HARBOR SEAL (*Phoca vitulina richardsi*): Bering Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the United States, British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). The results of recent satellite tagging studies in Southeast Alaska, Prince William Sound, and Kodiak are also consistent with the conclusion that harbor seals are non-migratory (Frost et al. 1996, Swain et al. 1996). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister 1981, Frost et al. 1996). Strong fidelity of individuals for haulout sites in June and August also has been reported, although these studies considered only limited areas during a relatively short period of time (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

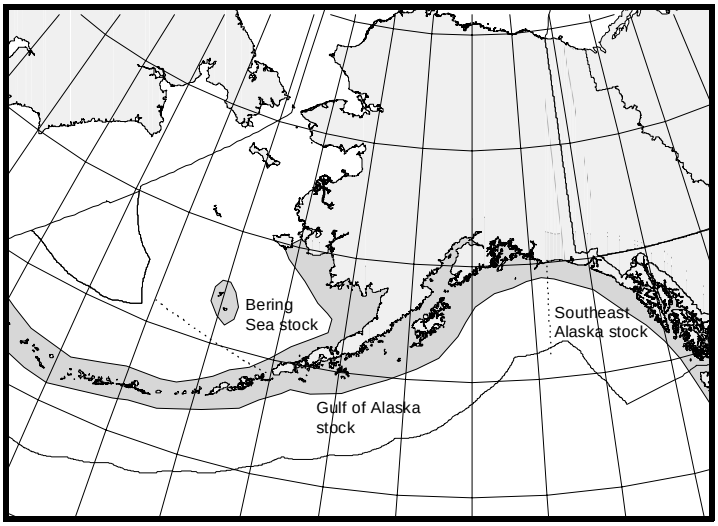

Figure 9. Approximate distribution of harbor seals in Alaska waters (shaded area).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, natal dispersal characteristics unknown, breeding dispersal is presumed to be very limited, year-round site fidelity observed, seasonal movements greater than 300 km rare (Harvey 1987) except in western Alaska (Hoover-Miller 1994); 2) Population response data: substantial differences in population dynamics between Southeast Alaska and the rest of Alaska, and presumed differences between Gulf of Alaska and Bering Sea (Hoover 1988, Hoover-Miller 1994, Withrow and Loughlin 1996b); 3) Phenotypic data: clinal variation in body size and color phase (Shaughnessy and Fay 1977, Kelly 1981); 4) Genotypic data: undetermined for Alaska, mitochondrial DNA analyses currently underway. Preliminary genetic data indicate substantial variation in mtDNA suggesting at least two genetically distinct stocks in Alaska (Westlake and O'Corry-Crowe 1997). However, until additional samples are analyzed the Alaska Scientific Review Group (SRG) recommended using the same stock boundaries as in the Stock Assessment Reports for 1996 (Hill et al. 1997).

The Alaska SRG concluded that the scientific data available to support three distinct biological stocks (i.e., genetically isolated populations) were equivocal. However, the Alaska SRG recommended that the available data were sufficient to justify the establishment of three management units for harbor seals in Alaska (DeMaster 1996). Further, the SRG recommended that, unlike the stock structure reported in Small and DeMaster (1995), animals in the Aleutian Islands should be included in the same management unit as animals in the Gulf of Alaska. As noted above, this recommendation has been adopted by NMFS with the caveat that management units and stocks are equivalent for the purposes of managing incidental take under section 118 of the Marine Mammal Protection Act (Wade and Angliss 1997). Therefore, based primarily on the significant population decline of seals in the Gulf of Alaska, the possible decline in the Bering Sea, and the stable population in Southeast Alaska (see Current Population Trend section in the respective harbor seal report for details), three separate stocks are recognized in Alaska waters: 1) the Southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, Alaska (144°W), 2) the Gulf of Alaska

stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and 3) the Bering Sea stock - including all waters north of Unimak Pass (Fig. 9). Information concerning the three harbor seal stocks recognized along the West Coast of the continental United States can be found in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Extensive photographic aerial surveys of harbor seals in the Bering Sea were conducted during the autumn molt in 1995 (28 August - 10 September), throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996a). All known harbor seal haulout sites in each area were surveyed, and reconnaissance surveys were flown prior to photographic surveys to establish the location of additional sites. Aerial surveys were flown within 2 hours on either side of low tide, based on the assumption that at locations affected by tides, harbor seals haul out in greatest numbers at and around the time of low tide (Pitcher and Calkins 1979, Calambokidis et al. 1987). At least four repetitive photographic counts were obtained for each major rookery and haulout site within each study area. Coefficients of variation were determined for multiple surveys and found to be <0.19 in all cases. This method of estimating abundance and its CV assumes that during the survey period no migration occurred between sites and that there was no trend in the number of animals ashore. The number of seals moving between areas was assumed to be small considering each area's large geographic size, though a small number of seals may have been counted twice or not at all.

