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KILLER WHALE (*Orcinus orca*): Eastern North Pacific Transient 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, killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). Along the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim 1982), in British Columbia and Washington inland waterways (Bigg et al. 1990), and along the outer coasts of Washington, Oregon, and California (Green et al. 1992; Barlow 1995, 1997; Forney et al. 1995). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intracoastal waterways of British Columbia and Washington State, where pods have been labeled as '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). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in Prince William Sound have been observed near Kodiak Island (Matkin et al. 1999) and whales identified in Southeast Alaska have been observed in Prince William Sound, British Columbia, and Puget Sound (Leatherwood et al. 1990, Dahlheim et al. 1997). Movements of killer whales between the waters of Southeast Alaska and central California have also been documented (Goley and Straley 1994).

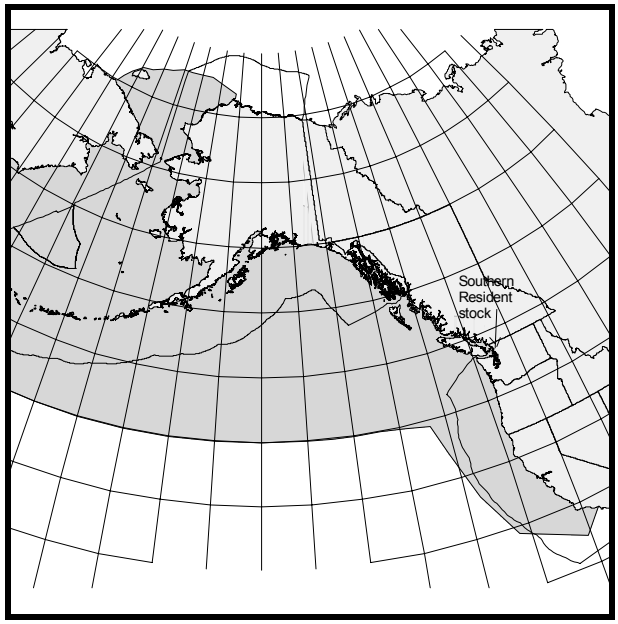

Figure 1. Approximate distribution of killer whales in the eastern North Pacific (shaded area). The distribution of the Eastern North Pacific Northern Resident and Transient stocks are largely overlapping (see text).

Studies on mtDNA restriction patterns provide evidence that the 'resident' and 'transient' types are genetically distinct (Stevens et al. 1989, Hoelzel 1991, Hoelzel and Dover 1991, Hoelzel et al. 1998). Analysis of 73 samples collected from eastern North Pacific killer whales from California to Alaska has demonstrated significant genetic differences among 'transient' whales from California through Alaska, 'resident' whales from the inland waters of Washington, and 'resident' whales ranging from British Columbia to the Aleutian Islands and Bering Sea (Hoelzel et al. 1998).

Based on data regarding association patterns, acoustics, movements, genetic differences and potential fishery interactions, five killer whale stocks are recognized within the Pacific U.S. EEZ: 1) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through Alaska, 2) 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, 3) the Eastern North Pacific Transient stock - occurring from Alaska through California (see Fig. 1), 4) the Eastern North Pacific Offshore stock - occurring from Southeast Alaska through California, and 5) the Hawaiian stock. 'Transient' whales in Canadian waters are considered part of the Eastern North Pacific Transient stock. The Stock Assessment Reports for the Alaska Region contain information concerning the Eastern North Pacific Northern Resident stock

POPULATION SIZE

The Eastern North Pacific Transient stock is a trans-boundary stock, including killer whales from British

Columbia. Preliminary analysis of photographic data resulted in the following minimum counts for 'transient' killer whales belonging to the Eastern North Pacific Transient stock (Note: individual whales have been matched between geographical regions and missing animals likely to be dead have been subtracted). In British Columbia and southeastern Alaska, 219 'transient' whales have been cataloged (Ford and Ellis 1999). In the Gulf of Alaska, 21 'transient' killer whales have been identified genetically and/or acoustically (Matkin et al. 1999). The 'transient' group AT1, commonly seen in Prince William Sound/Kenai Fjords, had only 11 remaining whales in 1998 (Matkin et al. 1999). Based on data collected from all Alaska waters west of Seward (Dahlheim and Waite 1993; Dahlheim 1994, 1997), 68 whales are considered 'residents' as they have been linked by association to 'resident' whales from Prince William Sound (G. Ellis, pers. comm.), and the remainder are provisionally classified as 174 'residents' and 53 'transients.' Provisional classifications were based primarily on morphological differences identified from the photographs. Accordingly, the numbers of 'residents' and 'transients' in Alaska waters west of Seward are considered preliminary at this time. Off the coast of California, 105 'transient' whales have been identified (Black et al. 1997): 10 whales were matched to photos of 'transients' in other catalogs and the remaining 95 were linked by association. An additional 14 whales in southeastern Alaska (M. Dahlheim, unpubl. data) and 16 whales off the coast of California (N. Black, pers. comm.) have been provisionally classified as 'transient' whales by association. Combining the counts of cataloged 'transient' whales gives a minimum number of 346 (219 + 21 + 11 + 95) killer whales belonging to the Eastern North Pacific Transient stock.

