

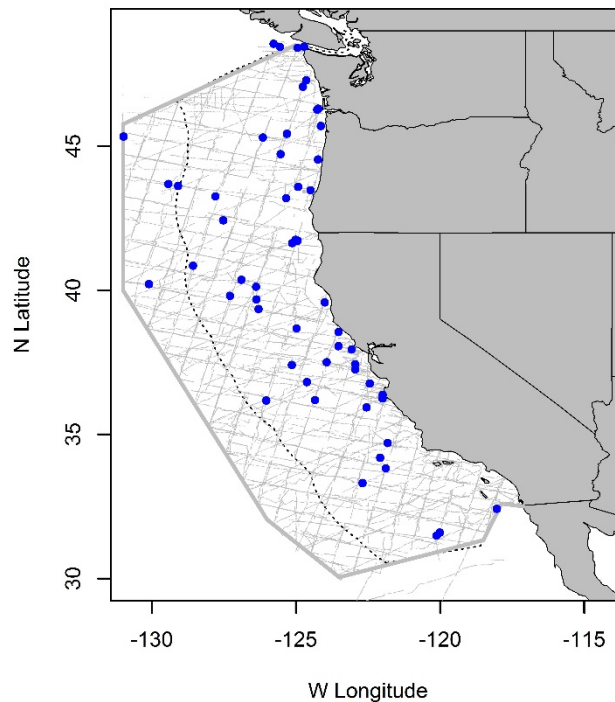
## Killer Whale (*Orcinus orca*): Eastern North Pacific Offshore Stock

### STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales are observed worldwide from the tropics to polar regions (Leatherwood and Dahlheim 1978), although they prefer colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975, Forney and Wade 2006). Near the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim 1982, Hamilton *et al.* 2009), in British Columbia and Washington inland waterways (Bigg *et al.* 1990), and along the outer coasts of Washington, Oregon and California (Hamilton *et al.* 2009). Seasonal and year-round occurrence are noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intra-coastal waterways of British Columbia and Washington, where three ecotypes are recognized: 'resident', 'transient' and 'offshore' (Bigg *et al.* 1990, Ford *et al.* 1994), based on aspects of morphology, ecology, genetics and behavior (Ford and Fisher 1982; Baird and Stacey 1988; Baird *et al.* 1992, Hoelzel *et al.* 1998, Morin *et al.* 2010, Ford *et al.* 2014). Offshore killer whales are known from southern California waters north to the Aleutian Islands and are considered to represent a single network of socially-connected individuals (Dahlheim *et al.* 2008, Ford *et al.* 2014). Photographic matches of individuals between Dutch Harbor, Alaska and southern California waters near Dana Point are documented (Dahlheim *et al.* 2008).

Offshore killer whales apparently do not mix with transient and resident killer whale stocks in these regions (Ford *et al.* 1994, Black *et al.* 1997). Studies indicate the 'offshore' type, although distinct from the other types ('resident' and 'transient'), appears to be more closely related genetically, morphologically, behaviorally, and vocally to 'resident' type killer whales (Black *et al.* 1997, Hoelzel *et al.* 1998, Morin *et al.* 2010). Global genetic studies suggest that residents and transient ecotypes warrant subspecies recognition (Morin *et al.* 2010) and each are currently listed as unnamed subspecies of *Orcinus orca* (Committee on Taxonomy 2018). Currently, the offshore killer whale ecotype is included under *Orcinus orca* (Committee on Taxonomy 2018).

Based on association patterns, acoustics, movements, genetic differences and potential fishery interactions, eight killer whale stocks are recognized within the Pacific U.S. EEZ: (1) the Eastern North Pacific Alaska Resident stock - occurring from Southeast Alaska to the Bering Sea, (2) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through Alaska, (3) the Eastern North Pacific Southern Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia but extending from central California into southern Southeast Alaska, (4) the West Coast Transient stock - occurring from Alaska through California, (5) the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock - occurring from southeast Alaska to the Bering Sea, (6) the AT1 Stock - found only in Prince William Sound, (7) the Eastern North Pacific Offshore stock - occurring from Alaska through California, and (8) the Hawaiian stock. The Stock Assessment



**Figure 1.** Sightings of killer whales (all ecotypes/stocks) encountered during Southwest Fisheries Science Center line-transect vessel surveys in the California Current ecosystem, 1991-2014.

Reports for the Alaska Region contains data on Eastern North Pacific Alaska Resident, Eastern North Pacific Northern Resident and the Gulf of Alaska, Aleutian Islands, and Bering Sea, AT1, and West Coast Transient stocks.

