BEARDED SEAL (*Erignathus barbatus*): Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bearded seals are circumpolar in their distribution, extending from the Arctic Ocean (85°N) south to Hokkaido (45°N) in the western Pacific. They generally inhabit areas of shallow water (less than 200 m) that are at least seasonally ice covered. During winter they are most common in broken pack ice (Burns 1967) and in some areas also inhabit shorefast ice (Smith and Hammill 1981). In Alaska waters, bearded seals are distributed over the continental shelf of the Bering, Chukchi, and Beaufort Seas (Ognev 1935, Johnson et al. 1966, Burns 1981; Fig. 11). Bearded seals are evidently most concentrated from January to April over the northern part of the Bering Sea shelf (Burns 1981, Braham et al. 1984). Recent spring surveys along the Alaskan coast indicate that bearded seals are typically more abundant 20-100 nmi from shore than within 20 nmi of shore, with the exception of high concentrations nearshore to the south of Kivalina (Bengtson et al. 2000). Many of the seals that winter in the Bering Sea migrate north through the Bering Strait from late April through June, and spend the summer along the ice edge in the Chukchi Sea (Burns 1967, Burns 1981). The overall summer distribution is quite broad, with seals rarely hauled out on land, and some seals do not migrate but remain in open-water areas of the Bering and Chukchi Seas (Burns 1981, Nelson 1981, Smith and Hammill 1981). An unknown proportion of the population migrates southward from the Chukchi Sea in late fall and winter, and Burns (1967) noted a movement of bearded seals away from shore during that season as well.

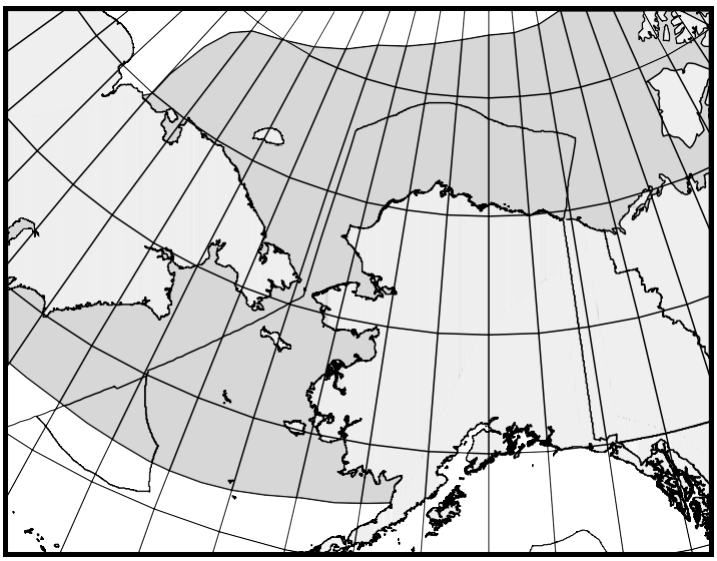

Figure 11. Approximate distribution of bearded seals in Alaska waters (shaded area). The combined summer and winter distributions are depicted.

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown; 3) Phenotypic data: unknown; 4) Genotypic data: unknown. Based on this limited information, and the absence of any significant fishery interactions, there is currently no strong evidence to suggest splitting the distribution of bearded seals into more than one stock. Therefore, only the Alaska stock is recognized in U. S. waters.

POPULATION SIZE

Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000 (Popov 1976, Burns 1981). Surveys flown from Shismaref to Barrowduring May-June 1999 provided preliminary results indicating densities up to 0.149 bearded seals/km^2 and an estimated abundance of 4,862 in the eastern Chukchi Sea (NMML, unpublished data). However, preliminary results of surveys flown in 2000 indicate that the abundance may be much greater. Until this discrepancy is addressed and additional surveys are conducted, a reliable estimate of abundance for the Alaska stock of bearded seals is considered unavailable.

Minimum Population Estimate

A reliable minimum population estimate (N_{MIN}) for this stock can not presently be determined because current reliable estimates of abundance are not available.

Current Population Trend

At present, reliable data on trends in population abundance for the Alaska stock of bearded seals are unavailable, though there is no evidence that population levels are declining.

