION AND GEOGRAPHIC RANGE**

Common bottlenose dolphins are widely distributed throughout the world in tropical and warm-temperate waters (Perrin et al. 2009). The species is primarily coastal in much of its range, but there are populations in some offshore deepwater areas as well. Bottlenose dolphins are common throughout the Hawaiian Islands, from the island of Hawaii to Kure Atoll (Shallenberger 1981, 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 18 sightings in 2002 and 20 sightings in 2010 (Barlow 2006, Bradford et al. 2013;

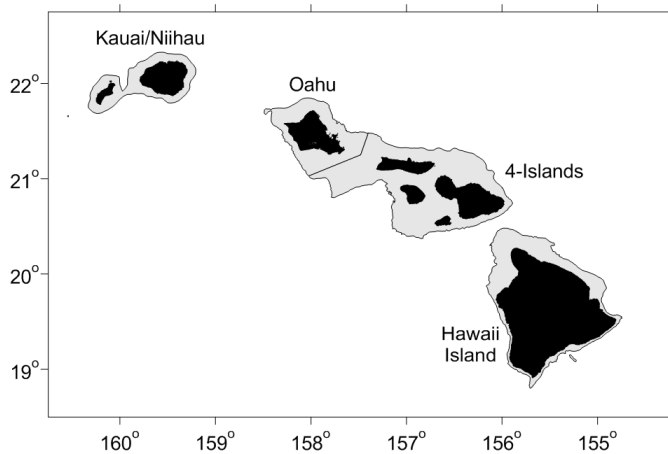
Figure 1). In the Hawaiian Islands, bottlenose dolphins are found in shallow inshore waters and deep water (Baird et al. 2009).

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. 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 off Oahu, Maui, Lanai, Kauai, Niihau, and Hawaii suggest limited movement of bottlenose dolphins between islands and offshore waters (Baird et al. 2009; Martien et al. 2012). These data suggest the existence of demographically distinct resident populations at each of the four main Hawaiian Island groups – Kauai & Niihau, Oahu, the ‘4-island’ region (Molokai, Lanai, Maui, Kahoolawe), and Hawaii. 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 populations around the main Hawaiian Islands (Baird et al. 2009) have been documented in waters of 1000 m or less (Martien & Baird 2009). Based on these data, Martien & Baird (2009) suggested that the boundaries between the insular stocks and the Hawaii Pelagic stock be placed along the 1000 m isobath. Since that isobath does not separate Oahu from the 4-Islands Region, the boundary between those stocks runs approximately equidistant between the 500 m isobaths around Oahu and the 4-



**Figure 1.** Bottlenose 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. 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 bottlenose dolphin stock boundaries (gray shading). Areas beyond the 1000 m isobath represent the pelagic stock range.

Islands 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 2005). 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 the 2010 survey indicate they are commonly found close to the islands and atolls there (Bradford et al 2013). Given the evidence of 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 (Andrews 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, the NWHI will remain part of the Hawaii Pelagic Stock. For the Marine Mammal Protection Act (MMPA) Pacific stock assessment reports, bottlenose dolphins within the Pacific U.S. 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) Kauai/Niihau, 4) Oahu, 5) 4-Islands (Molokai, Lanai, Maui, Kahoolawe), 6) Hawaii Island and 7) the Hawaiian Pelagic Stock, 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 pelagic stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands (NMFS 2005). Estimates of abundance, potential biological removals, and status determinations for the five Hawaiian stocks are presented separately below.

