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**KILLER WHALE (*Orcinus orca*): Eastern North Pacific
Northern Resident 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 occur at higher densities in colder and more productive waters of both hemispheres, with the greatest densities found at high latitudes (Mitchell 1975, Leatherwood and Dahlheim 1978, Forney and Wade in press). Killer whales are found throughout the North Pacific. 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. 2000) 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, 2002; Barrett-Lennard 2000). 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).

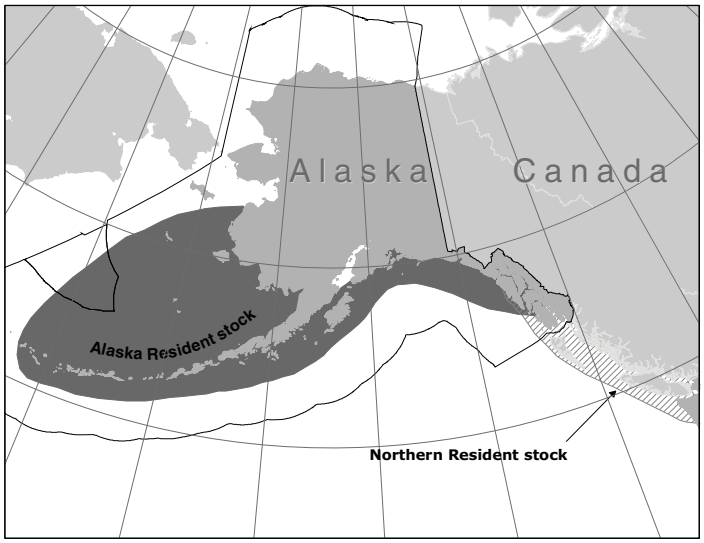

Figure 22. Approximate distribution of killer whales in the eastern North Pacific (shaded area). The distribution of the Eastern North Pacific Resident and Transient stocks are largely overlapping (see text).

Several studies provide evidence that the 'resident', 'offshore', and 'transient' ecotypes are genetically distinct in both mtDNA and nuclear DNA (Hoelzel and Dover 1991; Hoelzel et al. 1998, 2002; Barrett-Lennard 2000). Genetic differences have also been found between populations within the 'transient' and 'resident' ecotypes (Hoelzel et al. 1998, 2002; Barrett-Lennard 2000).

Within the resident ecotype, association data were initially used to describe three separate communities in the North Pacific (Bigg et al. 1990; Ford et al. 1994, 2000; Matkin et al. 1999). The Southern Resident population is found in summer primarily in waters of Washington state and southern British Columbia. The Northern Resident population is found in summer primarily in central and northern British Columbia. Resident whales are found throughout Alaska. Acoustic data (Ford 1989, 1991; Yurk et al. 2002) and genetic data (Hoelzel et al. 1998, 2002; Barrett-Lennard 2000) have confirmed that these three units represent discrete populations. Separate stock assessment reports have always acknowledged the distinction between residents, offshore, and transient killer whale populations.

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S. EEZ: 1) the Alaska Resident stock - occurring from southeastern Alaska to the Aleutian Islands and Bering Sea, 2) the Northern Resident stock - occurring from British Columbia through part of southeastern Alaska, 3) the 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 Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock - occurring mainly from

Prince William Sound through the Aleutian Islands and Bering Sea (see Fig. 22), 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 Offshore stock - occurring from California through Alaska, and 8) the Hawaiian stock. 'Transient' whales in Canadian waters are considered part of the West Coast Transient stock. The Stock Assessment Reports for the Alaska Region contain information concerning all the killer whale stocks except the Hawaiian and Offshore stocks.

The known range of the Northern Resident stock includes Canadian waters from approximately Mid-Vancouver Island and throughout most of southeastern Alaskan waters (Ford et al. 2000, Dahlheim unpublished data). They have been seen infrequently in Washington state waters.