An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region (Tynan and DeMaster 1996). Ice-associated seals, such as the bearded seal, are particularly sensitive to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. There are insufficient data to make reliable predictions of the effects of Arctic climate change on the Alaska bearded seal stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of bearded seals. Hence, 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 population status (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance N_{MIN} is currently not available, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries operating within the range of the Alaska stock of bearded seals were monitored for incidental take by NMFS observers during 1990-99: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. The only fishery for which incidental kill was observed was the Bering Sea groundfish trawl fishery, with 3 mortalities reported in 1991, 4 mortalities reported in 1994, 1 mortality reported in 1998, and 2 mortalities reported in 1999. These mortalities resulted in a mean annual (total) mortality rate of 0.6 (CV = 0.7) bearded seals per year. The range of observer coverage over the 5-year period from 1995-99, as well as the annual observed and estimated mortalities are presented in Table 10. It should be noted that one of the 1991 observed kills was later identified as a juvenile elephant seal (K. Wynne, pers. comm., University of Alaska). Further, only 1 mortality was reported during monitored hauls in 1994, which extrapolated to 2 mortalities for the entire fishery. Because NMFS observers recorded 3 additional bearded seal mortalities in unmonitored hauls, the estimated mortality in 1994 (2 seals) was known to be an underestimate. Accordingly, 4 was used as both the observed and estimated mortality for 1994 (Table 10). Similarly, while two mortalities were observed in 1999, the estimated mortality was calculated as 1; since this is clearly an underestimate, Table 10 incorporates the 2 observed mortalities as estimated mortalities for that year.

Table 10. Summary of incidental mortality of bearded seals (Alaska stock) due to commercial fisheries from 1990 through 1999 and calculation of the mean annual mortality rate. Data from 1995 to 1999 are used in the mortality calculation when more than 5 years of data are provided for a particular fishery.

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	90-99	obs data	31-74%	0, 3, 0, 0, 4, 0, 0, 0, 1, 2	0, 6, 0, 0, 4, 0, 0, 0, 1, 2	0.6 (CV = 0.67)
Observer program total						0.6
Total estimated annual mortality						0.6

An additional source of information on the number of bearded seals killed or injured incidental to commercial fishing operations is the logbook reports maintained by vessel operators as required by the MMPA interim exemption program. During the 4-year period between 1990 and 1993, the only logbook reports for bearded seals detailed 14 mortalities and 31 injuries in the Bristol Bay salmon drift gillnet fishery in 1991. These reports are suspect because it is highly unlikely that bearded seals would have been in the Bristol Bay vicinity during the summer salmon fishing months. These logbook mortalities have not been included in Table 10. However, because logbook records are most likely negatively biased (Credle et al. 1994), the absence of mortality reports does not assure bearded seal mortality did not occur. These logbook totals (0 animals) are based on all available logbook reports for Alaska fisheries through 1993. Logbook data are available for part of 1989-94, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period are fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

The estimated minimum mortality rate incidental to commercial fisheries is 0.6 bearded seals per year, based exclusively on observer data. Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level is insignificant and approaching zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Bearded seals are an important species for Alaska subsistence hunters, with estimated annual harvests of 1,784 (SD = 941) from 1966 to 1977 (Burns 1981). Between August 1985 and June 1986, 791 bearded seals were harvested in five villages in the Bering Strait region based on reports from the Alaska Eskimo Walrus Commission (Kelly 1988).

The Division of Subsistence, Alaska Department of Fish and Game maintains a database that provides additional information on the subsistence harvest of ice seals in different regions of Alaska (ADF&G 2000a, b). Information on subsistence harvest of bearded seals has been compiled for 129 villages from reports from the Division of Subsistence (Coffing et al. 1998, Georgette et al. 1998, Wolfe and Hutchinson-Scarbrough 1999) and a report from the Eskimo Walrus Commission (Sherrod 1982). Data were lacking for 22 villages; their harvests were estimated using the annual per capita rates of subsistence harvest from a nearby village. Harvest levels were estimated from data gathered in the 1980s for 16 villages; otherwise, data gathered from 1990-98 were used. As of August 2000; the subsistence harvest database indicated that the the estimated number of bearded seals harvested for subsistence use per year is 6,788.

A recent report on ice seal subsistence harvest in three Alaskan communities indicated that the number and species of ice seals harvested in a particular village may vary considerably between years (Coffing et al. 1999). These interannual differences are likely due differences in ice and wind conditions that change the hunters' access to different ice habitats frequented by different types of seals. Regardless of the extent to which the harvest may vary interannually, it is clear that the harvest level of 6,788 bearded seals estimated by the ADF&G Division of Subsistence is considerably higher than the previous minimum estimate of 791 per year from 5 villages in the Bering Strait. Although some of the more recent entries in the ADF&G database have associated measures of uncertainty (Coffing et al. 1999, Georgette et al. 1998), the overall total does not. The estimate of 6,788 bearded seals represents a mean estimate rather than a minimum estimate of subsistence harvest.

STATUS OF STOCK

Bearded seals are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock and because of the minimal interactions between bearded seals and any U. S. fishery, the Alaska stock of bearded seals is not classified as a strategic stock. This classification is consistent with the recommendations of the Alaska Scientific Review Group (DeMaster 1995: p. 26).

