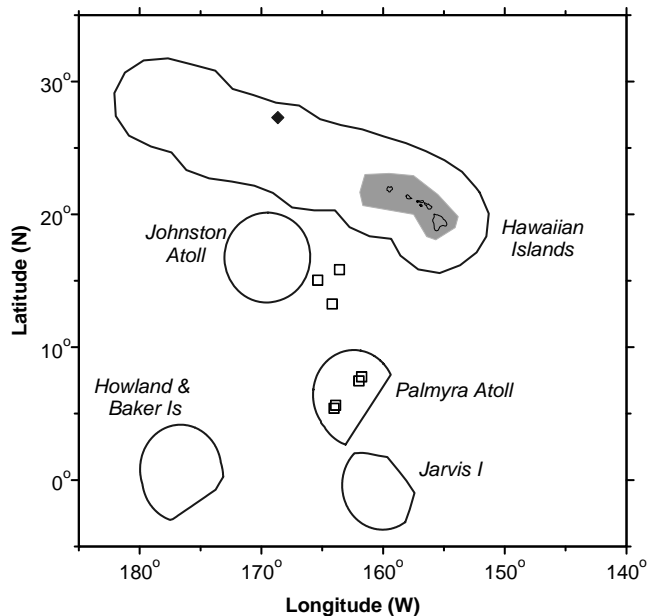


## FALSE KILLER WHALE (*Pseudorca crassidens*): Pacific Islands Region Stock Complex - Hawaii Insular, Hawaii Pelagic, and Palmyra Atoll Stocks

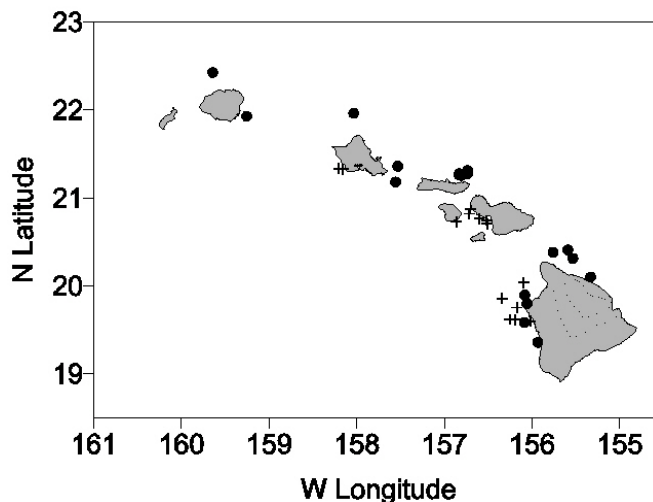
### STOCK DEFINITIONS AND GEOGRAPHIC RANGES

False killer whales are found worldwide mainly in tropical and warm-temperate waters (Stacey et al. 1994). In the North Pacific, this species is well known from southern Japan, Hawaii, and the eastern tropical Pacific. There are six stranding records from Hawaiian waters (Nitta 1991; Maldini 2005). One on-effort sighting of false killer whales was made during a 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands (Figure 1; Barlow 2006). Smaller-scale surveys conducted around the main Hawaiian Islands (Figure 2) show that false killer whales are also encountered in nearshore waters (Baird et al. 2005, Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004). This species also occurs in U.S. EEZ waters around Palmyra Atoll (Figure 1) and sightings of false killer whales have been recently confirmed within the Johnston Atoll EEZ (NMFS/PIR/PSD unpublished data) and the U.S. EEZ waters of American Samoa (Johnston et al. 2008).

