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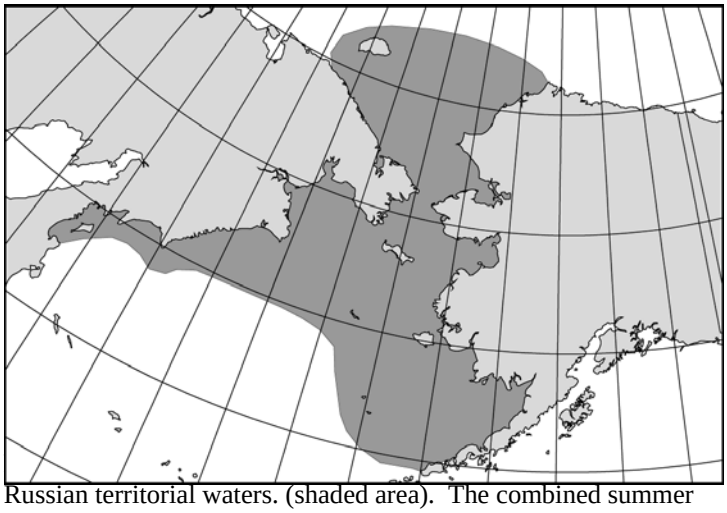
PACIFIC WALRUS (*Odobenus rosmarus divergens*): Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The family *Odobenidae* is represented by a single modern species *Odobenus rosmarus* of which two subspecies are generally recognized: the Atlantic walrus (*O. r. rosmarus*), and the Pacific walrus (*O. r. divergens*). The two subspecies occur in geographically isolated populations. The Pacific walrus is the only form occurring in U.S. waters and considered in this account.



Russian territorial waters. (shaded area). The combined summer and winter distributions are depicted.

Pacific walrus range throughout the continental shelf waters of the Bering and Chukchi seas, occasionally moving into the East Siberian Sea and the Beaufort Sea (Fig. 1). During the summer months most of the population migrates into the Chukchi Sea, however several thousand animals, primarily adult males, congregate near coastal haulouts in the Gulf of Anadyr and in Bristol Bay. During the late winter breeding season walrus are found in two major concentration areas of the Bering Sea where open leads, polynyas, or thin ice occur (Fay *et al.* 1984). While the specific location of these groups varies annually and seasonally depending upon the extent of the sea ice, generally one group ranges from the Gulf of Anadyr into a region southwest of St. Lawrence Island, and a second group is found in the southeastern Bering Sea from south of Nunivak Island into northwestern Bristol Bay. Currently, animals in these two regions are assumed to represent a single stock. Mitochondrial and nuclear DNA analysis of tissue samples taken from animals in the two areas in April (shortly after breeding season) indicate that either they are not discrete breeding groups, or, that separation took place so recently that it is not genetically detectable (Scribner *et al.* 1997).

POPULATION SIZE

The size of the Pacific walrus population has never been known with certainty. Based on large sustained harvests in the 18th and 19th centuries, Fay (1982) speculated that the pre-exploitation population was represented by a minimum of 200,000 animals. Since that time, population size is believed to have fluctuated markedly in response to varying levels of human exploitation (Fay *et al.* 1989). Large scale commercial harvests reduced the population to an estimated 50,000-100,000 animals in the mid-1950's (Fay *et al.* 1997). The population is believed to have increased rapidly in size during the 1960s and 1970s in response to reductions in hunting pressure (Fay *et al.* 1989).

Between 1975 and 1990, aerial surveys were carried out by the United States and Russia at five year intervals, producing population estimates ranging from 201,039 to 234,020 animals (Table 1). The estimates generated from these surveys are considered conservative population estimates and are not useful for detecting trends (Hills and Gilbert 1994, Gilbert *et al.* 1992). Efforts to survey the Pacific walrus population were suspended after 1990 due to unresolved problems with survey methods which produced population estimates with unacceptably large confidence intervals (Gilbert *et al.* 1992, Gilbert 1999). The current size of the Pacific walrus population is unknown.

In March 2000 the U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey hosted a workshop on walrus survey methods (Garlich-Miller and Jay 2000). Workshop participants reviewed past efforts to survey the Pacific walrus population and discussed various approaches to estimate population size and trend. The amount of survey effort required to achieve a population estimate with an acceptably small variance (CV <= 0.3) is expected to be extensive. Survey effort could be maximized by flying more transects, increasing survey swath width to sample a wider area, or both. Stratification could help focus survey area and reduce the amount of survey effort required, but will require additional research on the relationship between walrus distribution and environmental variables.

Workshop participants recommended investing in research on walrus distribution and haulout patterns and exploring new survey tools, including remote sensing systems, prior to conducting another aerial survey.

Table 1. Aerial survey estimates of the Pacific walrus population, 1975-1990. Differences in survey design and methods preclude describing trends in population size.