CITATIONS

Alaska Department of Fish and Game. 2000a. Community Profile Database 3.04 for Access 97. Division of Subsistence, Anchorage.

Alaska Department of Fish and Game. 2000b. Seals+ Database for Access 97. Division of Subsistence, Anchorage.

Bengtson, J. L., P. L. Boveng, L. M. Hiruki-Raring, K. L. Laidre, C. Pungowiyi, and M. A. Simpkins. 2000. Abundance and distribution of ringed seals (*Phoca hispida*) in the coastal Chukchi Sea. Pp. 149-160, *In* A. L. Lopez and D. P. DeMaster. Marine Mammal Protection Act and Endangered Species Act Implemention Program 1999. AFSC Processed Report 2000-11, Alaska Fish. Sci. Cent., 7600 Sand Point Way NE, Seattle, WA 98115.

Braham, H. W., J. J. Burns, G. A. Fedoseev, and B. D. Krogman. 1984. Habitat partitioning by ice-associated pinnipeds: distribution and density of seals and walruses in the Bering Sea, April 1976. Pp. 25-47, *In* F. H. Fay and G. A. Fedoseev (eds.), Soviet-American cooperative research on marine mammals. vol. 1. Pinnipeds. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 12.

Burns, J. J. 1967. The Pacific bearded seal. Alaska Dep. Fish and Game, Pittman-Robertson Proj. Rep. W-6-R and W-14-R. 66 pp.

Burns, J. J. 1981. Bearded seal-*Erignathus barbatus* Erxleben, 1777. Pp. 145-170, *In* S. H. Ridgway and R. J. Harrison (eds.), Handbook of Marine Mammals. vol. 2. Seals. Academic Press, New York.

Coffing, M., C. Scott, and C.J. Utermohle. 1998. The subsistence harvest of seals and sea lions by Alaska Natives in three communities of the Yukon-Kuskokwim Delta, Alaska, 1997-1998. Technical Paper No. 255, Alaska Department of Fish and Game, Division of Subsistence, Juneau.

Coffing, M., C. Scott, and C.J. Utermohle. 1999. The subsistence harvest of seals and sea lions by Alaska Natives in three communities of the Yukon-Kuskokwim Delta, Alaska, 1998-1999. Technical Paper No. 257, Alaska Department of Fish and Game, Division of Subsistence, Juneau.

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).

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.

Georgette, S., M. Coffing, C. Scott, and C. Utermohle. 1998. The subsistence harvest of seals and sea lions by Alaska Natives in the Norton Sound-Bering Strait Region, Alaska, 1996-97. Technical Paper No. 242, Alaska Department of Fish and Game, Division of Subsistence, Juneau.

Johnson, M. L., C. H. Fiscus, B. T. Stenson, and M. L. Barbour. 1966. Marine mammals. Pp. 877-924, *In* N. J. Wilimovsky and J. N. Wolfe (eds.), Environment of the Cape Thompson region, Alaska. U.S. Atomic Energy Comm., Oak Ridge, TN.

Kelly, B. P. 1988. Bearded seal, *Erignathus barbatus.* Pp. 77-94, *In* J. W. Lentfer (ed.), Selected marine mammals of Alaska. Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

Nelson, R. K. 1981. Harvest of the sea: coastal subsistence in modern Wainwright. North Slope Borough, Barrow, Alaska. 125 pp.

Ognev, S. I. 1935. Mammals of the U.S.S.R. and adjacent countries. vol. 3. Carnivora (Fissipedia and Pinnipedia). Gosudarst. Izdat. Biol. Med. Lit., Moscow. (Transl. from Russian by Israel Prog. Sci. Transl., 1962, 741 pp.).

Popov, L. A. 1976. Status of main ice forms of seals inhabiting waters of the U.S.S.R. and adjacent to the country marine areas. FAO ACMRR/MM/SC/51. 17 pp.

Sherrod, G.K. 1982. Eskimo Walrus Commission's 1981 Research Report: The Harvest and Use of Marine Mammals in Fifteen Eskimo Communities. Kawerak, Inc., Nome.

Smith, T. G., and M. O. Hammill. 1981. Ecology of the ringed seal, *Phoca hispida*, in its fast-ice breeding habitat. Can. J. Zool. 59:966-981.

Tynan, C., and D. P. DeMaster. 1996. Observations and predictions of Arctic climate change. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/O 21). 11 pp.

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.

Wolfe, R. And L.B. Hutchinson-Scarbrough. 1999. The subsistence harvest of harbor seal and sea lion by Alaska Natives in 1998. Technical Paper No. 250, Alaska Department of Fish and Game, Division of Subsistence, Juneau.