Genetic analyses of tissue samples collected within the Eastern North Pacific (ENP) indicate restricted gene flow between false killer whales sampled near the main Hawaiian Islands and false killer whales sampled in all other regions of the ENP (Chivers et al. 2007). Since 2003, observers of the Hawaii-based longline fishery have also been collecting tissue samples of caught cetaceans for genetic analysis whenever possible. Four false killer whale samples, two collected outside the Hawaiian EEZ and two collected more than 100 nautical miles from the main Hawaiian Islands (See Figure 3) were determined to have ENP-like haplotypes. The latter two samples indicate that false killer whales within the Hawaiian EEZ belong to two different genetic populations, with a boundary somewhere within the Hawaiian EEZ. Based on sighting locations and genetic analyses of tissue samples, Chivers et al. (2008) suggested a stock boundary at about 75 nmi distance from the main Hawaiian Islands. This corresponds roughly to the February-September longline exclusion area (Figure 1), which is provisionally applied as a stock boundary in this report, to recognize insular and pelagic false killer whales as separate stocks for management (NMFS 2005). This boundary may be revised in the future as additional information becomes available. For example, recent satellite telemetry studies, boat-based surveys, and photo-identification analyses of false killer whales around the island of Hawaii (Baird et al. 2008a,b)



**Figure 1.** False killer whale sighting locations during standardized shipboard surveys of the Hawaiian U.S. EEZ (2002, black diamond, Barlow 2006), the Palmyra U.S. EEZ and pelagic waters of the central Pacific south of the Hawaiian Islands (2005, open squares, Barlow and Rankin 2007). Outer lines represent approximate boundary of U.S. EEZs; shaded gray area is the February-September longline exclusion zone around the main Hawaiian Islands, proposed as a false killer whale stock boundary.



**Figure 2.** False killer whale sighting locations during 2000-2004 boat-based surveys (+) (Baird et al. 2005) and 1993-2003 aerial surveys (•) (Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004) around the main Hawaiian Islands. See Appendix 2 for details on timing and location of survey effort.

yielded a maximum offshore extent of about 96km (52 nmi) for insular false killer whales. Animals belonging to the pelagic stock of false killer whales have been documented 42-70km (23-38 nmi) offshore (Baird et al. 2008b, c). These studies provide the first movement data for animals from both stocks, but sample sizes are small and the results are not yet sufficient for revising stock boundaries. NMFS will continue to evaluate new information on stock ranges as it becomes available.

Comparisons amongst false killer whales sampled at Palmyra Atoll and those sampled in the waters of the pelagic ENP, Panama and Mexico also reveal some level of restricted gene flow, although the sample size remains low for robust comparisons (Chivers et al. 2007). Efforts are currently underway to obtain and analyze additional tissue samples of false killer whales for further studies of population structure in the North Pacific Ocean.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, there are currently three Pacific Islands Region management stocks (Chivers et al. 2008): 1) the Hawaii Insular Stock, which includes animals inhabiting waters within the February-September longline exclusion zone around the main Hawaiian Islands, and 2) the Hawaii Pelagic Stock, which includes false killer whales inhabiting the waters of the U.S. EEZ of Hawaii outside of the February-September longline exclusion zone around the main Hawaiian Islands, and 3) the Palmyra Stock, which includes false killer whales found within the U.S. EEZ of Palmyra Atoll. Estimates of abundance, potential biological removal, and status determinations for these three stocks are presented separately below.

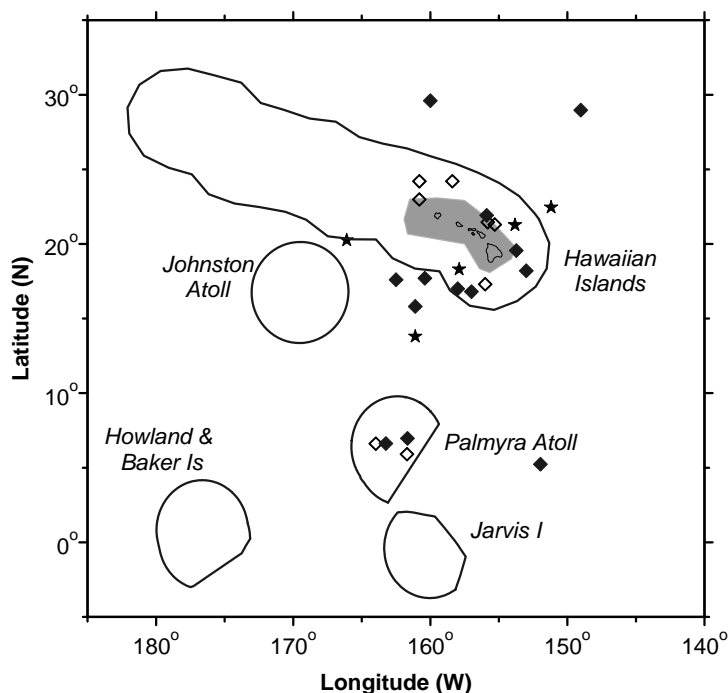
## HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