Year	Population Estimate	References
1975	221,350	Estes and Gilbert 1978, Estes and Gol'tsev 1984
1980	246,360	Johnson *et al.* 1982, Fedoseev 1984
1985	234,020	Gilbert 1986, 1989, Fedoseev and Razlivalov 1986
1990	201,039	Gilbert *et al.* 1992

Minimum Population Estimate

A minimum population estimate (N_{MIN}) for this stock can not be determined because a reliable estimate of current population size is not available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Estimates of net productivity rates for walrus populations have ranged from 3-13% per year with most estimates falling between 5-10% (Chapskii 1936, Mansfield 1959, Krylov 1965, 1968, Fedoseev and Gol'tsev 1969, Sease 1986, DeMaster 1984, Sease and Chapman 1988, Fay *et al.* 1997).

Chivers (1999) developed an individual age based model of the Pacific walrus population using published estimates of survival and reproduction. The model yielded a maximum population growth rate (R_{MAX}) of 8%. This estimate remains theoretical because age-specific survival rates for free ranging walrus are poorly known.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) of a marine mammal stock is defined in the Marine Mammal Protection Act as the product of the minimum population estimate (N_{MIN}), one-half the maximum theoretical net productivity rate (R_{MAX}) and a recovery factor (F_R). Without a reliable estimate of N_{MIN} the PBR for this stock can not be determined.

ANNUAL HUMAN CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

There are no data available concerning the incidental catch of walrus in fisheries operating in Russian waters. In the U.S. regulatory zone, walrus occasionally interact with trawl and longline gear of groundfish fisheries operating in the eastern Bering Sea. The USFWS has adopted the average annual fishery mortality rate over the past five years (1996-2000) as a representative estimate of the current rate of fishery related mortality in Alaska. Between 1996 and 2000, sixty-three interactions between commercial fishing gear and walrus were recorded through the National Marine Fisheries Services' fisheries observer program (mean: 12.6, range: 8-20 per year) (Unpublished fisheries observation data, Michael Perez, NMFS, 7600 Sand Pt. Way, NE, Seattle, WA 98115). Most (92%) of the observed interactions were with decomposed walrus carcasses or skeletal remains suggesting that the animals died prior to their interaction with the fishing gear. The only fishery for which incidental kill or injury was observed was the Bering Sea groundfish trawl fishery (non-pelagic). Five dead (not decomposed) walrus and one injured animal (released alive) were recorded over this time period. The range of observer coverage over the five year period (1996-2000), as well as the annual observed and estimated mortalities are presented in Table 2. A complete list of fisheries and marine mammal interactions is published annually by NMFS [67 FR 2410].

Another potential source of information on the number of walrus killed or injured incidental to commercial fisheries operations in Alaska is the NMFS fisher self reporting program. Although there were no walrus mortalities recorded through this program in 1996-2000, this reporting program may be negatively biased (Credle *et al*. 1994),

therefore the absence of mortality reports does not necessarily assure that no mortalities occurred.

Table 2. Summary of incidental mortality of Pacific walrus (Alaska stock) due to commercial fisheries from 1996-2000 and estimated mean annual mortality rate. Fisheries observation data provided by NMFS.

Fishery name	Years	Data type	Range of observer coverage[a]	Observed mortality[b] (in given years)	Estimated mortality[c] (in given years)	Estimated mean annual mortality
Bering Sea Groundfish Trawl	1996-2000	Obs data	62.1-76.5%	0, 2, [1], 0,[2]	NE(0),3,NE(1),NE(0),NE(2)	1.2 (CV = 0.42)

[a] Based on total tonnage of the catch monitored by observers.

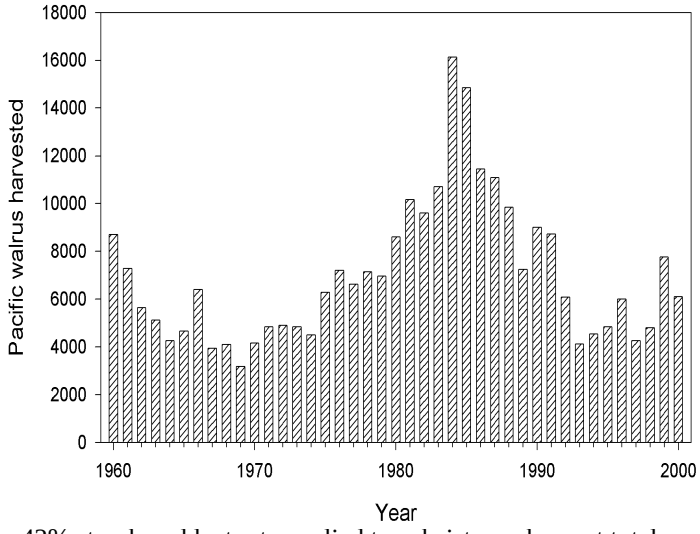
[b] Brackets indicate that the take was reported to or seen by the observer in an un-monitored haul.

