RINGED SEAL (*Phoca hispida*): Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Ringed seals have a circumpolar distribution from approximately 35/N to the North Pole, occurring in all seas of the Arctic Ocean (King 1983). In the North Pacific, they are found in the southern Bering Sea and range as far south as the Seas of Okhotsk and Japan. Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying seasonal and permanent ice. They remain in contact with ice most of the year and pup on the ice in late winter-early spring. Ringed seals are found throughout the Beaufort, Chukchi, and Bering Seas, as far south as Bristol Bay in years of extensive ice coverage (Fig. 12). During late April through June, ringed seals are distributed throughout their range from the southern ice edge northward (Burns and Harbo 1972, Burns et al. 1981, Braham et al. 1984). Preliminary results from recent surveys conducted in the Chukchi Sea in May-June 1999 and 2000 indicate that ringed seal density is higher within 20 nm from shore than 20-100 nm from shore (Bengtson et al. 2000; NMML unpublished data). Results of surveys conducted in May and reported by Frost et al. (1999) indicate that, in the Alaskan Beaufort Sea, the density of ringed seals is higher to the east than to the west of Flaxman Island. The overall winter distribution is probably similar, and it is believed there is a net movement of seals northward with the ice edge in late spring and summer (Burns 1970). Thus, ringed seals occupying the Bering and southern Chukchi Seas in winter apparently are migratory, but details of their movements are unknown.

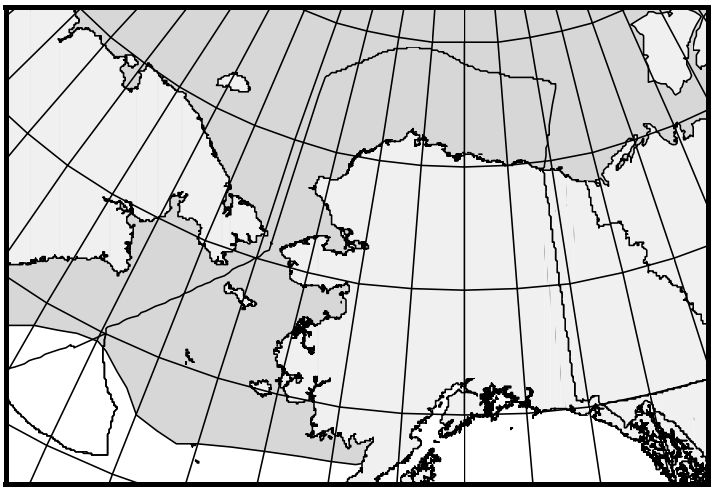

Figure 12. Approximate distribution of ringed seals in Alaska waters (shaded area). The combined summer and winter distribution is depicted.

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 ringed seals into more than one stock. Therefore, only the Alaska ringed seal stock is recognized in U. S. waters.

POPULATION SIZE

A reliable abundance estimate for the entire Alaska stock of ringed seals is currently not available. Crude estimates of the abundance of ringed seals in Alaska include 1-1.5 million (Frost 1985) or 3.3-3.6 million (Frost et al. 1988). One estimate of ringed seals is based on aerial surveys conducted in 1985, 1986, and 1987 by Frost et al. (1988). Survey effort was directed towards shorefast ice within 20 nm of shore, though some areas of adjacent pack ice were also surveyed, in the Chukchi and Beaufort Seas from southern Kotzebue Sound north and east to the U. S. - Canada border. The abundance estimate from 1987 was 44,360±9,130 (95% CI). More recently, surveys were flown perpendicular to the Alaskan coast from Shishmaref to Barrow during May-June 1999 and 2000 (Bengtson et al. 2000; NMML unpublished data). Preliminary results from the 1999 survey indicate that the density of ringed seals in this area ranged from 0.39 - 3.67 seals/km^2; the total abundance in the area surveyed was estimated at 245,048 (Bengston et al. 2000). Although the analysis of data from 2000 is not yet complete, the abundance estimate is unlikely to be substantially different (Personal communication, L. Hiruki-Raring, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98125). Densities of ringed seals in the Alaska Beaufort Sea in 1998 averaged 0.93

seals/km^2; seal densities were higher to the east of Flaxman Is than to the west of Flaxman Island (1.19 seals/km2 and 0.81 seals/km2, respectively). No population estimates have been calculated for the Alaska Beaufort Sea. While the preliminary estimate of 245,048 represents only a portion of the geographic range of the stock, as many ringed seals occur in the Beaufort Sea, in the pack ice, and along the coast of Russia, and has not been corrected for the numbers of ringed seals not hauled out at the time of the survey, it provides an update to the estimate from 1987.

