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RIBBON SEAL (*Histriophoca fasciata*): Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Ribbon seals inhabit the North Pacific Ocean and adjacent parts of the Arctic Ocean. In Alaska waters, ribbon seals range from the North Pacific Ocean and Bering Sea into the Chukchi and western Beaufort seas (Fig. 1). From late March to early May, ribbon seals inhabit the Bering Sea ice front (Burns 1970, 1981; Braham et al. 1984). Ribbon seals are very rarely seen on shorefast ice or land. They are most abundant in the northern part of the ice front in the central and western parts of the Bering Sea (Burns 1970, Burns et al. 1981). As the ice recedes in May to mid-July, the seals move farther to the north in the Bering Sea, where they haul out on the receding ice edge and remnant ice (Burns 1970, 1981; Burns et al. 1981). As the ice melts, seals become more concentrated, with at least part of the Bering Sea population moving towards the Bering Strait and the southern part of the Chukchi Sea. By the time the Bering Sea ice recedes through the Bering Strait, there is usually only a small number of ribbon seals hauled out on the ice. Ten ribbon seals tagged in the spring of 2005 near the eastern coast of Kamchatka spent the summer and fall throughout the Bering Sea and Aleutian Islands. However, of 72 ribbon seals satellite tagged in the central Bering Sea during 2007-2010, only 21 (29%) moved to the Bering Strait, Chukchi Sea, or Arctic Basin as the ice retreated northward. About 9.5% of ribbon seals' time budget during July through October was in those areas. The majority of the seals tagged in the central Bering Sea did not pass north of the Bering Strait. These seals, and the 10 seals tagged in 2005 near Kamchatka, dispersed widely, occupying coastal areas as well as the interior of the Bering Sea, both on and off the continental shelf (Boveng et al. 2013). Year-long passive acoustic sampling on the Chukchi Plateau from autumn 2008-2009 detected ribbon seal calls only in October and November 2008 (Moore et al. 2012).

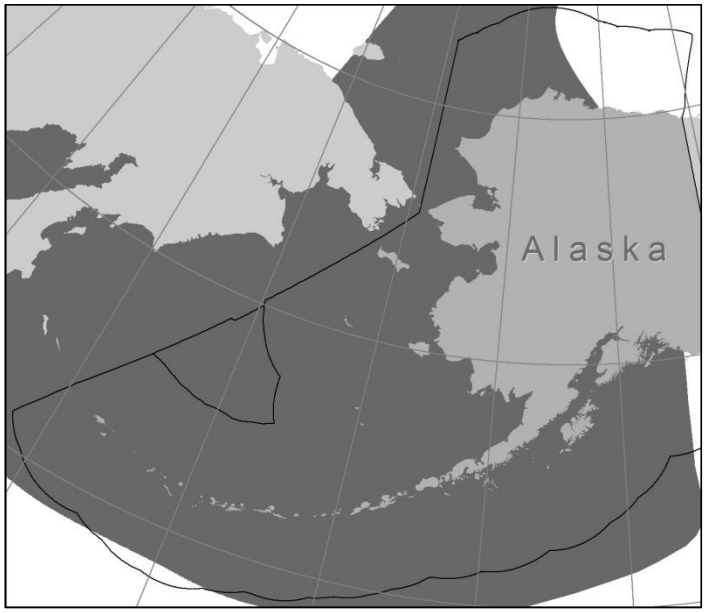

Figure 1. Approximate distribution of ribbon seals (dark shaded area) in Alaska waters. The combined summer and winter distribution is depicted.

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; and 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 ribbon seals into more than one stock (Boveng et al. 2013). Therefore, only the Alaska stock of ribbon seal is recognized in U.S. waters.