The total mean count for the 1995 surveys was 8,740 (CV=0.040) harbor seals, with mean counts of 955 (CV=0.071) for northern Bristol Bay and 7,785 (CV=0.044) for the north side of the Alaska Peninsula (Withrow and Loughlin 1996a). A correction factor based on data from animals from this stock is currently unavailable. A tagging experiment conducted from 17 to 23 August 1995 collected data from 25 harbor seals using a sand bar haul out near Cordova, Alaska (within the Gulf of Alaska), resulting in a correction factor of 1.50 (CV=0.047) to account for animals in the water which are thus missed during the aerial surveys (Withrow and Loughlin 1996b). This correction factor was used for the Bering Sea stock due to the similarity in haulout habitat type (sand bar) to a majority of harbor seal haulout sites found in the Bering Sea. Further, this CF was considered conservative by the Alaska SRG (DeMaster 1996) because the timing of the aerial survey was later than the timing of the CF study and it is likely that the fraction of seals hauled out during the surveys was smaller. Multiplying these aerial survey counts by the correction factor results in an estimated abundance of 13,110 (8,740 × 1.50; CV=0.062) harbor seals.

In 1995, daily land counts of harbor seals were conducted on Otter Island (one of the Pribilof Islands) from July 2 through August 8. The maximum count during this study was 202 seals (Withrow and Loughlin 1996a). Adding this count to the corrected estimated abundance from the aerial surveys results in an estimated abundance of 13,312 (13,110 + 202) harbor seals for the Bering Sea stock.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 13,110 from the aerial surveys and the associated CV(N) of 0.062, results in an estimate of 12,446 harbor seals. Adding the maximum count of 202 seals from the Otter Island survey results in an N_{MIN} of 12,648 for the Bering Sea harbor seal stock.

Current Population Trend

The number of harbor seals in the Bering Sea stock is thought to be declining (Alaska SRG, see DeMaster 1996); however, published data to support this conclusion are unavailable. Specifically, in 1974 there were 1,175 seals reported on Otter Island. The maximum count in 1995 (202 seals) represents an 83% decline (Withrow and Loughlin 1996a). However, as noted by the Alaska SRG (DeMaster 1996), the reason(s) for this decline is(are) confounded by the recolonization of Otter Island by northern fur seals since 1974, which has caused a loss of available habitat for harbor seals. Further, counts of harbor seals on the north side of the Alaska Peninsula in 1995 were less than 42% of the 1975 counts, representing a decline of 3.5% per year. The number of harbor seals in northern Bristol Bay are also lower, but have remained stable since 1990 (Withrow and Loughlin 1996a).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Gulf of Alaska or Bering Sea stock of harbor seal. Population growth rates were estimated at 6% and 8% between 1991 and 1992 in Oregon and Washington, respectively (Huber et al. 1994). Harbor seals have been protected in British Columbia since 1970, and the population has responded with an annual rate of increase of approximately 12.5% since 1973 (Olesiuk et al. 1990). However, until additional data become available from which more reliable estimates of population growth can be determined, it is recommended that the pinniped maximum theoretical net productivity rate (R_{MAX}) of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized 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 pinniped stocks with unknown population status (Wade and Angliss 1997). Thus, for the Bering Sea harbor seal stock, PBR = 379 animals ($12{,}648 \times 0.06 \times 0.5$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Bering Sea stock of harbor seals were monitored for incidental take by fishery observers during 1990-96: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Harbor seal mortality was observed in all three fisheries at low levels. The range of observer coverage over the period, as well as the annual observed and estimated mortalities are presented in Table 8a. The mean annual (total) mortality rate was 2.2 (CV=0.44) for the Bering Sea groundfish trawl fishery, 0.6 (CV=1.0) for the Bering Sea longline fishery, and 1.2 (CV=0.81) for the Bering Sea pot fishery. The harbor seal taken in the pot fishery in 1992 (34% observer coverage) occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1992 for that fishery, and should be considered a minimum estimate. Combining the estimates from the Bering Sea groundfish trawl, longline, and pot fisheries presented above (2.2 + 0.6 + 1.2 = 4.0) results in an estimated annual incidental kill rate in observed fisheries of 4.0 (CV=0.37) harbor seals per year from the Bering Sea stock.