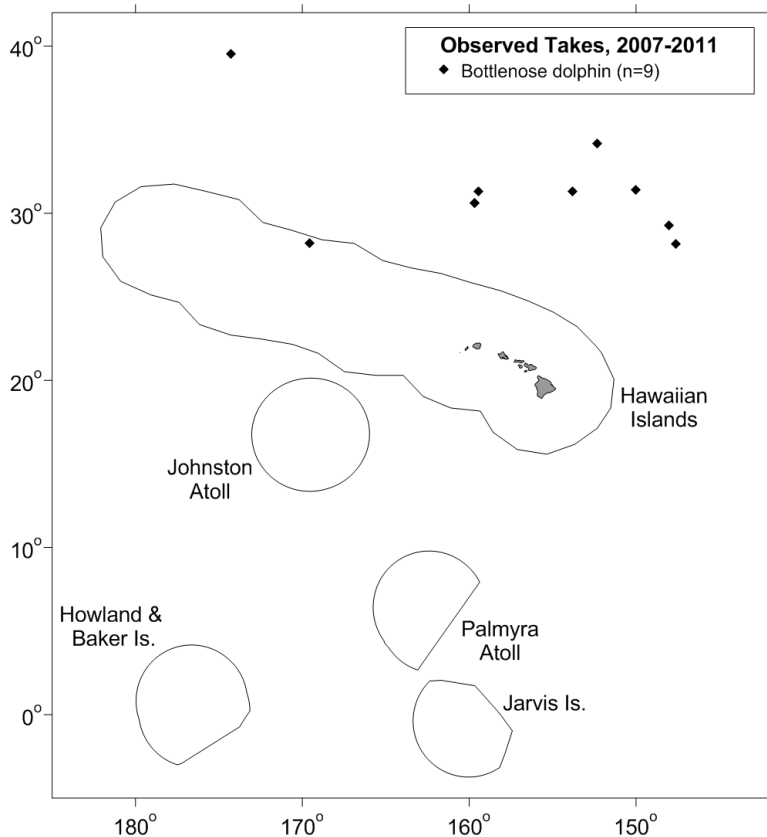
## HUMAN CAUSED MORTALITY AND SERIOUS INJURY

### 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, NOAA 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 Hawaii 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 drowning in gillnets off Maui (Nitta and Henderson, 1993, Maldini 2003, Bradford & 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 Oahu and require gillnet fishermen to monitor their nets for bycatch every 30 minutes in those areas where gillnetting is permitted. In 2009, one bottlenose dolphin, known to frequent aquaculture pens off the Kona Coast of the island of Hawaii, was seen with a hook and line



**Figure 3.** Locations of observed Pelagic Stock bottlenose dolphin takes (filled diamonds) in the Hawaii-based longline fishery, 2007-2011. Solid lines represent the U. S. EEZ. Fishery descriptions are provided in Appendix 1.

trailing out of its mouth (Bradford & Lyman 2013). Based on the description and photographs, this injury was considered serious under the most recently developed criteria for assessing serious injury in marine mammals (NMFS 2012). The animal was resighted in February 2012 without the fish hook and in normal body condition, such that this injury is no longer considered serious. The responsible fishery is not known. 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.

Bottlenose dolphins are one of the species commonly reported to steal bait and catch from several Hawaii 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 (palu-ahi) for tuna, 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 Hawaii and Kaula Rock and formerly on several banks of the Northwestern Hawaiian Islands. Fishermen claim interactions with dolphins that steal bait and catch are increasing, including anecdotal reports of bottlenose dolphins getting “snagged” (Rizzuto 2007). Interaction rates between dolphins and the NWHI bottomfish fishery were estimated based on studies conducted in 1990-1993, indicating that an average of 2.67 dolphin interactions, defined as incidence of dolphins removing bait or catch from hooks, occurred for every 1000 fish brought on board (Kobayashi and Kawamoto 1995). These interactions generally involved bottlenose dolphins and it is not known whether these interactions result in serious injury or mortality of dolphins. This fishery was observed from 2003 through 2005 at 18-25% coverage, during which time, no incidental takes of cetaceans were reported. The bottomfish fishery is no longer permitted for the Northwestern Hawaiian Islands.

**Table 1.** Summary of available information on incidental mortality and serious injury of bottlenose 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; n/a = not available. 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 stock bottlenose 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%                       | 0   | 0 (-)               | 0              | 0 (-)               |
|   | 2009 |               | 21%                       | 1/1   | 5 (0.5)             | 0              | 0 (-)               |
|   | 2010 |               | 21%                       | 1/1   | 4 (0.6)             | 0              | 0 (-)               |
|   | 2011 |               | 20%                       | 0   | 0 (-)               | 0              | 0 (-)               |
| <b>Mean Estimated Annual Take (CV)</b>            |      |               |                           | <b>1.9 (0.6)</b>  |                     | <b>0 (-)</b>   |                     |
| Hawaii-based shallow-set longline fishery         | 2007 | Observer data | 100%                      | 3/3   | 3                   | 1/1            | 1                   |
|   | 2008 |               | 100%                      | 0   | 0                   | 0              | 0                   |
|   | 2009 |               | 100%                      | 0   | 0                   | 0              | 0                   |
|   | 2010 |               | 100%                      | 2/2   | 2                   | 0              | 0                   |
|   | 2011 |               | 100%                      | 2/1   | 1                   | 0              | 0                   |
| <b>Mean Annual Takes (100% coverage)</b>          |      |               |                           | <b>1.2</b>  |                     | <b>0.2</b>     |                     |
| <b>Minimum total annual takes within U.S. EEZ</b> |      |               |                           |   |                     | <b>0.2 (-)</b> |                     |