POPULATION SIZE

A reliable population estimate for the entire stock is not available, but research programs have recently developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted aerial abundance and distribution surveys of the entire Bering Sea and Sea of Okhotsk (Moreland et al. 2013). The data from these image-based surveys are still being analyzed, but Conn et al. (2014), using a very limited sub-sample of the data collected from the U.S. portion of the Bering Sea in 2012, calculated an abundance estimate of approximately 184,000 (95% CI: 145,752-230,134) ribbon seals in those waters. Though this should be considered only a preliminary estimate, it is appropriate to consider this a reasonable estimate for the entire U.S. population of ribbon seals because few ribbon seals are expected to be north of the Bering Strait in the spring when these surveys were conducted. When the final analyses for both the Bering and Okhotsk seas are complete they should provide the first range-wide estimates of ribbon seal abundance.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for a stock is calculated using Equation 1 from the potential biological removal (PBR) guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the 2012 Bering Sea abundance estimate by Conn et al. (2014) provides an N_{MIN} of 163,086 ribbon seals in this stock.

Current Population Trend

At present, reliable data on trends in population abundance for the Alaska stock of ribbon seals are unavailable. This stock is thought to occupy its entire historically-observed range (Boveng et al. 2013).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Alaska stock of ribbon 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 PBR is defined as the product of the minimum population estimate (N_{MIN}), 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, the value for stocks thought to be stable (Wade and Angliss 1997). Thus, the PBR for the Alaska stock of ribbon seals = 9,785 (163,086 × 0.06 × 1.0).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Detailed information (including observer programs, observer coverage, and observed incidental takes of marine mammals) for federally-managed and state-managed U.S. commercial fisheries in Alaska waters is presented in Appendices 3-6 of the Alaska Stock Assessment Reports.

Until 2003, there were three different federally regulated commercial fisheries in Alaska that could have interacted with ribbon seals and were monitored for incidental mortality and serious injury by fishery observers. As of 2003, changes in fishery definitions in the MMPA List of Fisheries have resulted in separating these 3 fisheries into 13 fisheries (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. Between 2009 and 2013, incidental mortality and serious injury of ribbon seals occurred in the Bering Sea/Aleutian Islands flatfish trawl, Bering Sea/Aleutian Islands Atka mackerel trawl, and Bering Sea/Aleutian Islands pollock trawl fisheries (Table 1). The minimum estimated average annual mortality and serious injury rate incidental to U.S. commercial fisheries is 0.6 ribbon seals, based exclusively on observer data.

Table 1. Summary of incidental mortality and serious injury of the Alaska stock of ribbon seals due to U.S. commercial fisheries from 2009 to 2013 and calculation of the mean annual mortality and serious injury rate (Breiwick 2013; NMML, unpubl. data). Methods for calculating percent observer coverage are described in Appendix 6 of the Alaska Stock Assessment Reports.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Bering Sea/Aleutian Is. flatfish trawl	2009 2010 2011 2012 2013	obs data	99 99 99 99 99	0 0 0 1 0	0 0 0 1 0	0.2 (CV = 0.01)
Bering Sea/Aleutian Is. Atka mackerel trawl	2009 2010 2011 2012 2013	obs data	99 99 99 99 99	1 0 0 0 0	1 0 0 0 0	0.2 (CV = 0.01)

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean estimated annual mortality
Bering Sea/Aleutian Is. pollock trawl	2009 2010 2011 2012 2013	obs data	86 86 98 98 97	1 0 0 0 0	1 0 0 0 0	0.2 (CV = 0.11)
Minimum total estimated annual mortality						0.6 (CV = 0.04)

Alaska Native Subsistence/Harvest Information

Ribbon seals are an important resource for Alaska Native subsistence hunters. Approximately 64 Alaska Native communities in western and northern Alaska, from Bristol Bay to Kaktovik, regularly harvest ice seals (Ice Seal Committee 2014). The Ice Seal Committee, as co-managers with NMFS, recognizes the importance of harvest information and has been collecting it since 2008 as funding and available personnel have allowed. Annual household survey results are compiled in a statewide harvest report that includes historical ice seal harvest information back to 1960. This report is used to determine where and how often harvest information has been collected and where efforts need to be focused in the future (Ice Seal Committee 2014). Current information, within the last 5 years, is available for 11 communities (Kivalina, Noatak, Buckland, Deering, Emmonak, Scammon Bay, Hooper Bay, Tununak, Quinhagak, Togiak, and Twin Hills) (Table 2), but more than 50 other communities harvest ribbon seals and have not been surveyed in the last 5 years or have never been surveyed. Harvest surveys are designed to confidently estimate harvest within the surveyed community, but because of differences in seal availability, cultural hunting practices, and environmental conditions, extrapolating harvest numbers beyond that community is misleading. For example, during the past 5 years (2009-2013), only 11 of the 64 coastal communities have been surveyed for ribbon seals and of those only 6 have been surveyed for two or more consecutive years (Ice Seal Committee 2015). Based on the harvest data from these 11 communities (Table 2), a minimum estimate of the average annual harvest of ribbon seals in 2009-2013 is 3.2 seals. The Ice Seal Committee is working toward a better understanding of ice seal harvest by conducting more consecutive surveys with the goal of being able to report a statewide ice seal harvest estimate in the future.

