

SPINNER DOLPHIN (*Stenella longirostris longirostris*): Hawaiian Islands Stock Complex- Hawaii Island, Oahu/4-islands, Kauai/Niihau, Pearl & Hermes Reef, Midway Atoll/Kure, Hawaii Pelagic

STOCK DEFINITION AND GEOGRAPHIC RANGE

Six morphotypes within four subspecies of spinner dolphins have been described worldwide in tropical and warm-temperate waters (Perrin et al. 2009). The Gray's (or pantropical) spinner dolphin (*Stenella longirostris longirostris*) is the most widely distributed subspecies and is found in the Atlantic, Indian, central and western Pacific Oceans (Perrin et al. 1991). Within the central and western Pacific, spinner dolphins are island-associated and use shallow protected bays to rest and socialize during the day then move offshore at night to feed (Norris and Dohl 1980; Norris et al. 1994). They are common and abundant throughout the entire Hawaiian archipelago (Shallenberger 1981; Norris and Dohl 1980; Norris et al. 1994), and 26 strandings have been reported (Maldini et al. 2005). Sighting locations from a 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone (EEZ) of the main Hawaiian Islands (Barlow 2006) are shown in Figure 1. There were no on-effort sightings of spinner dolphins during the 2010 survey of the Hawaiian Islands (NMFS unpublished data).

Hawaiian spinner dolphins belong to a stock that is separate from animals in the eastern tropical Pacific (Perrin 1975; Dizon et al. 1994). The Hawaiian form is referable to the subspecies *S. longirostris longirostris*, which occurs pantropically (Perrin 1990). Genetic structure of spinner dolphins in the Hawaiian archipelago is evident between spinner dolphins sampled at five different islands/atolls: Hawaii, Oahu/4-islands, Kauai/Niihau, Pearl and Hermes Reef, Midway Atoll/Kure (Andrews 2009, Andrews et al. 2010). These distinctions are supported by available photo-ID and animal movement data (Karczmarski et al. 2005).

In particular, mitochondrial and microsatellite DNA data from individuals sampled along the Kona Coast of Hawaii Island show marked distinctions from individuals sampled at all other Hawaiian Islands including Maui (Andrews

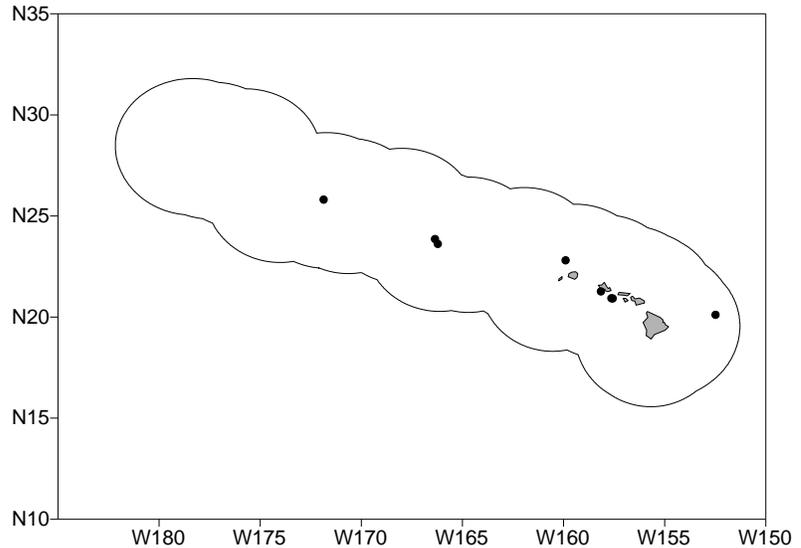


Figure 1. Spinner dolphin sighting locations during the 2002 shipboard cetacean survey of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006; see Appendix 2 for details on timing and location of survey effort). Outer line indicates approximate boundary of survey area and U.S. EEZ.