There are currently two distinct longline fisheries based in Hawaii: a deep-set longline (DSL) fishery that targets primarily tunas, and a shallow-set longline fishery (SSL) that targets swordfish. Both fisheries operate within U.S. waters and on the high seas. Between 2007 and 2011, seven bottlenose dolphins were observed hooked or entangled in the SSL fishery (100% observer coverage), and two bottlenose dolphins were observed taken in the DSL fishery (20-22% observer coverage) (Bradford & Forney 2013, McCracken 2013). Based on the locations, these takes are all considered to have been from the Pelagic Stock of bottlenose dolphins. Eight of the nine dolphins were considered to have been seriously injured (Bradford & Forney 2013), 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 2012). Average 5-yr estimates of annual mortality and serious injury for the Pelagic Stock during 2007-2011 are 3.1 (CV = 0.6) bottlenose dolphins outside of U.S. EEZs, and 0.2 (CV = 0) within the Hawaiian Islands EEZ (Table 1, McCracken 2013). Eight unidentified cetaceans were taken in the DSLL fishery, and two unidentified cetaceans were taken in the SSSL fishery, some of which may have been bottlenose dolphins.

### **KAUAI/NIHAU STOCK** **POPULATION SIZE**

A photo-identification study conducted from 2003 to 2005 identified 102 individual bottlenose dolphins around Kauai and Niihau (Baird et al. 2009). A Lincoln-Peterson mark-recapture analysis of the photo-identification data resulted in an abundance estimate of 147 (CV=0.11), or 184 animals when corrected for the proportion of marked individuals (Baird et al. 2009). The CV of this estimate is likely negatively-biased, as it does not account for variation in the proportion of marked animals within groups.

#### **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 Baird et al. (2009) mark-recapture estimate, or 168 bottlenose dolphins. This is greater than the number of distinct individuals (102) identified during the photo-identification study.

#### **Current Population Trend**

Only one abundance estimate is available for this stock, such that there is insufficient information to assess population trends.

### **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 (168) 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 reported fishery mortality or serious injury within the Kauai/Niihau stock range; Wade and Angliss 1997), resulting in a PBR of 1.7 bottlenose dolphins per year.

### **STATUS OF STOCK**

The Kauai/Niihau Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in the Kauai/Niihau stock relative to OSP is unknown, and there are insufficient data to evaluate abundance trends. No habitat issues are known to be of concern for this stock. 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 near-shore 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 bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate.

### **OAHU STOCK** **POPULATION SIZE**

A photo-identification study conducted in 2002, 2003 and 2006 identified 67 individual bottlenose dolphins around Oahu (Baird et al. 2009). A Lincoln-Peterson mark-recapture analysis of the photo-identification data resulted in an abundance estimate of 594 (CV=0.54), or 743 animals when corrected for the proportion of marked individuals (Baird et al. 2009). The estimate does not include individuals from the Northeastern (windward) side of the island.

#### **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 Baird et al. (2009) mark-recapture estimate, or 485. This is substantially greater than the number of distinct individuals (67) identified during the photo-identification study.

### **Current Population Trend**

Only one abundance estimate is available for this stock, such that there is insufficient information to assess population trends.

### **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 Oahu stock is calculated as the minimum population size (485) 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 reported fishery mortality in the Oahu stock range; Wade and Angliss 1997), resulting in a PBR of 4.9 bottlenose dolphins per year.

### **STATUS OF STOCK**

The Oahu stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in Oahu waters relative to OSP is unknown, and there are insufficient data to evaluate abundance trends. No habitat issues are known to be of concern for this stock. 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 near-shore 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 bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate.