Table 2. Ribbon seal harvest estimates from 2009 to 2013 and the Alaska Native population for each community (Ice Seal Committee 2015).

Community	Alaska Native population (2013)	Estimated ribbon seal harvest				
		2009	2010	2011	2012	2013
Kivalina	352			0		
Noatak	514			1		
Buckland	519			0		
Deering	176			0		
Emmonak	782			0		
Scammon Bay	498			4	2	
Hooper Bay	1144	0	0	0	4	0
Tununak	342	0	0	0	0	
Quinhagak	694		2	3	0	0
Togiak	842	0	0	0		
Twin Hills	66	0	0			
Total		0	2	8	6	0

Other Mortality

Beginning in mid-July 2011, elevated numbers of sick or dead seals, primarily ringed seals, with skin lesions were discovered in the Arctic and Bering Strait regions of Alaska. By December 2011, there were more than 100 cases of affected pinnipeds, including ringed seals, spotted seals, bearded seals, and walrus, in northern and western Alaska. Due to the unusual number of marine mammals discovered with similar symptoms across a wide geographic area, NOAA and USFWS declared a Northern Pinniped Unusual Mortality Event (UME) on December 20, 2011. Disease surveillance efforts in 2012-2013 did not detect any new cases similar to those observed in 2011, but the UME investigation remains open for ice seals based on continuing reports in 2013 and 2014 of ice seals in the Bering Strait region with patchy hair loss. To date, no specific cause for the disease has been identified. No ribbon seal cases were reported but they are not a coastal species and are seldom observed.

STATUS OF STOCK

Ribbon seals are not designated as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act (ESA). The minimum population estimate of ribbon seals in U.S. waters is 163,086, with a PBR of 9,785. Because the estimated average annual level of U.S. commercial fishery-related mortality and serious injury (0.6) is less than 10% of PBR (979), it can be considered insignificant and approaching zero mortality and serious injury rate. The total estimated annual level of human-caused mortality and serious injury based on commercial fisheries observer data (0.6) and a minimum estimate of the Alaska Native harvest (3.2) is 3.8 ribbon seals. The Alaska stock of ribbon seals is not considered a strategic stock.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al. 2004). Ribbon seals, along with other seals that are dependent on sea ice for at least part of their life history, will be vulnerable to reductions in sea ice. The main concern about the conservation status of ribbon seals stems from the likelihood that their sea-ice habitat has been modified by the warming climate and, more so, that the scientific consensus projections are for continued and perhaps accelerated warming in the foreseeable future (Boveng et al. 2013). A second major concern, related by the common driver of carbon dioxide (CO_2) emissions, is the modification of habitat by ocean acidification, which may alter prey populations and other important aspects of the marine ecosystem. Ocean acidification, a result of increased CO_2 in the atmosphere, may impact ribbon seal survival and recruitment through disruption of trophic regimes that are dependent on calcifying organisms. The nature and timing of such impacts are extremely uncertain. Laidre et al. (2008) concluded that on a worldwide basis ribbon seals were likely to be moderately sensitive to climate change based on an analysis of various life history features that could be affected by climate. Additional habitat concerns include the potential effects from increased shipping (particularly in the Bering Strait) and oil and gas exploration activities (particularly in the outer continental shelf leasing areas), such as disturbance from vessel traffic, seismic exploration noise, and the potential for oil spills.

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