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

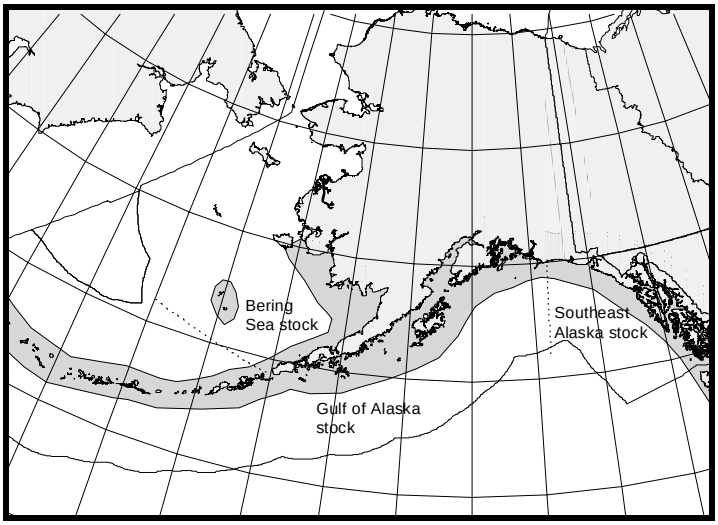

Figure 7. Approximate distribution of harbor seals in Alaska waters (shaded area).

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 1996); 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. 7). 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 most recent comprehensive aerial survey of harbor seals in Southeast Alaska was conducted during the autumn molt in 1993. Eleven separate areas, with a mean of 39 (21-59) sites each, were surveyed 5-9 times each; the minimum number of surveys for each of the 427 sites was usually 4 or 5. Ten of 11 areas were surveyed during the third week of September; one area was surveyed from 31 August to 6 September. 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). Some of the survey effort was conducted after the molt peak. If it is assumed that harbor seals decrease their amount of time hauled out after the molt, the counts from the 1993 surveys may have underestimated the number of seals. Mathews and Kelly (1996), for instance, suggested more than half of the estimated 6,000 seals found in Glacier Bay in August were not detected in the bay, or within a 60-km radius of the bay, during the September 1993 survey.

The sum of all mean counts was 21,523 with a combined CV=0.026 (Loughlin 1994). 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. 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). Although this correction factor (CF) was not derived during the actual survey in 1993, it was considered conservative because the data used to develop the CF were collected during a time period (early September) when seals are assumed to spend more time on haulouts than when the surveys were flown in 1993 (late September). Utilizing this correction factor results in a population estimate of 37,450 (21,523 × 1.74; CV=0.073) for the Southeast Alaska stock of harbor seals.

It should be noted that the CF developed for tidally influenced rocky substrate may not apply to seals hauled on ice from tidewater glaciers (Alaska SRG, see DeMaster 1996). Given the relatively small number of harbor seals counted on glacial haulouts, the magnitude of any bias resulting from using an inappropriate CF is likely small. That is, if no CF were applied to the counts of seals hauled on glacial haulouts during the 1993 surveys, the resulting abundance estimate for Southeast Alaska would be reduced by approximately 3% or 1,000 animals. NMFS will attempt to capture and radio-tag seals that utilize glacial haulouts prior to the next survey in Southeast Alaska. If such efforts are unsuccessful, pending recommendations from the Alaska SRG, NMFS will reconsider the methods used to correct for the number of seals hauled on glacial haulouts.

During August of 1997 aerial surveys of harbor seals in the northern portion of Southeast Alaska were completed. Aerial surveys for harbor seals in the southern portion of Southeast Alaska are scheduled for August of 1998. Results of these two surveys will be available in the Spring of 1999.

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 37,450 and its associated CV(N) of 0.073, N_{MIN} for this stock of harbor seals is 35,226.

Current Population Trend

Population trend data have been collected in the vicinity of Sitka and Ketchikan since 1983. When counts from 1993 were compared with those made in the early 1980s, mean counts of harbor seals at both locations were lower. However, this is probably explained by the late survey dates in 1993. Mean counts from both trend routes have increased since 1983. The mean count for the Ketchikan trend route was 2,708 in 1996, an increase of 3.8% from the 1995 count. The number of harbor seals at the Ketchikan trend sites has increased 9.3% annually (95% CI: 7.5%-

11.0%) from 1983 to 1996 (Small et al. 1997). The mean count for the Sitka trend route decreased 21.5% from the 1995 count of 2,041 to 1,602 in 1996. However, trend estimates based on modeling count data and environmental covariates indicate that the number of harbor seals at the Sitka trend sites has increased 3.0% annually (95% CI: 2.1%-3.9%) from 1983 to 1996 (Small et al. 1997). It should be clear that these data are from selected 'trend' sites and not complete census surveys. Further, both of these trend routes are for terrestrial haul outs, which may not be representative of animals that use glacial haul outs.