### Fishery Information

Interactions with cetaceans have been reported for Hawaiian pelagic fisheries, and false killer whales have been identified in fishermen's logs and NMFS observer records as taking catches from pelagic longlines (Nitta and Henderson 1993, NMFS/PIR unpublished data). They have also been observed feeding on mahi mahi, *Coryphaena hippurus*, and yellowfin tuna, *Thunnus albacares*, and they have been reported to take large fish (up to 70 pounds) from the trolling lines of both commercial and recreational fishermen (Shallenberger 1981).

There are 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. Following implementation of regulations to protect sea turtles and seabirds in the SSL fishery in 2004, no false killer whales have been observed hooked or entangled through the end of 2007, with 100% observer coverage (Forney and Kobayashi, 2007, Forney and McCracken 2008, McCracken and Forney 2008). Between 1994 and 2007, 24 false killer whales and fifteen unidentified cetaceans that may have been false killer whales (based on the observer's descriptions), have been documented hooked or entangled in the DSL fishery. In the most recent five years (2003-2007), with 20-28% observer coverage in the DSL fishery, 14 false killer whale deaths and serious injuries were documented in 18,848 observed sets (a rate of 0.74 per 1000 sets). Estimates of overall mortality and serious injury for false killer whales, by EEZ, are shown in Table 1.

Information on stock identity of false killer whales that interact with the DSL fishery in EEZ waters of Hawaii is limited. Six of the eight 2003-2007 false killer whales taken within Hawaiian Islands EEZ waters were within the range of the Hawaii Pelagic Stock, and the remaining two occurred at an unspecified location during sets that straddled the Insular/Pelagic Stock boundary at about 75nmi from shore. Two genetic samples obtained from



**Figure 3.** Locations of observed false killer whale takes (filled symbols) and possible takes of this species (open symbols) in the Hawaii-based longline fishery, 2002-2006. Stars are locations of genetic samples from fishery-caught false killer whales. Solid lines represent the U.S. EEZ; shaded gray area is the February-September longline exclusion boundary around the main Hawaiian Islands. Set locations in this fishery are summarized in Appendix 1.

animals hooked or entangled in the longline fishery within the Hawaiian Islands EEZ were determined to be from the Pelagic Stock (S. Chivers, NMFS unpublished data; Figure 3). Based on these results, the estimated takes of false killer whales are provisionally considered to have come from the Hawaii Pelagic Stock. However, from October to January, a small subset of longline fishing effort takes place within the current stock range of the Hawaiian Insular Stock, and Baird and Gorgone (2005) documented a high rate of dorsal fin disfigurements, which were consistent with injuries from unidentified fishing line. At the present time, it is unknown whether these injuries might have been caused by longline gear or other hook-and-line gear used around the main Hawaiian Islands. Additional research is needed to evaluate potential overlap between the insular false killer whale stock and line fisheries and to determine whether any of the estimated false killer whale takes in the longline fishery might have involved the Hawaiian Insular Stock.

**Table 1.** Summary of available information on incidental mortality and serious injury of false killer whales (Pacific Islands Stock Complex) in commercial fisheries, within and outside of selected U.S. EEZs (Forney and McCracken 2008, McCracken and Forney 2008). Mean annual takes are based on 2003-2007 data unless otherwise indicated.

