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HARBOR SEAL (*Phoca vitulina richardsi*): Southeast Alaska Stock

NOTE - January 2006: 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 needs 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 2006. 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).

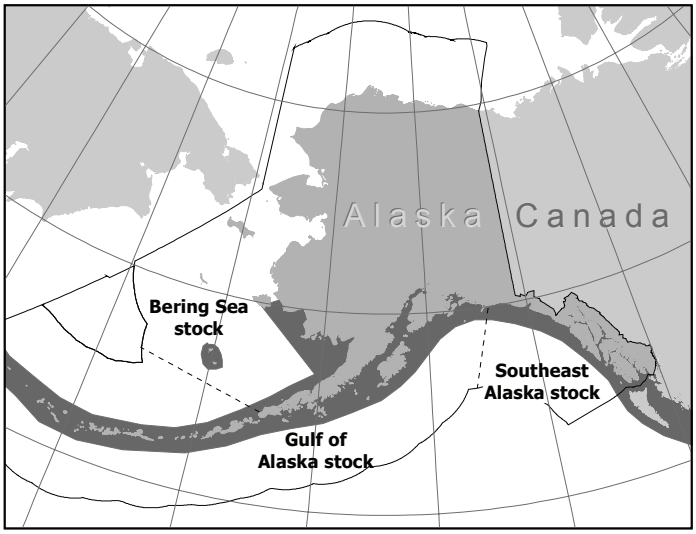

Figure 8. Approximate distribution of harbor seals in Alaska waters (shaded area).

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. 8). 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

A comprehensive aerial survey of harbor seals in Southeast Alaska was conducted during the autumn molt in 1993. Eleven separate areas were surveyed 5-9 times each. The sum of all mean counts was 21,523 with a combined CV = 0.026 (Loughlin 1994). Data collected from 36 tagged harbor seals in Southeast Alaska from 1 to 11 September 1994 resulted in a correction factor of 1.74 (CV = 0.068) to account for animals in the water which are thus missed during the aerial surveys (Withrow and Loughlin 1995). Using this correction factor resulted in an abundance estimate of 37,450 (21,523 $\times$ 1.74; CV = 0.073) for the Southeast Alaska stock of harbor seals.

Between 1996 and 2000 the National Marine Mammal Laboratory (Alaska Fisheries Science Center) conducted aerial surveys of harbor seals across the entire range of harbor seals 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.

The current statewide abundance estimate for Alaskan harbor seals is 180,017 (CV = 0.03 NMFS, unpublished data). This estimate is based on 1996-2000 surveys that had 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 SE Alaska stock (112,391; CV=0.04) was calculated from northern southeast Alaska surveys (32,454; 27,090 $\times$ 1.198; CV = 0.06) in 1997 and southern southeast Alaska surveys (79,937; 66,725 $\times$ 1.198; CV = 0.05) in 1998 (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 112,391 and its associated CV(N) of 0.04, N_{MIN} for this stock of harbor seals is 108,670.

Current Population Trend

Population trend data have been collected in the vicinity of Sitka and Ketchikan since 1983. Based on counts near Ketchikan, abundance has increased 7.4% annually (95% CI: 6.1-8.7) from 1983 to 1998, but at a lower rate of 5.6% during the latter portion between 1994 and 1998 (Small et al. 2003). Counts near Sitka failed to show a significant trend either between 1984 and 2001 or 1995 and 2001 (Small et al. 2003). It should be emphasized that these data are from selected 'trend' sites and not complete census surveys. Further, both of these trend routes are for terrestrial haulouts, which may not be representative of animals that use glacial haulouts. Alaska Natives who hunt for seals in Yakutat Bay believe the local harbor seal population has declined over the past 10-15 years, as determined by less successful hunting trips over time (Yakutat Tlingit Tribe, pers. comm., cited in Jansen et al. 2006).