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 ringed seals are unavailable, though there is no evidence 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 ringed 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 ringed 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 ringed 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 ringed 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 2 mortalities reported in 1992. Because no mortalities have been observed since 1992, the mean annual mortality rate is 0. The range of observer coverage over the 10-year period, as well as the annual observed and estimated mortalities are presented in Table 11.

An additional source of information on the number of ringed 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, logbook reports from all Alaska fisheries indicated no mortalities of ringed seals. Logbook data are available for part of 1989-1994, 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). There have been no logbook reports of ringed seal mortalities or injuries.

Table 11. Summary of incidental mortality of ringed 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 morality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	90-99	obs data	9.7-74%	0, 0, 2, 0, 0, 0, 0, 0, 0, 0	0, 0, 3, 0, 0, 0, 0, 0, 0, 0	0
Total estimated annual mortality						0

Based on data from 1995-1999, there have been no mortalities of ringed seals incidental to commercial fishing operations. Because the PBR for this stock is unknown, it is currently not possible to determine what annual mortality level considered to be insignificant and approaching zero mortality and serious injury rate. However, based on recent surveys, it seems likely that there are over 250,000 ringed seals in U.S. waters. If there were 250,000 ringed seals the PBR would equal 7,500 (250,000 × 0.06 × 0.5 = 7,500), and annual mortality levels less than 750 animals (i.e., 10% of PBR) would be considered insignificant. Currently, there is no reason to believe there are less than 250,000 ringed seals in U. S. waters.

Subsistence/Native Harvest Information

Ringed seals are an important species for Alaska Native subsistence hunters. The annual subsistence harvest in Alaska dropped from 7,000 to 15,000 in the period from 1962 to 1972 to an estimated 2,000-3,000 in 1979 (Frost unpubl. report). Based on data from two villages on St. Lawrence Island, the annual take in Alaska during the mid-1980s likely exceeded 3,000 seals (Kelly 1988). A reliable estimate of the annual number of ringed seals currently taken by Alaska Natives for subsistence is unavailable.

STATUS OF STOCK

Ringed 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 ringed seals and any U. S. fishery, the Alaska stock of ringed 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

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, 195 pp.

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. Comer., NOAA Tech. Rep. NMFS 12.

Burns, J. J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi Seas. J. Mammal. 51:445-454.

Burns, J. J., and S. J. Harbo. 1972. An aerial census of ringed seals, northern coast of Alaska. Arctic 25:279-290.

Burns, J. J., L. H. Shapiro, and F. H. Fay. 1981. Ice as marine mammal habitat in the Bering Sea. Pp. 781-797, *In* D. W. Hood and J. A. Calder (eds.), The eastern Bering Sea shelf: oceanography and resources. vol. 2. U.S. Dep. Commer., NOAA, Off. Mar. Pollut. Assess., Juneau, Alaska.

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.

Frost, K. J. 1985. Unpubl. rep. The ringed seal. Alaska Dep. Fish and Game, Fairbanks. 14 pp.

Frost, K. J., L. F. Lowry, J. R. Gilbert, and J. J. Burns. 1988. Ringed seal monitoring: relationships of distribution and abundance to habitat attributes and industrial activities. Final Rep. contract no. 84-ABC-00210 submitted to U.S. Dep. Interior, Minerals Management Service, Anchorage, AK. 101 pp.

Frost, K. J. and L. F. Lowry. 1999. Monitoring distribution and abundance of ringed seals in northern Alaska. Interim Rep. Cooperative Agreement Number 14-35-0001-30810 submitted to the U.S. Dep. Interior, Minerals Management Service, Anchorage, AK. 37p + appendix

Kelly, B. P. 1988. Ringed seal, *Phoca hispida*. Pp. 57-75, *In* J. W. Lentfer (ed.), Selected marine mammals of Alaska. Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

King, J. E. 1983. Seals of the world. 2nd ed. Br. Mus. (Nat. Hist.), London. 240 pp.

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.