Revised 10/09/2014

## 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 northward from Bristol Bay in the 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, Burns 1981, Braham et al. 1984). 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, Burns 1981, Burns et al. 1981). There is little known about the range of ribbon seals during the rest of the year. Recent sightings and a review of the literature suggest that many ribbon seals migrate into the Chukchi Sea for the summer (Kelly 1988). Ribbon seal vocalizations were detected on the northern Chukchi Plateau only in late fall of 2008 and not thereafter (Moore et al. 2012). Satellite tag data from 2005 and 2007 suggest ribbon seals disperse widely. Ten seals tagged in 2005 near the eastern coast of Kamchatka spent the summer and fall throughout the Bering Sea and Aleutian Islands; eight of the 26 seals tagged in 2007 in the central Bering Sea moved to the Bering Strait, Chukchi Sea, or Arctic Basin as the seasonal ice retreated (Boveng et al. 2008).

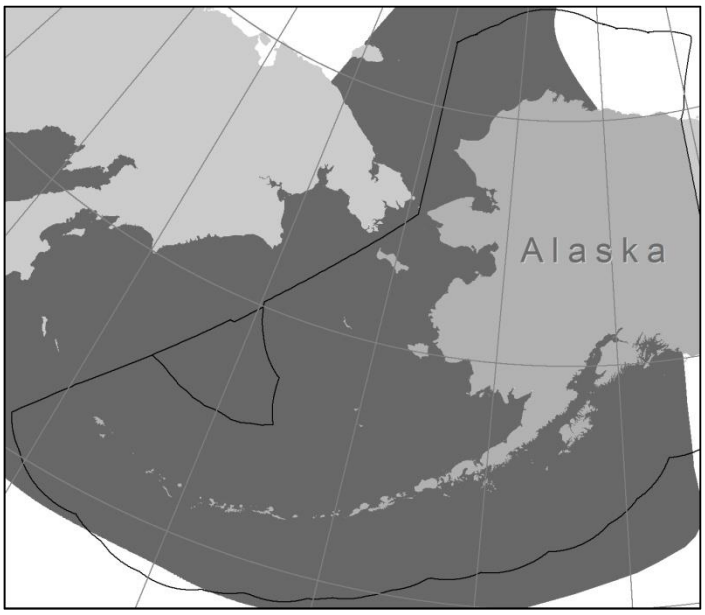


**Figure 1.** Approximate distribution of ribbon seals (shaded area) in Alaska waters. The combined summer and winter distribution is depicted.

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; 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. 2008). Therefore, only the Alaska stock of ribbon seal is recognized in U.S. waters.

### POPULATION SIZE

A reliable abundance estimate for the Alaska stock of ribbon seals is currently not available. Burns (1981) estimated the worldwide population of ribbon seals at 240,000 in the mid-1970s, with an estimate for the Bering Sea at 90,000-100,000.

Aerial surveys were conducted in portions of the eastern and central Bering Sea in spring of 2003 (Simpkins et al. 2003), 2007 (Cameron and Boveng 2007, Moreland et al. 2008), and 2008 (Cameron et al. 2008). Frequencies of sightings data from the 2007 surveys and information on ice distribution and the timings of seal haul-out behavior were analyzed to develop a population estimate of 61,100 (95% CI 35,200-189,300) ribbon seals in the areas surveyed in that year (Ver Hoef et al. 2014). In spring of 2012, NOAA researchers, in collaboration with Russian colleagues, conducted aerial abundance and distribution surveys of the entire Bering Sea (Moreland et al. 2012). Information from these surveys, and similar surveys planned for both the Bering and Okhotsk Seas in 2013, should provide the current range-wide estimates of ribbon seal abundance.

#### 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 ribbon seals are unavailable. Although the current population trend is unknown, a recent provisional estimate of 49,000 ribbon seals in portions of the eastern and central Bering Sea is consistent enough with historical estimates to suggest that no major or catastrophic change has occurred in recent decades (Boveng et al. 2008). This stock is thought to occupy its entire historically-observed range (Boveng et al. 2008).

## 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 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

**New Serious Injury Guidelines**

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen et al. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

**Fisheries Information**

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 by fishery observers. As of 2003, changes in fishery definitions in the List of Fisheries have resulted in separating these three 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 2008 and 2012, there were incidental serious injuries and mortalities of ribbon seals in the Bering Sea/Aleutian Islands Atka mackerel trawl and the Bering Sea/Aleutian Islands pollock trawl fisheries (Table 1). The estimated minimum mortality rate incidental to commercial fisheries is 1.02 (CV = 0.06) ribbon seal per year, based exclusively on these observer data.