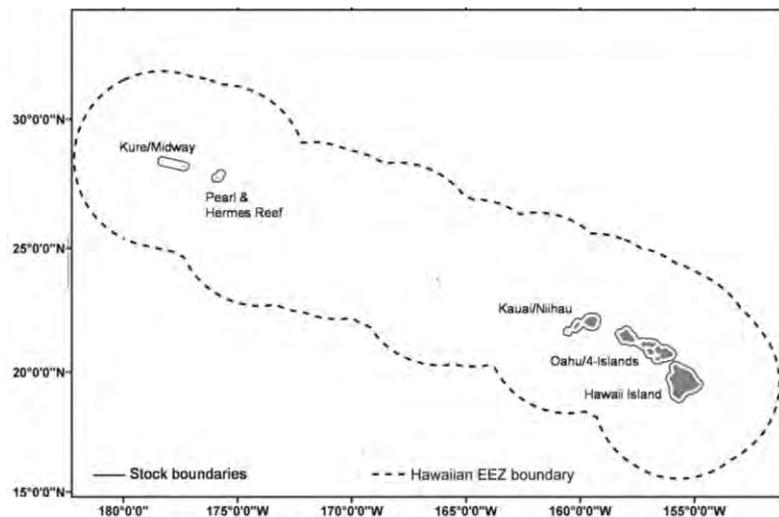


Figure 2. Spinner dolphin stock boundaries. Animals outside of the defined island areas represent the pelagic stock range

2009, Andrews et al. 2010). Hill et al. (2010) suggest an offshore boundary for each island-associated stock at 10 nmi from shore based on anecdotal accounts of spinner dolphin distribution. Analysis of individual spinner dolphin movements suggest that few individuals move long distances (from one main Hawaiian Island to another) and no dolphins have been seen farther than 10 nmi from shore (Hill et al. 2011). Norris et al. (1994) suggested that spinner dolphins may move between leeward and windward shores of the main Hawaiian Islands seasonally, and this does appear to be supported by recent analyses of abundance at Hawaii Island (Hill et al. 2011). For the Marine Mammal Protection Act (MMPA) stock assessment reports, there are six stocks found within the U.S. EEZ of the Hawaiian Islands: 1) Hawaii Island, 2) Oahu/4-Islands, 3) Kauai/Niihau, 4) Pearl & Hermes Reef, 5) Kure/Midway, and 6) Hawaii Pelagic, including animals found both within the Hawaiian Islands EEZ (outside of island-associated boundaries) and in adjacent international waters. Spinner dolphins in the eastern tropical Pacific that may interact with tuna purse-seine fisheries are managed separately under the MMPA.

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 Hawaii-based fisheries cause marine mammal mortality and serious injury in other U.S. fisheries. Gillnets appear to entangle marine mammals wherever they are used, and float lines from lobster or fish traps and longlines occasionally entangle cetaceans (Perrin et al. 1994). In Hawaii, some entanglements of spinner dolphins have been observed (Nitta and Henderson 1993; NMFS/PIR, unpublished data), but no estimate of annual human-caused mortality and serious injury is available because the nearshore fisheries are not observed or monitored.

Interactions with cetaceans have been reported for all Hawaii pelagic fisheries (Nitta and Henderson 1993). 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. Both fisheries operate within U.S. waters and on the high seas. However, there are fishery closures within 25-75 miles from shore in the MHI and 50 miles from shore in the NWHI where insular or island-associated species occur. Between 2006 and 2010, no spinner dolphins were observed hooked or entangled in the SSLL fishery (100% observer coverage) or the DSLL fishery (20-28% observer coverage) (McCracken 2011).

Interaction rates between dolphins and the former NWHI bottomfish fishery were estimated based on studies conducted in 1990-1993, indicating an average of 2.67 dolphin interactions occurred for every 1000 fish brought on board, most likely involving bottlenose and rough-toothed dolphins (Kobayashi and Kawamoto 1995). This fishery was observed from 2003 through 2005 at 18-25% coverage, during which time no incidental takes of cetaceans were reported.

