Revised 1/4/06

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

NOTE – March 2007: NMFS has new genetic information on harbor seals in Alaska which indicates that the current division of Alaskan harbor seals into the Southeast Alaska, Gulf of Alaska, and Bering Sea stocks need to be reassessed. NMFS, in cooperation with our partners in the Alaskan Native community, is evaluating the new genetic information and hopes to make a joint recommendation regarding stock structure in 2007. In the interim, new information on harbor seal abundance, mortality levels, and trends is provided within this report. A complete revision of the harbor seal stock assessments will be postponed until new stocks are defined.

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 (Swain et al. 1996, Lowry et al. 2001, Small et al. 2001). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister 1981, Lowry et al. 2001, Small et al. 2001). 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).

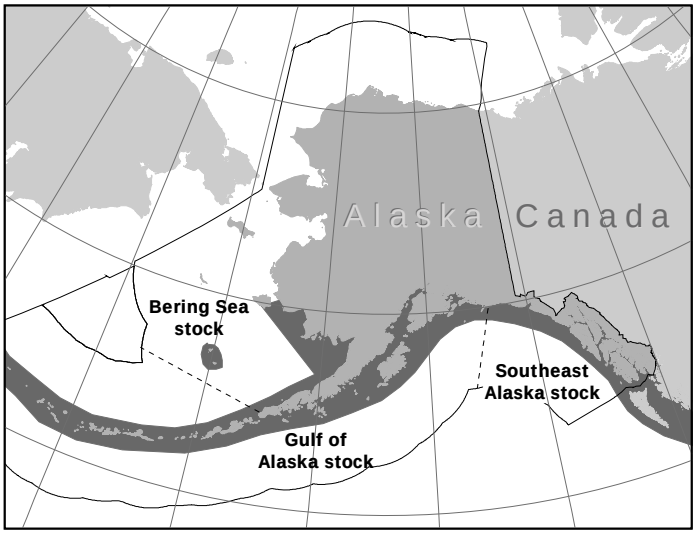

Figure 10. Approximate distribution of harbor seals in Alaska waters (shaded area).

Westlake and O'Corry-Crowe's (2002) analysis of genetic information revealed population subdivisions on a scale of 600-820 km. These results suggest that genetic differences within Alaska, and most likely over their entire North Pacific range, increase with increasing geographic distance. New information revealed substantial genetic differences indicating that female dispersal occurs at region specific spatial scales of 150-540 km. This research identified 12 demographically independent clusters within the range of Alaskan harbor seals; however additional research is required as unsampled areas within the Alaskan harbor seal range remain (O'Corry-Crowe et al. 2003).

The Alaska SRG concluded in 1996 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 what was believed in the early 1990s to be a 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. 10). 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

The National Marine Mammal Laboratory (Alaska Fisheries Science Center) routinely conducts aerial surveys of harbor seals across their entire range in Alaska. Each of five survey regions was surveyed, with one region surveyed per year. To derive an accurate estimate of population size from these surveys, a method was developed to address the influence of external conditions on the number of seals hauled out on shore, and counted, during the surveys. Many factors influence the propensity of seals to haul out, including tides, weather, time of day, and date in the seals' annual life history cycle. A statistical model defining the relationship between these factors and the number of seals hauled out was developed for each survey region. Based on those models, the survey counts for each year were adjusted to the number of seals that would have been ashore during a hypothetical survey conducted under ideal conditions for hauling out (Boveng et al. 2003). In a separate analysis of radio-tagged seals, a similar statistical model was used to estimate the proportion of seals that were hauled out under those ideal conditions (Simpkins et al. 2003). The results from these two analyses were combined for each region to estimate the population size of harbor seals in Alaska. Discussions of estimates from a previous survey (1995) can be found in earlier stock assessment reports.

The current statewide abundance estimate for Alaskan harbor seals is 180,017 (CV = 0.03; NMFS, unpublished data), based on data collected during 1996-2000. This estimate, however, is believed to be low because it is based on incomplete coverage of terrestrial sites in Prince William Sound and of glacial sites in the Gulf of Alaska and the Southeast Alaska regions. Those problems have been addressed in the current survey (2001-2005). Prince William Sound was surveyed completely in 2001, and new methods have been developed and used for surveying glacial sites in 2001-2002. Analyses are currently underway, and a manuscript describing the regional and statewide population estimates is in preparation; the analytical methods are described in Boveng et al. (2003) and Simpkins et al. (2003) and have been presented at the 14th Biennial Conference on the Biology of Marine Mammals. The current abundance estimate for the Bering Sea stock (21,651; 18,073 $\times$ 1.198; CV = 0.1) is calculated from surveys in 2000 (NMFS, unpublished data).