Additional information concerning trend counts in Southeast Alaska come from Glacier Bay. The number of harbor seals in Johns Hopkins Inlet (a tidewater glacial fjord in Glacier Bay) increased steeply (30.7% annually) between 1975 and 1978, and then at a slower rate (2.6% annually) for the period from 1983 to 1996 (Mathews and

Pendleton 1997). Immigration and reduced mortality may have contributed to the steep growth between 1975 and 1978. During 1992-96, the number of seals in Johns Hopkins Inlet (glacial ice haul out) increased 7.1% annually (95% CI: 1.7%-12.4%), whereas the number of seals using terrestrial haul outs decreased 8.6% annually (95% CI: 5.6%-11.7%) over the same period. New information from Glacier Bay indicates a sharp overall decline of 63-75% in harbor seal abundance from 1992 to 2002; the cause of the decline is unknown (Mathews and Pendleton 2006). Results from the Sitka (stable), Ketchikan (increasing), and Glacier Bay (decreasing) trend analyses, and observations about a possibly declining local population in Yakutat Bay provide an uncertain basis for inferring trends in the Southeast Alaska stock as a whole.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Southeast Alaska harbor seal stock. A population growth rate of 7.4% was observed in Ketchikan between 1983 and 1998 (Small et al. 2003). 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, 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 status (Wade and Angliss 1997). Thus, for this stock of harbor seals, PBR = 3,260 animals ($108{,}670 \times 0.06 \times 0.5$).

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 Southeast Alaska 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 nine 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. During the 5-year period from 2000 to 2004 there were no observed incidental takes in any of these fisheries (Perez 2006).

The estimated minimum annual mortality rate incidental to commercial fisheries is 0. 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 known to interact with this stock. The Southeast Alaska drift gillnet fishery is scheduled to be observed in 2007 and 2008, funds permitting.

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 Southeast Alaska stock of harbor seals for 1994-1996 was 1,749 animals per year (including struck and lost). Recent information from the ANHSC and ADFG indicates the average harvest level from 2000 to 2004, including struck and lost, was 1,092 harbor seals per year (Table 10).

Table 10. Summary of the subsistence harvest data for the Southeast Alaska 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	1,361	1,210	151
2001	1,176	1,020	156
2002	1,007	877	129
2003	1,069	945	124
2004	845	743	102

Year	Estimated total number taken	Number harvested	Number struck and lost
Mean annual harvest (2000-2004)	1,092	959	132

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 documents five reports of stranded harbor seals that had been shot, for an average of 1 per year over 5 years. It is not known whether these animals were killed illegally or if they were stuck 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.

The Alaska Region stranding records document one Southeast Alaska harbor seal was killed by a vessel collision between 1998 and 2002. One Southeast Alaska harbor seal was entangled in a non-commercial hatchery seine net and released without injury.

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, annual U.S. commercial fishery-related mortality levels less than 326 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 is insignificant. Based on the best scientific information available, the estimated annual level of total human-caused mortality (1,092 + 0.2 + 1 = 1,094) is not known to exceed the PBR (3,260) for this stock. Therefore, the Southeast Alaska 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.

CITATIONS

Bigg, M. A. 1969. The harbour seal in British Columbia. Fish. Res. Bd. Can. Bull. 172. 33 pp.

Bigg, M. A. 1981. Harbour seal, *Phoca vitulina*, Linnaeus, 1758 and *Phoca largha*, Pallas, 1811. Pp. 1-27 *In* S. H. Ridgway and R. J. Harrison (eds.), Handbook of Marine Mammals, vol.2: Seals. Academic Press, New York.

Boveng, P. L., J. L. Bengtson, D. E. Withrow, J. C. Cesarone, M. A. Simpkins, K. J. Frost and J. J. Burns. 2003. The abundance of harbor seals in the Gulf of Alaska. Mar. Mammal Sci. 19(1):111-127.

DeMaster, D. P. 1996. Minutes from the 11-13 September 1996 meeting of the Alaska Scientific Review Group, Anchorage, Alaska. 20 pp. + appendices. (Available upon request - National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115).

Fisher, H. D. 1952. The status of the harbour seal in British Columbia, with particular reference to the Skeena River. Fish. Res. Bd. Can. Bull. 93. 58 pp.

Jansen, J. K., J. L. Bengtson, P. L. Boveng, S. P. Dahle, and J. VerHoef. 2006. Disturbance of harbor seals by cruise ships in Disenchantment Bay, Alaska: An investigation at three spatial and temporal scales. AFSC Processed Report 2006-02. 75pp.

Loughlin, T. R. 1994. Abundance and distribution of harbor seals (*Phoca vitulina richardsi*) in Southeastern Alaska during 1993. Annual report to the MMPA Assessment Program, Office of Protected Resources, NMFS, NOAA, 1335 East-West Highway, Silver Spring, MD 20910.

Lowry, L. F., K. J. Frost, J. M. VerHoef, and R. A. DeLong. 2001. Movements of satellite-tagged subadult and adult harbor seals in Prince William Sound, Alaska. Mar. Mammal Sci. 17:835-861.