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. The combined effect of the recent divergent trend at glacial ice versus terrestrial haul outs is that numbers in Glacier Bay overall appear to be stable or possibly increasing (Mathews and Pendleton 1997). Results from the Sitka, Ketchikan, and Glacier Bay trend analyses provide a strong indication that the number of harbor seals in Southeast Alaska has been increasing since at least 1983 (Small et al. 1997).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Reliable rates of maximum net productivity have not been estimated for the Southeast Alaska harbor seal stock. Population growth rates of 6% and 8% were observed between 1991 and 1992 in Oregon and Washington, respectively. 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 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 1.0 (Wade and Angliss 1997), as population levels have increased or remained stable with a known human take (Pitcher 1990, Small et al. 1997). Thus, for this stock of harbor seals, PBR = 2,114 animals (35,226 × 0.06 × 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Some fishing effort by vessels participating in the Gulf of Alaska (GOA) groundfish longline fishery occurs in the offshore waters of Southeast Alaska. Effort levels are insignificant for the portion of the GOA groundfish trawl and pot fisheries operating in these waters. During the period from 1990 to 1996, 21-31% of the GOA longline catch occurred within the range of the Southeast Alaska harbor seal stock. This fishery has been monitored for incidental take by fishery observers from 1990 to 1996 (8-21% observer coverage), although observer coverage has been very low in the offshore waters of Southeast Alaska (Table 6a). The only observed harbor seal mortality in this fishery occurred in 1995, resulting in a mean annual (total) mortality of 4 (CV=1.0).

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 the period between 1990 and 1996, fisher self-reports from 2 unobserved fisheries (see Table 6a) resulted in an annual mean of 31.25 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. As recommended by the Alaska SRG, given that harbor seals are the only common phocid in Southeast Alaska, fisher self-reports of unidentified phocid mortalities have been included as incidental takes of harbor seals in Table 6a (DeMaster 1996: p. 8). The majority of self-reported incidental takes were reported in the Yakutat salmon set gillnet fishery. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable for 1996 (see Appendix 4).

Table 6a. Summary of incidental mortality of harbor seals (Southeast Alaska 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
Gulf of Alaska groundfish longline (incl. misc. finfish and sablefish fisheries)	90-96	obs data	<1-5%	0, 0, 0, 0, 0, 1, 0	0, 0, 0, 0, 0, 20, 0	4 (CV=1.0)
Observer program total						4 (CV=1.0)
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-96	self reports	n/a	8, 1, 4, 2, n/a, n/a, n/a	n/a	[≥3.75]
Yakutat salmon set gillnet	90-96	self reports	n/a	0, 18, 31, 61, n/a, n/a, n/a	n/a	[≥27.5]
Minimum total annual mortality						≥35.25 (CV=1.0)

The estimated minimum annual mortality rate incidental to commercial fisheries is 36 harbor seals, based on observer data (4) and self-reported fisheries information (rounded to 32). 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 Yakutat salmon set gillnet fishery is scheduled to be observed in 2000 and 2001. The Southeast Alaska drift gillnet fishery is scheduled to be observed in 2005 and 2006.

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 NMFS (Table 6b: 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. Interviews were conducted in 18 communities in Southeast Alaska. 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 6b provides a summary of the subsistence harvest information for the Southeast Alaska 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 1,749 animals. The reported average age-specific kill of the harvest from the Southeast Alaska stock since 1992 was 85% adults, 7% juveniles, 1% pups, and 7% of unknown age. The reported average sex-specific kill of the harvest was 49% males, 24% females, and 27% of unknown sex.

Table 6b. Summary of the subsistence harvest data for the Southeast Alaska stock of harbor seals, 1992-96.

Year	Estimated total number taken	Percentage of statewide total	Number harvested	Number struck and lost
1992	1,670	58.3%	1, 481	189
1993	1,615	59.2%	1,425	190
1994	1,500	57.2%	1,348	152
1995	1,890	68.9%	1,719	171
1996	1,858	67.7%	1,642	216
Mean annual take (1994-96)	1,749			

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).

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 is insignificant. At present, annual mortality levels less than 211 animals per year (i.e., 10% of PBR) can be considered insignificant and approaching zero mortality and serious injury rate. Based on currently available data, the estimated annual level of total human-caused mortality is 1,785 (36 + 1,749) harbor seals. Although considered unlikely due to stable or increasing trends, it is unknown if the estimated annual level of total human-caused mortality and serious injury exceeds the PBR (2,114) for this stock. Until additional information on mortality incidental to commercial fisheries becomes available, the Southeast Alaska stock of harbor seals is not classified as strategic. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: p. 14). The status of this stock relative to its Optimum Sustainable Population size is unknown.