Fishery Name	Year	Data Type	Percent Observer Coverage	Observed and estimated mortality and serious injury of false killer whales, by EEZ region								
				Outside of U.S. EEZs			Hawaiian Islands EEZ <sup>1</sup>			Palmyra Atoll EEZ		
				Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)
<b>Hawaii-based deep-set longline fishery</b>	2003	observer data	22%	0	0 (-)		2	7 (0.83)		0	0	
	2004		25%	3	14 (0.43)	5.4	3	12 (0.46)	7.4	0	0	
	2005		28%	1	3 (2.76)	(0.45)	1	3 (3.16)	(0.19)	0	0	0.3
	2006		22%	1	7 (1.42)		1	7 (1.84)		0	0	(1.01)
	2007		20%	0	3 (6.50)		1	8 (1.98)		1	2 (5.50)	
<b>Hawaii-based shallow-set longline fishery</b>	2003	observer data	no fishing	0								
	2004		100%	0		0	0	0	0	0	0	0
	2005		100%	0	0	0	0	0	0	0	0	0
	2006		100%	0	0	0	0	0	0	0	0	0
	2007		100%	0	0	0	0	0	0	0	0	0
<b>Minimum total annual takes within U.S. EEZ waters</b>							<b>7.7 (0.19)</b>					

<sup>1</sup>All false killer whales taken by the Hawaii longline fisheries within the Hawaiian EEZ were within the stock range of the Hawaii Pelagic Stock or straddling the insular/pelagic stock boundary, and genetic analyses for the two available samples indicated these animals were part of the Hawaii Pelagic Stock. All Hawaiian Islands EEZ takes of false killer whales are, therefore, provisionally considered to be from the Hawaii Pelagic Stock; however, there is potential for overlap between insular false killer whales and the longline fishery and further study is needed (see text above).

## **HAWAII INSULAR STOCK** **POPULATION SIZE**

A mark-recapture study of photo-identification data obtained during 2000-2004 around the main Hawaiian Islands produced an estimate of 123 (CV=0.72) false killer whales (Baird et al. 2005). This updates an estimate of 121 (CV=0.47) made by Mobley et al. (2000) based on 1994-1998 aerial surveys. Both estimates apply only to the Hawaii Insular Stock because surveys were conducted within 75 nmi of the main Hawaiian Islands.

### **Minimum Population Estimate**

The minimum population estimate for the Hawaii Insular stock false killer whales is the number of distinct individuals identified in this population during the 2002-2004 photo-identification studies, 76 individuals (Baird et al. 2005). This is similar to the log-normal 20th percentile of the mark-recapture abundance estimate, 71 false killer whales.

### **Current Population Trend**

A recent study (Reeves et al. 2009) summarized information on false killer whale sightings near Hawaii between 1989 and 2007, based on various survey methods, and suggested that the insular stock of false killer whales may have declined during the last two decades. However, because of differences in survey methods, no quantitative analysis of the sightings data and population trend has been made.

## **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 insular Hawaii false killer whale stock is calculated as the minimum population size (76) 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 documented human-caused mortality and serious injury; see Wade and Angliss 1997), resulting in a PBR of 0.8 false killer whales per year.

## **STATUS OF STOCK**

The status of false killer whales in insular Hawaiian waters (within 75 nmi) relative to OSP is unknown. Reeves et al. (2009) suggested that this population may have declined since the late 1980s; however, there are insufficient data to evaluate trends in abundance quantitatively. A recent study (Ylitalo et al. 2008) documented elevated levels of polychlorinated biphenyls (PCBs) in three of nine insular false killer whales sampled, and biomass of some false killer whale prey species has declined around the main Hawaiian Islands (Reeves et al. 2009). False killer whales are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. This stock is not considered “strategic” under the 1994 amendments to the MMPA because there has been no documented human-caused mortality or serious injury of false killer whales belonging to the Hawaii Insular Stock. However, a high incidence of fin disfigurements in this stock (Baird and Gorgone 2005) indicates that interactions with unidentified line fisheries may be of concern, and the stock range includes an area where some longline fishing operations take place seasonally.

