

KILLER WHALE (*Orcinus orca*): Hawaii Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim 1978). Although reported from tropical and offshore waters (Heyning and Dahlheim 1988), killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). They are considered rare in Hawaiian waters. No killer whales were seen during 1993-98 aerial surveys within about 25 nmi of the main Hawaiian Islands, but one sighting was reported during subsequent surveys (Mobley et al. 2000, 2001). Baird et al. (2006) reported 21 sighting records in Hawaiian waters between 1994 and 2004. Summer/fall shipboard surveys of U.S. Exclusive Economic Zone (EEZ) Hawaiian waters resulted in two sightings in 2002 and one in 2010. (Figure 1; Barlow 2006; Bradford et al. 2017). Three strandings have been reported since 1950 (Richards 1952, NMFS PIR Marine Mammal Responses Network database), including one since 2007. Eighteen additional sightings were reported around the main Hawaiian Islands, French Frigate Shoals, and offshore of the Hawaiian islands (Baird et al. 2006). Except in the northeastern Pacific where "resident", "transient", and "offshore" stocks have been described for coastal waters of Alaska, British Columbia, and Washington to California (Bigg 1982; Leatherwood et al. 1990, Bigg et al. 1990, Ford et al. 1994), little is known about stock structure of killer whales in the North Pacific. A global-scale analysis of killer whale phylogeographic structure clustered one animal sampled near Hawaii with eastern and western North Pacific transients. The other Hawaii sample within that analysis did not cluster with any known ecotype, but had divergence time between that of transient and offshore forms (Morin et al 2010).

For the Marine Mammal Protection Act (MMPA) stock assessment reports, eight killer whale stocks are recognized within the Pacific U.S. EEZ: 1) the Eastern North Pacific Alaska Resident stock - occurring from southeastern Alaska to the Aleutian Islands and Bering Sea, 2) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through part of southeastern Alaska, 3) the Eastern North Pacific Southern Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia, but also in coastal waters from British Columbia through California, 4) the Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock - occurring mainly from Prince William Sound through the Aleutian Islands and Bering Sea, 5) the AT1 Transient stock - occurring in Alaska from Prince William Sound through the Kenai Fjords, 6) the West Coast Transient stock - occurring from California through southeastern Alaska, 7) the Eastern North Pacific Offshore stock - occurring from California through Alaska, and 8) the Hawaiian stock (this report). The Hawaii stock includes 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 this stock is evaluated based on data from U.S. EEZ waters of the Hawaiian Islands (NMFS 2005). Stock assessment reports for the Southern Resident, Eastern North Pacific Offshore, and Hawaiian stocks can be found in the Pacific Region stock assessment reports; all other killer whale stock assessments are included in the Alaska Region stock assessments.

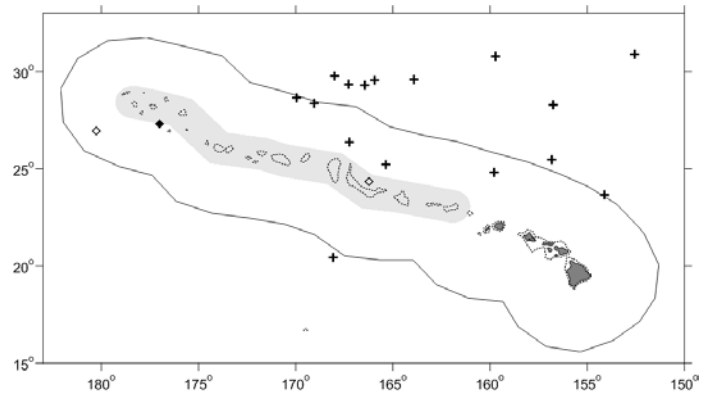


Figure 1. Locations of killer whale sightings from longline observer records (crosses; NMFS/PIR, unpublished data) and sighting locations during the 2002 (open diamonds) and 2010 (black diamonds) shipboard surveys of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2006, Bradford et al 2017; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ. Dark and light gray shading indicate the original and expanded areas of Papahānaumokuākea Marine National Monument. Dotted line represents the 1,000 m isobath.

POPULATION SIZE

Encounter data from a 2010 shipboard line-transect survey of the entire Hawaiian Islands EEZ was recently evaluated using Beaufort sea-state-specific trackline detection probabilities for killer whales, resulting in an abundance estimate of 146 (CV = 0.96) killer whales (Bradford et al. 2017) in the Hawaii stock. A 2002 shipboard line-transect survey of the same area resulted in an abundance estimate of 349 (CV=0.98) killer whales (Barlow 2006). Species abundances estimated from the 2002 HICEAS survey used pooled small dolphin, large dolphin, and large whale $g(0)$ (the probability of sighting and recording an animal directly on the track line) estimates stratified by group size (Barlow 1995). Since then, Barlow (2015) developed a more robust method for estimating species-specific $g(0)$ values that are adjusted for the Beaufort sea states that are encountered during a survey. This new method was used for analyzing the data from the 2010 survey, but has not yet been used to analyze the 2002 data.

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 abundance estimate or 74 killer whales within the Hawaiian Islands EEZ.

Current Population Trend

Abundance analyses of the 2002 and 2010 datasets used different $g(0)$ values. The 2002 survey data have not been reanalyzed using this method. This change precludes evaluation of population trends at this time. Assessment of population trend will likely require additional survey data and reanalysis of all datasets using comparable methods.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current and maximum net productivity rate 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 (74) 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 known fishery mortality or serious injury within the Hawaiian Islands EEZ; Wade and Angliss 1997), resulting in a PBR of 0.7 killer whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Information on fishery-related mortality and serious injury of cetaceans in Hawaiian waters is limited, but the gear types used in Hawaiian fisheries are responsible for marine mammal mortality and serious injury in other fisheries throughout U.S. waters. No interactions between nearshore fisheries and killer whales have been reported in Hawaiian waters. 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. Killer whale interactions with Hawaii fisheries appear to be rare. In 1990, a solitary killer whale was reported to have removed the catch from a longline in Hawaii (Dollar 1991). 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 2011 and 2015, no killer whales were observed hooked or entangled in the SSL fishery (100% observer coverage) or the DSL fishery (20-22% observer coverage) (Bradford 2017, Bradford and Forney 2017, McCracken 2017).

STATUS OF STOCK

The Hawaii stock of killer whales is not considered strategic under the 1994 amendments to the MMPA. The status of killer whales 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. Killer whales are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor designated as “depleted” under the

MMPA. Given the absence of recent recorded fishery-related mortality or serious injuries the total fishery mortality and serious injury can be considered to be insignificant and approaching zero.

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