REFERENCES

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.

Calambokidis, J., B. L. Taylor, S. D. Carter, G. H. Steiger, P. K. Dawson, and L. D. Antrim. 1987. Distribution and haul out behavior of harbor seals in Glacier Bay, Alaska. Can. J. Zool. 65:1391-1396.

Credle, V. R., D. P. DeMaster, M. M. Merklein, M. B. Hanson, W. A. Karp, and S. M. Fitzgerald (eds.). 1994. NMFS observer programs: minutes and recommendations from a workshop held in Galveston, Texas, November 10-11, 1993. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-94-1, 96 pp.

DeMaster, D. P. 1995. Minutes from the 4-5 and 11 January 1995 meeting of the Alaska Scientific Review Group, Anchorage, Alaska. 27 pp. + appendices. (available upon request - D. P. DeMaster, National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115).

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 - D. P. DeMaster, National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115).

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

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.

Frost, K. F., L. F. Lowry, R. J. Small, and S. J. Iverson. 1996. Monitoring, habitat use, and trophic interactions of harbor seals in Prince William Sound. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Project # 95064), Alaska Dep. of Fish and Game, Division of Wildlife Conservation. Fairbanks, AK. 131 pp.

Harvey, J. T. 1987. Population dynamics, annual food consumption, movements, and diving behavior of harbor seals, *Phoca vitulina*, in Oregon. Ph.D. dissertation, Oregon State Univ., Corvalis, OR. 177 pp.

Hill, P. S., D. P. DeMaster, and R. J. Small. 1997. Alaska Marine Mammal Stock Assessments, 1996. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-78, 150 pp.

Hoover, A. A. 1988. Harbor seal. Pp. 125-157 *In* J. W. Lentfer (ed.), Selected marine mammals of Alaska: Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

Hoover-Miller, A. A. 1994. Harbor seal (*Phoca vitulina*) biology and management in Alaska. Marine Mammal Commission, Washington D.C., Contract #T75134749.

Kelly, B. P. 1981. Pelage polymorphism in Pacific harbor seals. Can. J. Zool. 59:1212-1219.

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.

Mathews, E. A., and B. P. Kelly. 1996. Extreme temporal variation in harbor seal (*Phoca vitulina richardsi*) numbers in Glacier Bay, a glacial fjord in Southeast Alaska. Mar. Mammal Sci. 12(3):483-489.

Mathews, E. A., and G. W. Pendelton. 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. of Fish and Game, Division of Wildlife Conservation. Anchorage, AK.

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.

Pitcher, K. W. 1990. Major decline in number of harbor seals, *Phoca vitulina richardsi*, on Tugidak Island, Gulf of Alaska. Mar. Mammal Sci. 6:121-134.

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.

Shaughnessy, P. D., and F. H. Fay. 1977. A review of the taxonomy and nomenclature of North Pacific harbour seals. J. Zool. (Lond.). 182:385-419.

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. Pendelton, and K. M. Wynne. 1997. Harbor seal population trends in the Ketchikan, Sitka, and Kodiak Island areas of Alaska. Pp. 7-32 *In* Annual Report: Harbor seal investigations in Alaska. NOAA Grant NA57FX0367. Alaska Dep. of Fish and Game, Division of Wildlife Conservation. Anchorage, AK.

Swain, U., J. Lewis, G. Pendelton, 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. of 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. 1997. Genetic investigation of Alaskan harbor seal stock stricture using mtDNA. Pp. 205-234 *In* Annual Report: Harbor seal investigations in Alaska. NOAA Grant NA57FX0367. Alaska Dep. of Fish and Game, Division of Wildlife Conservation. Anchorage, AK.

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.

Withrow, D. E., and T. R. Loughlin. 1996. Haulout behavior and a correction factor estimate for the proportion of harbor seals missed during molt census surveys near Cordova, 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., and C. Mishler. 1993. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1992. Final report for year one, subsistence study and monitor system (no. 50ABNF20055). Prepared for the NMFS by Alaska Dep. Fish and Game, Juneau, Alaska, 94 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1994. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1993. Final report for year two, subsistence study and monitor system (no. 50ABNF20055). Prepared for the NMFS by Alaska Dep. Fish and Game, Juneau, Alaska, 60 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1995. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1994. Final report for year three, subsistence study and monitor system (no. 50ABNF20055). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 69 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1996. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1995. Final report for year four, subsistence study and monitor system (no. 50ABNF400080). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 69 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1997. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1996. Technical Paper 241. Draft Final report for year five, subsistence study and monitor system (no. 50ABNF400080). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 70 pp. + appendices.