An additional source of information on the number of harbor seals killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During period between 1990 and 1996, fisher self-reports from the Bristol Bay salmon drift and set gillnet fisheries (see Table 8a) resulted in an annual mean of 26.75 mortalities from interactions with commercial fishing gear. 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. These totals are based on all available self-reported fisheries information for Bering Sea fisheries, except the groundfish trawl, longline and pot fisheries for which observer data were presented above. In 1990, fisher self-reports from the Bristol Bay set and drift gillnet fisheries were combined. As a result, some of the harbor seal mortalities reported in 1990 may have occurred in the set net fishery. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable for 1996 (see Appendix 4).

The estimated minimum annual mortality rate incidental to commercial fisheries is 31, based on observer data (4) and self-reported fisheries information (27) where observer data were not available. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in the gillnet fisheries mentioned above. The Bristol Bay salmon set and drift gillnet fisheries are scheduled to be observed in 2005 and 2006.

Table 8a. Summary of incidental mortality of harbor seals (Bering Sea stock) due to commercial fisheries from 1990 through 1996 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information. Data from 1992 to 1996 (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	90-96	obs data	53-74%	1, 1, 2, 0, 3, 0, 2	1, 1, 3, 0, 5, 0, 3	2.2 (CV=0.44)
BSAI groundfish longline (incl. misc. finfish and sablefish fisheries)	90-96	obs data	27-80%	0, 0, 0, 1, 0, 0, 0	0, 0, 0, 3, 0, 0, 0	0.6 (CV=1.0)
BSAI finfish pot	90-96	obs data	17-43%	0, 0, 1, 0, 0, 1, 0	0, 0, 1, 0, 0, 5, 0	1.2 (CV=0.81)
Observer program total						4.0 (CV=0.37)
				Reported mortalities		
Bristol Bay salmon drift gillnet	90-96	self reports	n/a	38, 23, 2, 42, n/a, n/a, n/a	n/a	[≥26.25]
Bristol Bay salmon set gillnet	90-96	self reports	n/a	0, 0, 1, 1, n/a, n/a, n/a	n/a	[≥0.5]
Minimum total annual mortality						≥30.75 (CV=0.37)

Subsistence/Native Harvest Information

The 1992-96 subsistence harvest of harbor seals in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Table 8b: Wolfe and Mishler 1993, 1994, 1995, 1996, 1997). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the harbor seal in Alaska. Between 1992-96, interviews were conducted in approximately 14 communities that lie within the range of the Bering Sea harbor seal stock. The statewide total subsistence take of harbor seals in 1992 was estimated at 2,888 (95% CI 2,320-3,741), with 2,535 harvested and 353 struck and lost. The total subsistence take in 1993 was estimated at 2,736 (95% CI 2,334-3,471), with 2,365 harvested and 371 struck and lost. The total subsistence take in 1994 was estimated at 2,621 (95% CI 2,110-3,457), with 2,313 harvested and 308 struck and lost. The total subsistence take in 1995 was estimated at 2,742 (95% CI 2,184-3,679), with 2,499 harvested and 243 struck and lost. The total subsistence take in 1996 was estimated at 2,741 (95% CI 2,378-3,479), with 2,415 harvested and 327 struck and lost.

Table 8b provides a summary of the subsistence harvest information for the Bering Sea stock. The mean annual subsistence take from this stock of harbor seals, including struck and lost, over the 3-year period from 1994 to 1996 was 161 animals. The reported average age-specific kill of the harvest from the Bering Sea stock since 1992 was 69% adults, 14% juveniles, 4% pups, and 13% of unknown age. The reported average sex-specific kill of the harvest was 25% males, 8% females, and 67% of unknown sex.

Other Mortality

Illegal intentional killing of harbor seals occurs, but the magnitude of this mortality is unknown (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except where imminently necessary to protect human life).

Table 8b. Summary of the subsistence harvest data for the Bering Sea stock of harbor seals, 1992-96.

Year	Estimated total number taken	Percentage of statewide total	Number harvested	Number struck and lost
1992	229	8.0%	160	59
1993	199	7.3%	122	77
1994	208	7.9%	145	63
1995	127	4.6%	97	30
1996	148	5.4%	94	54
Mean annual take (1994-96)	161			

STATUS OF STOCK

Harbor seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. A reliable estimate of the annual rate of mortality incidental to commercial fisheries is unavailable. Therefore, it is unknown whether the kill rate due to commercial fishing is insignificant. At present, annual mortality levels less than 38 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. Based on the best scientific information available, the estimated level of human-caused mortality and serious injury (31 + 161 = 192) is not known to exceed the PBR (379). Therefore, the Bering Sea stock of harbor seals is not classified as a strategic stock. The status of this stock relative to its Optimum Sustainable Population size is unknown.

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