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 21,651 from the aerial surveys and the associated CV(N) of 0.1, results in an estimate of 19,907 harbor seals. Adding the maximum count of 202 seals from the Otter Island survey results in an N_{MIN} of 20,109 for the Bering Sea harbor seal stock.

Current Population Trend

The number of harbor seals in the Bering Sea stock is thought to have declined between the 1980s and 1990s (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 1996). 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 1996). Trend counts have been conducted in Bristol Bay only between 1998 and 2001. During this period, counts indicated a non-significant trend of -1.3% (95% CI: -5.9 - 3.3; Small et al. 2003). Calculation of trends in abundance in this area is somewhat problematic due to the presence of a sympatric species, spotted seals, which may overlap the range of harbor seals but cannot be identified as a different species by aerial surveys.

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 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 pinniped stocks with unknown population status (Wade and Angliss 1997). Thus, for the Bering Sea harbor seal stock, PBR = 603 animals ($20{,}109 \times 0.06 \times 0.5$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The previous stock assessment for harbor seals indicated that there were three observed commercial fisheries that operated within the range of the Bering Sea stock of harbor seals. As of 2003, changes in how fisheries are defined in the List of Fisheries have resulted in separating these fisheries into 14 fisheries based on both gear type and target species (69 FR 70094, 2 December 2004). This change does not represent a change in fishing effort, but provides managers with better information on the component of each fishery that is responsible for the incidental serious injury or mortality of marine mammal stocks in Alaska.

Observer programs in several fisheries have documented mortalities or serious injuries in the Bering Sea/Aleutian Islands flatfish trawl and the Bering Sea/Aleutian Islands Pacific cod trawl (Table 13). Over the last 5 years, there were no observed serious injuries or mortalities of harbor seals in any Bering Sea/Aleutian Islands groundfish longline fisheries, or any Bering Sea/Aleutian Islands finfish pot fisheries (Perez 2006).

The estimated minimum annual mortality rate incidental to commercial fisheries for the period 2000-2004 is 1.3. However, a reliable estimate of the mortality rate incidental to commercial fisheries is currently unavailable because of the absence of observer placements in salmon gillnet fisheries known to interact with this stock.

Table 13. Summary of incidental mortality of harbor seals (Bering Sea stock) due to commercial fisheries from 1990 through 2004 and calculation of the mean annual mortality rate.

Fishery name	Years	Data type	Range of observer coverage (%)	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea Pacific cod trawl	2000	obs data	47.3	0	0	0.79 (CV = 0.50)
	2001		53.8	0	0	
	2002		38.3	0	0	
	2003		42.3	1	2.0	
	2004		45.3	1	2.0	
Bering Sea flatfish trawl	2000	obs data	64.5	1	1.3	0.46 (CV = 0.49)
	2001		57.6	0	0	
	2002		58.4	0	0	
	2003		64.1	0	0	
	2004		64.3	0	1.0	
Minimum total annual mortality						1.25 (CV = 0.36)

Subsistence/Native Harvest Information

The Alaska Native subsistence harvest of harbor seals has been estimated by the Alaska Native Harbor Seal Commission (ANHSC) and the Alaska Department of Fish and Game (ADFG). The previous stock assessment

reported that the estimated average harvest of the Bering Sea stock of harbor seals for 1994-1996 was 161 animals per year (including struck and lost). Recent information from the ADFG indicates the average harvest level from 2000-2004, including struck and lost, was 174.3 animals per year. Because surveys did not occur in 1999 an estimate of subsistence harvest in 1999 is unavailable.

Table 14 provides a summary of the subsistence harvest information for the Bering Sea stock. 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.

Table 14. Summary of the subsistence harvest data for the Bering Sea stock of harbor seals, 2000-2004. Data are from Wolfe et al. 2004; J. Fall, ADFG, pers. comm.

Year	Estimated total number taken	Number harvested	Number struck and lost
2000	330.5	272.4	58.0
2001	200.3	158.8	41.6
2002	139.6	95.2	44.2
2003	82.1	65.4	16.7
2004	119.0	76.1	42.9
Mean annual harvest (2000-2004)	174.3		

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). The Alaska Region stranding records from 1998 to 2002 document 2-3 reports of stranded harbor seals found shot in Bristol Bay, for a maximum average of 0.6 harbor seals/year over 5 years. It is not known whether these animals were killed illegally or if they were struck but lost in the subsistence harvest. Because the reason for the shooting is not known, these animals are added to the total number of human-related mortalities.

STATUS OF STOCK

Harbor seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. At present, U.S. commercial fishery-related annual mortality levels less than 60 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. 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. Based on the best scientific information available, the estimated level of human-caused mortality and serious injury (1.25 + 174.3 + 0.6 = 176.2) is not known to exceed the PBR (603). 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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