## **HAWAII PELAGIC STOCK** **POPULATION SIZE**

Analyses of a 2002 shipboard line-transect survey of the Hawaiian Islands EEZ (HICEAS survey) resulted in an abundance estimate of 236 (CV=1.13) false killer whales (Barlow 2006) outside of 75 nm of the main Hawaiian Islands. A recent re-analysis of the HICEAS data using improved methods and incorporating additional sighting information obtained on line-transect surveys south of the Hawaiian EEZ during 2005, resulted in a revised estimate of 484 (CV = 0.93) false killer whales within the Hawaiian Islands EEZ outside of 75 nmi of the main Hawaiian Islands (Barlow & Rankin 2007). This is the best available abundance estimate for the Hawaii Pelagic Stock of false killer whales.

### **Minimum Population Estimate**

The log-normal 20th percentile of the 2002 abundance estimate for the Hawaiian Islands EEZ outside of 75 nmi from the main Hawaiian Islands (Barlow & Rankin 2007) is 249 false killer whales.

### **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.

## **POTENTIAL BIOLOGICAL REMOVAL**

The potential biological removal (PBR) level for the Hawaii Pelagic Stock of false killer whale is calculated as the minimum population size (249) 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 a Hawaiian Islands EEZ mortality and serious injury rate  $CV < 0.30$ ; Wade and Angliss 1997), resulting in a PBR of 2.5 false killer whales per year.

## **STATUS OF STOCK**

The status of the Hawaii Pelagic Stock of false killer whale 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 as “depleted” under the MMPA. Because the rate of mortality and serious injury to false killer whales within the Hawaiian Islands EEZ and outside of 75 nmi in the Hawaii-based longline fishery (7.4 animals per year) exceeds the PBR (2.5), this stock is considered a “strategic stock” under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Hawaiian false killer whales cannot be considered to be insignificant and approaching zero, because it exceeds the PBR. Furthermore, additional injury and mortality of false killer whales is known to occur in U.S and international longline fishing operations in international waters, and the potential effect on the Hawaii Pelagic Stock is unknown.

## **PALMYRA STOCK**

### **POPULATION SIZE**

Recent line transect surveys in the U.S. EEZ waters of Palmyra Atoll produced an estimate of 1,329 (CV = 0.65) false killer whales (Barlow & Rankin 2007). This is the best available abundance estimate for false killer whales within the Palmyra Atoll EEZ.

### **Minimum Population Estimate**

The log-normal 20th percentile of the 2002 abundance estimate for the Palmyra Atoll EEZ (Barlow & Rankin 2007) is 806 false killer whales.

### **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 Palmyra Atoll waters.

### **POTENTIAL BIOLOGICAL REMOVAL**

The potential biological removal (PBR) level for the Palmyra Atoll false killer whale stock is calculated as the minimum population size (806) times one half the default maximum net growth rate for cetaceans ( $\frac{1}{2}$  of 4%) times a recovery factor of 0.40 (for a stock of unknown status with a mortality and serious injury rate CV >0.80; Wade and Angliss 1997), resulting in a PBR of 6.4 false killer whales per year.

### **STATUS OF STOCK**

The status of false killer whales in Palmyra Atoll EEZ 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. They are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The rate of mortality and serious injury to false killer whales within the Palmyra Atoll EEZ in the Hawaii-based longline fishery (0.3 animals per year) does not exceed the PBR (6.4) for this stock and thus, this stock is not considered “strategic” under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Palmyra Atoll false killer whales is less than 10% of the PBR and, therefore, can be considered to be insignificant and approaching zero. Additional injury and mortality of false killer whales is known to occur in U.S. and international longline fishing operations in international waters, and the potential effect on the Palmyra stock is unknown.

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