[c] NE = no estimate because either zero take occurred, or, no takes occurred during monitored hauls. The number in parentheses are kills known to have occurred in all hauls on all vessels.

Based on the available fisheries observer data, the estimated mortality rate incidental to commercial fisheries in Alaska is approximately 1.2 walrus per year (CV = 0.42). Because the PBR for this stock is not known, it is not possible to quantify fishery mortalities relative to this standard. However, a fishery mortality level of 1.2 animals per year can be considered insignificant relative to other sources of human caused mortality affecting this stock.

Subsistence/Commercial Harvest

Over the past forty years the Pacific walrus population has sustained estimated annual harvest mortalities ranging from 3,200 to 16,100 animals per year (mean: 6,993) (Fig. 2). Recent harvest levels are lower than historic highs. It is not known whether lower harvest levels reflect changes in walrus abundance or hunting effort. Factors affecting harvest levels include the cessation of Russian commercial walrus harvests after 1991, changes in political, economic, and social conditions of subsistence hunters in Alaska and Chukotka, and the effects of variable weather and ice conditions on hunting success.



In 1997, a Cooperative Agreement was developed between the USFWS and the Alaska Eskimo Walrus Commission to facilitate the participation of subsistence hunters in activities related to the conservation and management of walrus stocks in Alaska. Specific activities carried out under this agreement have included the strengthening and expansion of harvest monitoring programs in Alaska and Chukotka as well as efforts to develop locally based subsistence harvest regulations.

a 42% struck and lost rate applied to subsistence harvest totals (Fay *et al.* 1994).

The USFWS has adopted the average annual harvest over the past five years as a representative estimate of current harvest levels in Alaska and Chukotka. Based on 1996-2000 harvest statistics, adjusted for animals mortally wounded but not retrieved, harvest mortality levels are estimated at 5,789 animals per year (Table 3). Based on data collected through the USFWS Marking Tagging and Reporting Program, the sex-ratio of the reported U.S. walrus harvest over this time period was approximately equal. The sex-ratio of the reported Russian walrus harvest was approximately 0.5 female:male (based on harvest information collected Chukotka TINRO in 1999 and 2000 only).

Table 3. Estimated harvest of Pacific walrus, 1996-2000. Russian harvest information provided by Chukotka TINRO. U.S. harvest information collected by the U.S. Fish and Wildlife Service and are adjusted for unreported walrus (Garlich-Miller and Burn 1997). Corrected harvest incorporates a 42% struck and lost rate from Fay *et al.* (1994).

Year	Reported Russia Harvest	Reported U.S. Harvest	Total Reported Harvest	Total Corrected Harvest
1996	941	2,541	3,482	6,003
1997	731	1,739	2,470	4,259
1998	950	1,840	2,790	4,810
1999	1,670	2,829	4,499	7,757
2000	1,212	2,334	3,546	6,114
Mean	**1,101**	**2,257**	**3,357**	**5,789**

Other Removals

Between 1996 and 2000 there were 15 mortalities associated with research activities and 5 orphaned walrus calves collected for public display. Based on this information, an estimated 4 walrus per year were taken due to other human activities

Total Estimated Human Caused Mortality

The total estimated annual human caused mortality or removal is calculated to be 5,794 walrus per year (1 attributed to fisheries interactions, 5,789 due to harvest, and 4 due to other human activities).

STATUS OF STOCK

Pacific walrus are not listed as "depleted" under the Marine Mammal Protection Act, or as "threatened" or "endangered" under the Endangered Species act. Because of minimal interactions between walrus and any U.S. fishery the Pacific walrus population is not classified as a "strategic" stock with respect to managing incidental take under section 118 of the Marine Mammal Protection Act. The status of this stock relative to its Optimum Sustainable Population size is unknown.

Conservation Issues and Habitat Concerns

While recent harvest levels are lower than historical highs, a lack of information on population size or trend precludes any meaningful assessment of the impact of current harvest levels. Ensuring that harvest levels remain sustainable is a goal shared by subsistence hunters and resource managers in the U.S. and Russia. Achieving this management goal will require continued investments in population research, harvest monitoring programs, international coordination and co-management relationships.

Another element of concern is the potential for global climate change and associated changes in the distribution and extent of pack ice in the Bering and Chukchi Seas. The distribution of walrus is closely linked with the seasonal distribution of the pack ice because walrus rely on sea ice as a substrate for resting and giving birth. There are no data to make reliable predictions of the net impacts that changing climate conditions would have on the status and trend of the Pacific walrus population.

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