**POPULATION SIZE**

Population size of the eastern North Pacific stock of offshore killer whales is estimated with photo-ID mark-recapture methods at 300 whales (95% Highest Posterior Density Interval (HPDI) = 257–373, CV=0.10), including marked and unmarked individuals encountered from 1988-2012 (Ford *et al.* 2014). This study included 157 encounters of 355 distinct whales from the Aleutian Islands to southern California. The cumulative number of unique animals reported via a ‘discovery curve’ was not asymptotic, implying that additional individuals are undocumented. Most encounters (n=85) during the photo-ID study were from southeast Alaska and Vancouver Island, where survey effort was most intense. The fraction of this population utilizing U.S. waters is unknown and the number of animals using areas outside of the currently known geographic range (Aleutian Islands to southern California) is unknown.

**Minimum Population Estimate**

The minimum population size is calculated as the lower 20<sup>th</sup> percentile of the estimate (N=300, CV=0.1) reported by Ford *et al.* (2014), or 276 animals.

**Current Population Trend**

The population trajectory for eastern North Pacific offshore killer whales is described as ‘stable’ by Ford *et al.* (2014). The stable designation includes considerations such as an estimated average annual survival rate of 0.98 (95% HPDI = 0.92–0.99) and annual recruitment rates of 0.02 (95% HPDI = 0–0.07) (Ford *et al.* 2014).

**CURRENT AND MAXIMUM NET PRODUCTIVITY RATES**

Annual recruitment rates of 2% (95% HPDI = 0 – 7%) were estimated by Ford *et al.* (2014) for offshore killer whales, based on a Bayesian mark-recapture model.

**POTENTIAL BIOLOGICAL REMOVAL**

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (276) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a species of unknown status with no known fishery mortality; Wade and Angliss 1997), resulting in a PBR of 2.8 offshore killer whales.

**HUMAN-CAUSED MORTALITY AND SERIOUS INJURY**

**Fishery Information**

Offshore killer whales have not been documented killed by anthropogenic sources in Alaska or U.S. west coast waters, but mortalities are likely to be undetected, given the offshore range of this ecotype. Ford *et al.* (2014) reports one offshore killer whale injury (severed dorsal fin) due to a vessel strike, but does not report a location or year. Offshore killer whales are likely vulnerable to the same anthropogenic threats (fishery interactions, vessel strikes, sonar) as other killer whale stocks.

**Table 1.** Data on incidental mortality and injury of Eastern North Pacific Offshore killer whales in commercial fisheries. No killer whale entanglements have been observed in the CA swordfish drift gillnet fishery since 1995, when a single whale was killed (Carretta *et al.* 2018a). The whale was genetically identified as a transient ecotype and is the only killer whale observed entangled in the fishery over a 27-year period (Carretta *et al.* 2017, 2018). Bycatch estimates for the fishery appear in Table 1 and are based on a bycatch model that pools all years of observer data, but does not include the observation of a transient killer whale.

Fishery Name	Data Type	Years	Percent Observer Coverage	Observed Mortality	Estimated Annual Mortality	Mean Annual Takes (CV)
CA thresher shark/swordfish drift gillnet	Observer	2012	19%	0	0	0
		2013	37%	0	0	
		2014	24%	0	0	
		2015	20%	0	0	
		2016	18%	0	0	
<b>Minimum total annual takes</b>						0

## STATUS OF STOCK

The status of Eastern North Pacific offshore killer whales in relation to OSP is unknown. The estimated population size is described as 'stable' by Ford *et al.* (2014). No habitat issues are known to be of concern for this stock. The tendency for whales in this population to occur in large groups, sometimes between 50 -100 animals, combined with the small population size, raises concern that a relatively large fraction of the population faces exposure risk to such anthropogenic events as fishery interactions, vessel strikes, oil spills, or military sonar (Ford *et al.* 2014). Offshore killer whales are not listed as "threatened" or "endangered" under the Endangered Species Act nor as "depleted" under the MMPA. There has been no documented human-caused mortality of this stock but Ford *et al.* (2014) reported one injury due to a vessel strike. It is likely that undetected mortality and injury of killer whales from this stock occurs in gillnets and other fishing gear. Along the U.S. west coast, observations of the California swordfish drift gillnet fishery includes one *transient* killer whale entangled and killed during 8,845 fishing sets from 1990-2016 (Carretta *et al.* 2017a, Carretta *et al.* 2018). Documented injuries and mortalities of offshore killer whales due to anthropogenic sources are extremely rare, and the fishery most likely to interact with them along the U.S. west coast has not had a documented interaction in 27 years, therefore Eastern North Pacific offshore killer whales are not classified as a "strategic" stock under the MMPA. The total fishery mortality and serious injury for offshore killer whales is considered to be insignificant and approaching zero mortality and serious injury rate.

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