**Table 1.** Summary of incidental mortality of ribbon seals (Alaska stock) due to fisheries from 2008 to 2012 and calculation of the mean annual mortality rate (Breiwick 2013). Details of how percent observer coverage is measured are included in Appendix 6.

| Fishery name | Years | Data type | Observer coverage | Observed mortality (in given yrs.) | Estimated mortality (in given yrs.) | Mean annual mortality |
|---|---|---|---|---|---|---|
| Bering Sea/Aleutian Islands flatfish trawl | 2008 | obs | 100 | 0 | 0 | 0.2 |
| | 2009 | data | 100 | 0 | 0 | (CV = 0.01) |
| | 2010 | | 100 | 0 | 0 | |
| | 2011 | | 100 | 0 | 0 | |
| | 2012 | | 100 | 1 | 1.0 | |

| Fishery name | Years | Data type | Observer coverage | Observed mortality (in given yrs.) | Estimated mortality (in given yrs.) | Mean annual mortality |
|---|---|---|---|---|---|---|
| Bering Sea/Aleutian Islands Atka mackerel trawl | 2008<br>2009<br>2010<br>2011<br>2012 | obs data | 100<br>99<br>100<br>100<br>100 | 0<br>1<br>0<br>0<br>0 | 0<br>1.0<br>0<br>0<br>0 | 0.2<br>(CV = 0.01) |
| Bering Sea/Aleutian Islands pollock trawl | 2008<br>2009<br>2010<br>2011<br>2012 | obs data | 85<br>86<br>86<br>98<br>98 | 2<br>1<br>0<br>0<br>0 | 2.1<br>1.0<br>0<br>0<br>0 | 0.62<br>(CV = 0.10) |
| Total estimated annual mortality | | | | | | 1.02<br>(CV = 0.06) |

**Subsistence/Native Harvest Information**

Ribbon seals are harvested occasionally by Alaska Native subsistence hunters, primarily from villages in the vicinity of Bering Strait and to a lesser extent at villages along the Chukchi Sea coast (Kelly 1988). The annual subsistence harvest was estimated to be less than 100 seals annually from 1968 to 1980 (Burns 1981). In the mid-1980s, the Alaska Eskimo Walrus Commission estimated the subsistence take to still be less than 100 seals annually (Kelly 1988).

The Division of Subsistence, Alaska Department of Fish and Game maintained a database that provided additional information on the subsistence harvest of ice seals in different regions of Alaska (ADFG 2000a, b). Information on subsistence harvest of ribbon seals was 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 to 1998 were used. As of August 2000; the subsistence harvest database indicated that the estimated number of ribbon seals harvested for subsistence use per year was 193. Data on community subsistence harvests are no longer routinely being collected, and no new statewide annual harvest estimates exist. Five Alaska Native communities in the Northwest Arctic region of Alaska voluntarily reported a total of 1 ringed seal was harvested during 2012 (Ice Seal Committee 2013).

At this time, there are no efforts to quantify the total statewide level of harvest of ribbon seals by all Alaska communities. A 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 to 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 193 ribbon seals estimated by the Division of Subsistence is higher than the previous minimum estimate. Although some of the more recent entries in the ADFG database have associated measures of uncertainty (Coffing et al. 1999, Georgette et al. 1998), the overall total does not.

**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). Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. Because the PBR for ribbon seals is unknown, the level of annual U.S. commercial fishery-related mortality that can be considered insignificant and approaching zero mortality and serious injury rate is unknown. The Alaska stock of ribbon seals is not considered a strategic stock.

On 20 December 2007, NMFS received a petition to list ribbon seals under the ESA, primarily due to concern about threats to the species' habitat from climate warming and loss of sea ice. NMFS found that the petition presented sufficient information to consider listing and initiated a conservation status review of ribbon seals (73 FR 16617, 28 March 2008). After the status review of the ribbon seal was complete (Boveng et al. 2008), NMFS published a finding on December 30, 2008, that listing ribbon seals was not warranted at that time (73 FR 79822, 30 December 2008). New information became available after this finding, including data on ribbon seal movements and diving, and a modified threat-specific approach to analyzing the foreseeable future, which was used in the more

recent spotted, ringed, and bearded seal ESA status reviews. In consideration of this new information, NMFS conducted a new status review of the ribbon seal (78 FR 41371; July 10, 2013) and determined that listing the ribbon seal as threatened or endangered under the ESA is not warranted at this time.

**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. 2008). 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 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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