HAWAII ISLAND STOCK **POPULATION SIZE**

Over the past few decades abundance estimates have been produced from studies along the Kona coast of Hawaii Island. Norris et al. (1994) photo-identified 192 individuals along the west coast of Hawaii and estimated 960 animals for this area in 1979-1980. Östman (1994) photo-identified 677 individual spinner dolphins in the same area from 1989 to 1992. Using the same estimation procedures as Norris et al. (1994), Östman (1994) estimated a population size of 2,334 for his study area along the Kona coast of Hawaii. As part of the Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate (ATOC) study, a total of twelve aerial surveys were conducted within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998. An abundance estimate of 3,184 (CV=0.37) spinner dolphins was calculated from the combined survey data (Mobley et al. 2000), now representing the Kauai/Niihau, Oahu/4-Islands, and Hawaii Island stocks. Those data are well over 8 years old and abundance estimates are out of date. New mark-recapture estimates based on photo-identification studies have resulted in new seasonal abundance estimates for the Hawaii Island stock. Closed capture models provide three seasonal estimates for the leeward coast of Hawaii Island for different time periods: 790 (CV = 0.17) for May to July, 2003; 280 (CV = 0.21) for January to March, 2005; and 205 (CV = 0.16) for January to March, 2006 (Hill et al. 2011). Considerable seasonal variation in spinner dolphin occurrence on the leeward versus south and east sides of the island is thought to occur, with lower abundance off the leeward Kona coast in the winter, potentially due to increased wind and swell in that region (Norris et al. 1994). Because estimates are confined to a small geographic region along the leeward coast, the summer estimate (May to July 2003) is likely to provide the best representation of the number of animals resident to Hawaii Island, though it is likely still an underestimate.

Minimum Population Estimate

The log-normal 20th percentile of the 2003 abundance summer estimate for the leeward coast of Hawaii Island is 685 spinner dolphins. This minimum estimate is several years old and may not represent the current population. Moreover, it is likely negatively-biased, as it represents a minimum estimate of the number of dolphins, accounting only for those along the leeward coast in 2003; no data were included from the rest of Hawaii Island.

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 for this species in Hawaiian waters. A default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaii Island stock is calculated as the minimum estimate of population size (685) 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 U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997) resulting in a PBR of 6.9 spinner dolphins per year.

STATUS OF STOCK

The status of Hawaii Island spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. A habitat issue of increasing concern is the potential effect of swim-with-dolphin programs and other tourism activities on spinner dolphins around the main Hawaiian Islands (Danil et al. 2005, Courbis & Timmel 2009). All Hawaiian spinner dolphin stocks are potentially exposed to high levels of Naval sonar and frequent detonations during training exercises. The sensitivity of spinner dolphins to these sound levels is unknown and therefore the impact of these exercises on spinner dolphin stocks is unknown. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Hawaii Island stock of spinner dolphins is not considered a strategic stock under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero, although coastal fisheries that are most likely to interact with this stock are unmonitored. Insufficient information is available to determine whether the total fishery mortality and serious injury for this Hawaii Island spinner dolphin stock is insignificant and approaching zero mortality and serious injury rate.

OAHU/4-ISLANDS STOCK **POPULATION SIZE**

As part of the Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate (ATOC) study, a total of twelve aerial surveys were conducted within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998. An abundance estimate of 3,184 (CV=0.37) spinner dolphins was calculated from the combined survey data (Mobley et al. 2000), now representing the Kauai/Niihau, Oahu/4-Islands, and Hawaii Island stocks. Those data are well over 8 years old and abundance estimates from these data are out of date. New mark-recapture estimates based on photo-identification studies have resulted in new seasonal abundance estimates for the Oahu/4-Islands stock. Closed-capture models provide two separate estimates for the leeward coast of Oahu representing different time periods: 160 (CV = 0.14) for June to July, 2002; and 355 (CV = 0.09) for July to September 2007 (Hill et al. 2011). The 2002 estimate is now more than 8 years old and therefore will no longer be used based on NMFS Guidelines for Assessing Marine Mammal Stocks (NMFS 2005). The 2007 estimate is the best-available estimate of the population size of the Oahu/4-Islands stock; however, it is likely an underestimate as it includes only dolphins found off the leeward coast of Oahu, and does not account for individuals that may spend most of their time along other parts of Oahu or somewhere else in the 4-Islands area.

Minimum Population Estimate

The log-normal 20th percentile of the 2007 abundance estimate for the summertime leeward coast of Oahu and the 4-Islands area is 329 spinner dolphins. This minimum estimate is several years old and may not represent the current population. Moreover, it is likely negatively-biased, as it represents a minimum estimate of the number of dolphins, accounting only for those along the leeward Oahu coast in 2007; no data were included from the rest of the stock range.