Minimum Population Estimate

The abundance estimate of killer whales is a direct count of individually identifiable animals. However, the number of cataloged whales does not necessarily represent the number of live animals. Some animals may have died, but whales can not be presumed dead if not resighted because long periods of time between sightings is common for some 'transient' animals. On the other hand, given that researchers continue to identify new whales, the estimate of abundance based on the number of uniquely identified individuals cataloged is likely conservative. However, the rate of discovering new whales within Southeast Alaska and Prince William Sound is relatively low. In addition, the abundance estimate does not include 53 whales from western Alaska, 14 whales from southeastern Alaska, and 16 whales off the coast of California that have been provisionally classified as 'transients.'

Other estimates of the overall population size (i.e., N_{BEST}) and associated CV(N) are not currently available. Thus, the minimum population estimate (N_{MIN}) for the Eastern North Pacific Transient stock of killer whales is 346 animals, which includes animals found in Canadian waters (see PBR Guidelines regarding the status of migratory trans-boundary stocks, Wade and Angliss 1997). Information on the percentage of time animals typically encountered in Canadian waters spend in U.S. waters is unknown. However, as noted above, this minimum population estimate is considered conservative. This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1996).

Current Population Trend

At present, reliable data on trends in population abundance for the Eastern North Pacific Transient stock of killer whales are unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of killer whales. Studies of 'resident' killer whale pods in the Pacific Northwest resulted in estimated population growth rates of 2.92% and 2.54% over the period from 1973 to 1987 (Olesiuk et al. 1990, Brault and Caswell 1993). However, a population increases at the maximum growth rate (R_{MAX}) only when the population is at extremely low levels; thus, the estimate of 2.92% is not a reliable estimate of R_{MAX}. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (346) times one-half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.40 (for a cetacean stock of unknown status with a mortality rate CV$0.80, Wade and Angliss 1997), resulting in a PBR of 2.8 whales per year. The proportion of time that this trans-boundary stock spends in Canadian waters cannot be determined (G. Ellis, pers. comm.).

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries in Alaska that could have interacted with killer whales were monitored for incidental take by fishery observers from 1994 to 1998: Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska groundfish trawl, longline, and pot fisheries. Of the six observed fisheries, killer whale mortalities occurred only in the Bering Sea groundfish trawl and longline fisheries (Table 1; Perez in prep.). From 1994 to 1998, one killer whale mortality was observed in 1997 in the Bering Sea groundfish trawl fishery. The 1995 mortality in the longline fishery occurred during an unmonitored haul and could not be used to estimate total mortality for the fishery.

NMFS observers also monitored the California/Oregon thresher shark/swordfish drift gillnet fishery from 1994 to 1998 (Table 1; Julian 1997, Julian and Beeson 1998, Cameron and Forney 1999). The observed mortality in this fishery, in 1995, was a transient whale as determined by genetic testing (S. Chivers, pers. comm.). Overall entanglement rates in the California/Oregon thresher shark/swordfish drift gillnet fishery dropped considerably after the 1997 implementation of a Take Reduction Plan, which included skipper education workshops and required the use of pingers and minimum 6-fathom extenders (Barlow and Cameron 1999). Because of the changes in this fishery after implementation of the Take Reduction Plan, mean annual takes in Table 1 are based only on 1997-1998 data. Additional fisheries that could interact with the Eastern North Pacific Transient stock of killer whales are listed in Appendix 1.

The mean annual mortality was 0.4 (CV=1.0) for the Bering Sea groundfish trawl fishery, 0.2 (0 from monitored hauls + 0.2 from unmonitored haul data) for the combined Bering Sea longline fishery, and zero for the California/Oregon thresher shark/swordfish drift gillnet fishery (1997-1998 data), resulting in a mean annual mortality rate of 0.6 killer whales per year from observed fisheries.

An additional source of information on the number of killer whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1994 and 1998, there were no fisher self-reports of killer whale mortalities from any Alaska fisheries operating within the range of this stock. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable after 1995 (see Appendix 4 of Hill and DeMaster 1998).