Mathews, E. A., and G. W. Pendleton. 1997. Estimation of trends in abundance of harbor seals at terrestrial and glacial ice haulouts in Glacier Bay National Park, Southeast Alaska, 1975-1996. Pp. 57-75 *In* Annual Report: Harbor seal investigations in Alaska. NOAA Grant NA57FX0367. Alaska Dep. Fish and Game, Division of Wildlife Conservation. Anchorage, AK.

Mathews, E. A., and G. W. Pendleton. 2000. Declining trends in harbor seal (Phoca vitulina richardsi) numbers at glacial ice and terrestrial haulouts in Glacier Bay National Park, 1992-1998. Unpublished report to the Glacier Bay National Park and Preserve. 23 pp.

Mathews, E. A., and G. W. Pendleton. 2006 Declines in harbor seal (Phoca vitulina) numbers in Glacier Bay National Park, Alaska, 1992-2002. Mar. Mammal Sci.. 22:167-189.

O'Corry-Crowe, G. M., Martien, K. K., and B. L. Taylor. 2003. The analysis of population genetic structure in Alaskan harbor seals, *Phoca vitulina*, as a framework for the identification of management stocks. Administrative Report LJ-03-08, Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA, 8604 La Jolla Shores Dr., La Jolla, CA 92037.

Olesiuk, P. F., M. A. Bigg, and G. M. Ellis. 1990. Recent trends in the abundance of harbour seals, *Phoca vitulina*, in British Columbia. Can. J. Fish. Aquat. Sci. 47:992-1003.

Perez, M. A. 2006. Analysis of marine mammal bycatch data from the trawl, longline, and pot groundfish fisheries of Alaska, 1998-2004, defined by geographic area, gear type, and target groundfish catch species. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-167.

Pitcher, K. W., and D. G. Calkins. 1979. Biology of the harbor seal (*Phoca vitulina richardsi*) in the Gulf of Alaska. U.S. Dep. Commer., NOAA, OCSEAP Final Rep. 19(1983):231-310.

Pitcher, K. W., and D. C. McAllister. 1981. Movements and haul out behavior of radio-tagged harbor seals, *Phoca vitulina*. Can. Field Nat. 95:292-297.

Scheffer, V. B., and J. W. Slipp. 1944. The harbor seal in Washington state. Amer. Midl. Nat. 32:373-416.

Simpkins, M. A., D. E. Withrow, J. C. Cesarone and P. L. Boveng. 2003. Stability in the proportion of harbor seals hauled out under locally ideal conditions. Mar. Mammal Sci. 19(4):791-805.

Small, R. J., and D. P. DeMaster. 1995. Alaska marine mammal stock assessments 1995. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-57, 93 pp.

Small, R. J., G. W. Pendleton, and K. W. Pitcher. 2003. Trends in abundance of Alaska harbor seals, 1983-2001. Mar. Mammal Sci. 19(2):344-362

Small, R. J., L. F. Lowry, K. J. Frost, J. M. VerHoef, R. A. DeLong, and M. J. Rehberg. 2001. Movements of satellite-tagged harbor seal pups in Prince William Sound and the Gulf of Alaska. Mar. Mammal Sci. 17:835-861.

Swain, U., J. Lewis, G. Pendleton, and K. Pitcher. 1996. Movements, haulout, and diving behavior of harbor seals in southeast Alaska and Kodiak Island. Pp. 59-144, *In* Annual Report: Harbor seal investigations in Alaska. NOAA Grant NA57FX0367. Alaska Dep. Fish and Game, Division of Wildlife Conservation. Douglas, AK.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Westlake, R. L., and G. O'Corry-Crowe. 2002. Macrogeographic structure and patterns of genetic diversity in harbor seals (*Phoca vitulina*) from Alaska to Japan. J. Mamm. 83(4):1111-1126.

Withrow, D. E., and T. R. Loughlin. 1995. Haulout behavior and method to estimate the proportion of harbor seals missed during molt census surveys in Alaska. Annual report to the MMPA Assessment Program, Office of Protected Resources, NMFS, NOAA, 1335 East-West Highway, Silver Spring, MD 20910.

Wolfe, R. J., J. A. Fall, and R. T. Stanek. 2004. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 2003. Alaska Dep. Fish and Game, Division of Subsistence Technical Paper No. 291. Juneau, AK.