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 for this species in Hawaiian waters. A default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Oahu/4-Islands stock is calculated as the minimum estimate of population size (329) 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 U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997) resulting in a PBR of 3.3 spinner dolphins per year.

STATUS OF STOCK

The status of Oahu/4-Islands spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. A habitat issue of increasing concern is the potential effect of swim-with-dolphin programs and other tourism activities on spinner dolphins around the main Hawaiian Islands (Danil et al. 2005, Courbis & Timmel 2009). All Hawaiian spinner dolphin stocks are potentially exposed to high levels of Naval sonar and frequent detonations during training exercises. The sensitivity of spinner dolphins to these sound levels is unknown and therefore the impact of these exercises on spinner dolphin stocks is unknown. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Oahu/4-Islands stock of spinner dolphins is not considered a strategic stock under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero, although coastal fisheries that are most likely to interact with this stock are unmonitored. Insufficient data exist to determine whether the total fishery mortality and serious injury for this Oahu/4-Islands spinner dolphin stock is insignificant and approaching zero mortality and serious injury rate.

KAUAI/NIIHAU STOCK **POPULATION SIZE**

As part of the Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate (ATOC) study, a total of twelve aerial surveys were conducted within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998. An abundance estimate of 3,184 (CV=0.37) spinner dolphins was calculated from the combined survey data (Mobley et al. 2000), now representing the Kauai/Niihau, Oahu/4-Islands, and Hawaii Island stocks. Those data are well over 8 years old and abundance estimates from these data are out of date. New mark-recapture estimates based on photo-identification studies have resulted in a new seasonal abundance estimate for the Kauai/Niihau stock. Closed capture models provide an estimate of 601 (CV = 0.20) spinner dolphins for the leeward coast of Kauai for the period October to November 2005. This estimate is considered the best-available estimate of the population size of the Kauai/Niihau stock; however, it is likely an underestimate as it includes only dolphins found off the leeward coast of Kauai, and does not account for individuals that may spend most of their time along other parts of Kauai, Niihau, or Kaula Rock.

Minimum Population Estimate

The log-normal 20th percentile of the leeward Kauai abundance estimate is 509 spinner dolphins. This minimum estimate is several years old and may not represent the current population. Moreover, it is likely negatively-biased, as it represents a minimum estimate of the number of dolphins, accounting only for those along the leeward Kauai coast in 2005; no data were included from the rest of the stock range near Niihau or Kaula Rock.

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 for this species in Hawaiian waters. A default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Kauai/Niihau stock is calculated as the minimum population size (509) 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 U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997 resulting in a PBR of 5.1 spinner dolphins per year.

STATUS OF STOCK

The status of Kauai/Niihau spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate abundance trends. A habitat issue of increasing concern is the potential effect of swim-with-dolphin programs and other tourism activities on spinner dolphins around the main Hawaiian Islands (Danil et al. 2005, Courbis & Timmel 2009). All Hawaiian spinner dolphin stocks are potentially exposed to high levels of Naval sonar and frequent detonations during training exercises. The sensitivity of spinner dolphins to these sound levels is unknown and therefore the impact of these exercises on spinner dolphin stocks is unknown. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Kauai/Niihau stock of spinner dolphins is not considered a strategic stock under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero, although coastal fisheries that are most likely to interact with this stock are unmonitored. Insufficient data are available to determine whether the total fishery mortality and serious injury for this Kauai/Niihau spinner dolphin stock is insignificant and approaching zero mortality and serious injury rate.

PEARL & HERMES REEF STOCK

POPULATION SIZE

There is no information on the abundance of the Pearl & Hermes Reef stock of spinner dolphins. A photo-identification catalog of individual spinner dolphins from this stock is available, though inadequate survey effort and low re-sighting rates prevent robust estimation of abundance.

Minimum Population Estimate

There is no information on the minimum abundance of the Pearl & Hermes Reef stock of spinner 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 for this species in Hawaiian waters. A default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Pearl & Hermes Reef stock is calculated as the minimum population size 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 U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997). Because there is no minimum population estimate available for this stock the PBR for Pearl & Hermes Reef stock of spinner dolphins is undetermined.