The estimated minimum mortality rate incidental to recently monitored U.S. commercial fisheries is 0.6 animals per year, based on observer data (0.4 from monitored hauls + 0.2 from unmonitored hauls). As the animals which were taken incidental to commercial fisheries in Alaska have not been identified genetically, it is not possible to determine whether they belonged to the Eastern North Pacific Northern Resident or the Eastern North Pacific Transient killer whale stock. Accordingly, these same mortalities can be found in the stock assessment report for the Northern Resident stock.

Table 1. Summary of incidental mortality of killer whales (Eastern North Pacific Transient stock) due to commercial fisheries and calculation of the mean annual mortality rate. Mean annual takes are based on 1994-98 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	94	obs data	65.5%	0	0	0.4 (1.0)
	95		67.3%	0	0	
	96		66.2%	0	0	
	97		63.9%	1	2	
	98		67.0%	0	0	
BSAI groundfish longline (incl. misc. finfish and sablefish fisheries)	94	obs data	27.3%	0	0	0
	95		28.0%	0	0	
	96		28.7%	0	0	
	97		32.5%	0	0	
	98		36.2%	0	0	
	95	unmonitored haul		1		0.2

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
CA/OR thresher shark/ swordfish drift gillnet	94 95 96 97 98	obs data	17.9% 15.6% 12.4% 23.0% 20.0%	0 1 0 0 0	0 6 0 0 0	0[1]
Estimated total annual takes						0.6 (1.0)

[1] Only 1997-98 mortality estimates are included in the average because of gear modifications implemented within the fishery as part of a 1997 Take Reduction Plan. Gear modifications included the use of net extenders and acoustic warning devices (pingers).

Due to a lack of Canadian observer programs, there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries, which are analogous to U.S. fisheries that are known to interact with killer whales. The sablefish longline fishery accounts for a large proportion of the commercial fishing/killer whale interactions in Alaska waters. Such interactions have not been reported in Canadian waters where sablefish are taken via a pot fishery. Since 1990, there have been no reported fishery-related strandings of killer whales in Canadian waters. However, in 1994, one killer whale was reported to have contacted a salmon gillnet, but it did not entangle (Guenther et al. 1995). Data regarding the level of killer whale mortality related to commercial fisheries in Canadian waters, though thought to be small, are not readily available or reliable which results in an underestimate of the annual mortality for this stock.

Subsistence/Native Harvest Information

There are no reports of a subsistence harvest of killer whales in Alaska or Canada.

Other Mortality

There is considerable interaction between killer whales and longline vessels in the Bering Sea (Dahlheim 1988; Yano and Dahlheim 1995; Perez in prep.; M. Perez, unpubl. data), as well as reports of killer whales consuming the processing waste of Bering Sea groundfish trawl fishing vessels (M. Perez, unpubl. data). However, it most likely is the 'resident' stock of killer whales that is involved in such fishery interactions since these whales are known to be fish eaters, while 'transient' whales have only been observed feeding on marine mammals.

The shooting of killer whales in Canadian waters has also been a concern in the past. However, in recent years there have been no reports of shooting incidents in Canadian waters. In fact, the likelihood of shooting incidents involving 'transient' killer whales is thought to be minimal since commercial fishermen are most likely to observe 'transients' feeding on seals or sea lions instead of interacting with their fishing gear (G. Ellis, pers. comm.).

Collisions with boats are another source of mortality. One mortality due to a ship strike occurred in 1998, when a killer whale struck the propeller of a vessel in the Bering Sea groundfish trawl fishery, resulting in an estimated annual mortality of 0.2 killer whales from this stock in 1994-1998.

STATUS OF STOCK

Killer whales are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Recall that the human-caused mortality has been underestimated, primarily due to a lack of information on Canadian fisheries, and that the minimum abundance estimate is considered conservative (because researchers continue to encounter new whales and provisionally classified whales from western Alaska, southeastern Alaska, and off the coast of California were not included), resulting in a conservative PBR estimate. Based on currently available data, the estimated annual fishery-related mortality level (0.6) exceeds 10% of the PBR (0.28) and, therefore, can not be considered to be insignificant and approaching zero mortality and serious injury rate. The estimated annual level of human-caused mortality and serious injury (0.6 + 0.2 = 0.8 animals per year) is not known to exceed the PBR (2.8). Therefore, the Eastern North Pacific Transient stock of killer whales is not classified as a strategic stock. Population trends and status of this stock relative to its Optimum Sustainable Population (OSP) level are currently unknown.

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