### **4-ISLANDS STOCK POPULATION SIZE**

A photo-identification study conducted from 2000-2006 identified 98 individual bottlenose dolphins around Maui and Lanai (Baird et al. 2009). A Lincoln-Peterson mark-recapture analysis of the photo-identification data resulted in an abundance estimate of 153 (CV=0.24), or 191 animals when corrected for the proportion of marked individuals (Baird et al. 2009). This abundance estimate likely underestimates the total number of bottlenose dolphins in the 4-islands region because it does not include individuals from the Northeastern (windward) sides of Maui and Molokai. The CV of this estimate is likely negatively-biased, as it does not account for variation in the proportion of marked animals within groups.

### **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 Baird et al. (2009) mark-recapture estimate, or 156 bottlenose dolphins. This is greater than the number of distinct individuals (98) identified during the photo-identification study.

### **Current Population Trend**

Only one abundance estimate is available for this stock, such that there is insufficient information to assess population trends.

### **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 4-Islands stock is calculated as the minimum population size (156) 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 reported fishery mortality in the 4-Islands stock area; Wade and Angliss 1997), resulting in a PBR of 1.6 bottlenose dolphins per year.

### **STATUS OF STOCK**

The 4-Islands Region Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in 4-Islands waters 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 stock. 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 near-shore 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 bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate.

## **HAWAII ISLAND STOCK**

### **POPULATION SIZE**

A photo-identification study conducted from 2000-2006 identified 69 individual bottlenose dolphins around the island of Hawaii (Baird et al. 2009). A Lincoln-Peterson mark-recapture analysis of the photo-identification data resulted in an abundance estimate of 102 (CV=0.13), or 128 animals when corrected for the proportion of marked individuals (Baird et al. 2009). This abundance estimate likely underestimates the total number of bottlenose dolphins around the island of Hawaii because it does not include individuals from the Northeastern (windward) side of the island. The CV of this estimate is likely negatively-biased, as it does not account for variation in the proportion of marked animals within groups.

### **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 Baird et al. (2009) mark-recapture estimate, or 115 bottlenose dolphins. This is greater than the number of distinct individuals (69) identified during the photo-identification study.

### **Current Population Trend**

Only one abundance estimate is available for this stock, such that there is insufficient information to assess population trends.

### **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 Island stock is calculated as the minimum population size (115) 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 reported fishery mortality in the Hawaii Islands stock area; Wade and Angliss 1997), resulting in a PBR of 1.1 bottlenose dolphins per year.

### **STATUS OF STOCK**

The Hawaii Island Stock of bottlenose dolphins is not considered strategic under the 1994 amendments to the MMPA. The status of bottlenose dolphins in waters around Hawaii Island relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. Hawaii 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. 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 of takes in near-shore 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 bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate.

## **HAWAII PELAGIC STOCK**

### **POPULATION SIZE**

Population estimates have been made in Japanese waters (Miyashita 1993), but it is not known whether 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 3,215 (CV= 0.59) bottlenose dolphins (Barlow 2006), equivalent to a density of 1.31 individuals per 1000 km<sup>2</sup>. Applying this density to the area of the Pelagic Stock between the 1000m isobath and the Hawaiian Islands EEZ boundary (see Figures 1-2), the stock-specific abundance for 2002 was estimated as 3,178 (CV=0.59). The recent 2010 shipboard line-transect survey of the Hawaiian Islands EEZ resulted in an abundance estimate of 5,950 (CV = 0.59) bottlenose dolphins within the pelagic stock area (Bradford et al 2013). This is currently the best available abundance estimate

for the Hawaii Pelagic stock.

### **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 line-transect abundance estimate for the Hawaii Pelagic Stock, or 3,755 bottlenose dolphins.

### **Current Population Trend**

The broad and overlapping confidence intervals around the 2002 and 2010 estimates preclude assessment of population trends with the available data.

### **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 (3,755) times one half the default maximum net growth rate for cetaceans ( $\frac{1}{2}$  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 38 bottlenose dolphin per year.

### **STATUS OF STOCK**

The Hawaii 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. No habitat issues are known to be of concern for this stock. 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 (0.2 animals per year) is less than the PBR (38). The total fishery mortality and serious injury for Hawaii pelagic bottlenose dolphins is insignificant and approaching zero mortality and serious injury rate.

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