STATUS OF STOCK

The status of Pearl & Hermes Reef spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Pearl & Hermes Reef stock of spinner dolphins is not considered a strategic stock under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero. 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.

MIDWAY ATOLL/KURE STOCK

POPULATION SIZE

In the Northwestern Hawaiian Islands, a multi-year photo-identification study at Midway Atoll resulted in a population estimate of 260 spinner dolphins based on 139 identified individuals (Karczmarski et al. 1998). This abundance estimate for the Midway Atoll/Kure stock of spinner dolphins is now more than 8 years old and therefore will no longer be used based on NMFS Guidelines for Assessing Marine Mammal Stocks (NMFS 2005). A 2010 shipboard line-transect survey within the Hawaiian EEZ resulted in a single off-effort sighting of spinner dolphins at Kure Atoll. This sighting cannot be used within a line-transect framework; however, photographs of individuals may be used in the future to estimate the abundance of spinner dolphin at Midway Atoll/Kure using mark-recapture methods.

Minimum Population Estimate

The minimum abundance estimate for the Midway Atoll/Kure stock is now more than 8 years old and therefore will no longer be used (NMFS 2005). There is no current minimum population size available for this stock.

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 for this species in Hawaiian waters. A default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Midway Atoll/Kure stock is calculated as the minimum population size 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 U.S. EEZ of the Hawaiian Islands; Wade and Angliss 1997). The PBR for the Midway Atoll/Kure stock of spinner dolphins is undetermined because no minimum population estimate is available for this stock.

STATUS OF STOCK

The status of Midway Atoll/Kure spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Midway Atoll/Kure stock of spinner dolphins is not considered strategic under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero. Insufficient data are available to determine whether the total fishery mortality and serious injury for this Midway Atoll/Kure spinner dolphin stock is insignificant and approaching zero mortality and serious injury rate.

HAWAII PELAGIC STOCK **POPULATION SIZE**

A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 3,351 (CV=0.74) spinner dolphins (Barlow 2006); however, this estimate assumed a single Hawaiian Islands stock. This estimate for the Hawaiian EEZ is ≥ 8 years old and therefore will no longer be used based on NMFS Guidelines for Assessing Marine Mammal Stocks (NMFS 2005). A 2010 shipboard line-transect survey within the Hawaiian EEZ did not result in any sightings of pelagic spinner dolphins.

Minimum Population Estimate

The log-normal 20th percentile of the 2002 abundance estimate for all stocks combined (Barlow 2006) is 1,920 spinner dolphins, however the minimum abundance estimate for the entire Hawaiian EEZ is ≥ 8 years old and will no longer be used (NMFS 2005). No minimum estimate of abundance is available for this stock, as there were no sightings of pelagic spinner dolphins during a 2010 shipboard line-transect survey of the Hawaiian EEZ.

Current Population Trend

No data on current population trend are available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Hawaiian waters. A

default level of 4% is assumed for maximum net productivity rate.

POTENTIAL BIOLOGICAL REMOVAL

Because there is no minimum population size estimate for Hawaii pelagic spinner dolphins, the potential biological removal (PBR) is undetermined.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Interactions with cetaceans have been reported for all Hawaii pelagic fisheries (Nitta and Henderson 1993). 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. Both fisheries operate within U.S. waters and on the high seas. Between 2006 and 2010, no spinner dolphins were observed hooked or entangled in the SSLL fishery (100% observer coverage) or the DSLL fishery (20-28% observer coverage) (McCracken 2011).

STATUS OF STOCK

The status of Hawaii pelagic spinner dolphins relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance for this stock. Spinner dolphins are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The Hawaii pelagic stocks of spinner dolphins is not considered a strategic stock under the MMPA, because the estimated rate of mortality and serious injury within the Hawaiian Islands EEZ is zero. However, there is no systematic monitoring of nearshore fisheries that may take animals from the pelagic stock. Insufficient information is available to determine whether the total fishery mortality and serious injury for this Hawaii pelagic spinner dolphin stock is insignificant and approaching zero mortality and serious injury rate.

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