POPULATION SIZE

The Eastern North Pacific Northern Resident stock is a transboundary stock, and includes killer whales that frequent British Columbia, Canada and southeastern Alaska. Photo-identification studies since 1970 (Ford et al. 2000) have catalogued every individual in this population resulting in the following minimum count for 'resident' killer whales belonging to the Eastern North Pacific Northern Resident stock (Note: individual whales have been matched between geographical regions and missing animals likely to be dead have been subtracted). A count of 216 'resident' whales was made as of 1998 (Ford et al. 2000; Table 31). Births and deaths since 1998 are not accounted for here.

Table 31. Numbers of animals in each pod of killer whales belonging to the Eastern North Pacific Northern Resident stock of killer whales.

British Columbia	Ford et al. 1994	Ford et al. 2000
A1	15	16
A4	11	11
A5	12	13
B1	9	7
C1	13	14
D1	7	12
H1	8	9
I1	10	8
I2	7	2
I18	19	16
G1	28	29
G12	11	13
I11	18	22
I31	10	12
R1	23	29
W1	3	3
Total	**204**	**216**

Minimum Population Estimate

The survey technique utilized for obtaining the abundance estimate of killer whales is a direct count of individually identifiable animals. Other estimates of the overall population size (i.e., N_{BEST}) and associated CV(N) are not currently available. Because this population has been studied for such a long time period, each individual is well documented and, except for births, no new individuals are expected to be discovered. Therefore, the estimated population size of 216 animals can also serve as a minimum count of the population.

Thus, the minimum population estimate (N_{MIN}) for the Northern Resident stock of killer whales is 216 animals, which includes animals found in Canadian waters (see PBR Guidelines regarding the status of migratory transboundary stocks, Wade and Angliss 1997). Information on the percentage of time animals typically encountered in Canadian waters spend in U. S. waters is unknown. This approach is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1996).

Current Population Trend

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). These rates were for combined northern and southern resident communities. Recent analyses indicate that some pods in the Northern Resident population had increased at approximately 3% per year and were apparently approaching carrying capacity since the rates of increase appeared to be slowing (P. Olesiuk as reported in Dahlheim et al. 2000).

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 British Columbia and Washington waters 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). Until more recent stock-specific 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

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). Thus, for the Eastern North Pacific Northern Resident killer whale stock, PBR = 2.16 animals ($216 \times 0.02 \times 0.5$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Due to limited Canadian observer program coverage, there are few data on the mortality of marine mammals incidental to Canadian commercial fisheries (i.e., those similar to U.S. fisheries 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 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

The shooting of killer whales in Canadian waters has been a concern in the past. However, in recent years the Canadian portion of the stock has been researched so extensively that evidence of bullet wounds would have been noticed if shooting was prevalent (G. Ellis, Pacific Biological Station, Canada, pers. comm.).

Other Issues

In U.S. waters, there is considerable interaction between killer whales and fisheries aside from incidental take. Interactions between killer whales and longline vessels, specifically predation by killer whales on sablefish catch, have been well documented (Dahlheim 1988, Yano and Dahlheim 1995, Sigler et al. 2002). However, it is unknown whether these interactions also occur in Canada.

STATUS OF STOCK

The Northern Resident killer whale stock is not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. In April 1999, the Committee on the Status of Endangered Wildlife in Canada voted to designate all resident killer whales in British Columbia as "threatened", and the designation appears to have been based on the fact that the small size and low growth rate make the northern resident populations at risk from immunotoxic effects of persistent toxic chemicals and a reduction in prey

availability (Baird 1999). Baird (1999) also indicates that the commercial and recreational whale watching industry may be having an impact. It is likely that the human-caused mortality level for this stock is underestimated. The human-caused mortality has been underestimated due primarily to a lack of information on Canadian fisheries; however, a review of the status of killer whales in Canada indicates that the available evidence suggests that mortality incidental to commercial fisheries is rare and does not have the potential to cause substantial population reductions in the future (Baird, 1999).

Based on currently available data, the estimated annual fishery related mortality level is zero, which does not exceed 10% of the PBR (0.22) and therefore is considered to be insignificant and approaching zero mortality and serious injury rate. The estimated annual level of human-caused mortality and serious injury is not known to exceed the PBR (2.2). Therefore, the eastern North Pacific Northern Resident stock of killer whales is not classified as a strategic stock. Population trends and status of this stock relative to its Optimum Sustainable Population size are currently unknown.

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