Updated status of ringed and bearded seal productivity in Alaska using harvest-based monitoring results for 2013 and 2014

Lori Quakenbush, Justin Crawford, John Citta, and Anna Bryan

Alaska Department of Fish and Game, Arctic Marine Mammals Program, Fairbanks, Alaska, lori.quakenbush@alaska.gov

Introduction

Arctic sea ice has declined in extent, thickness, and duration; these declines are predicted to continue, along with a reduction in snow cover and an increase in winter rainfall. Declines in sea ice are predicted to negatively affect both ringed (*Pusa hispida*) and bearded (*Erignathus barbatus*) seals by reducing their time to rest, pup, nurse, and molt on sea ice. A reduction in snow cover and increasing rainfall is expected to be especially detrimental to ringed seal productivity and pup survival because of ringed seals' reliance upon snow cover for the construction of pupping dens. There are no reliable estimates of ringed and bearded seal abundance or trend in Alaska; however, since 1960, the Alaska Department of Fish and Game has worked with Alaska Native hunters to collect data from the subsistence harvest that can be used as indices to population health and status.

We have previously published an examination of several population indices to determine if declines in sea ice have affected ringed and bearded seals between 1975 and 2012 (Crawford et al. 2015); these indices included sternal blubber thickness, growth rate, pregnancy rate, age of maturity, and the proportion of pups in the harvest. Through 2012, we observed no evidence of a decline in any population index that was predicted to occur with climate change. Here we update our 1975–2012 results with data from 2013 and 2014.

Methods

We sampled ringed and bearded seals from subsistence harvests at 11 villages along the Bering and Chukchi sea coasts (Fig. 1). Samples collected included the female reproductive tracts and a canine tooth. We examined reproductive tracts for sexual maturity and reproductive condition. Age of seals was determined by counting annuli in the dentine and cementum layers of sectioned teeth.

Age of Maturity

- Seals that had ovulated at least once were classified as mature.
- We estimated average age of maturity as the age at which 50% of females were mature (DeMaster 1978) using a probit regression in SAS (PROC PROBIT).

Pregnancy Rate

- We defined pregnancy rate as the proportion of mature females that were pregnant when harvested.
- We estimated average pregnancy rates and evaluated differences among periods using a logistic regression model in SAS (PROC LOGISTIC).

Proportion of Pups Harvested

- The proportion of pups (<1 year of age) harvested is representative of their presence in the population. If pups were not surviving past weaning, their presence in the harvest would decrease.
- We evaluated differences in the proportion of pups harvested during each period, including only villages where ≥50 seals were sampled, using SAS (PROC FREQ).

References

CRAWFORD, J. A., L. T. QUAKENBUSH AND J. J. CITTA. 2015. A comparison of ringed and bearded seal diet, condition and productivity between historical (1975–1984) and recent (2003–2012) periods in the Alaskan Bering and Chukchi seas. Progress in Oceanography 136: 133–150. doi: 10.1016/j.pocean.2015.05.011.

DEMASTER, D. P. 1978. Calculation of the average age of sexual maturity in marine mammals. Journal of Fisheries Research Board Canada 35: 912–915.

Figure 1. Villages in the Bering and Chukchi seas where harvested ringed and bearded seals were sampled (1975–2014).

Age of Maturity

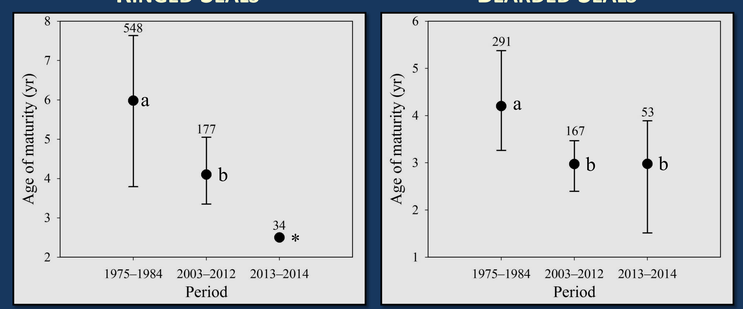

Figure 2. Average age of maturity of ringed and bearded seals by period (1975–1984, 2003–2012, and 2013–2014). Data with different letter labels are significantly different (P<0.05).

** Sample size was too small to determine statistical differences.*

- Ringed seals: average age of maturity has been younger since 2003 than during 1975–1984 (*P*<0.05)
- Bearded seals: average age of maturity has been younger since 2003 than during 1975–1984 (*P*<0.05) and has not changed from 2003–2012 to 2013–2014 (P>0.05)

Pregnancy Rate

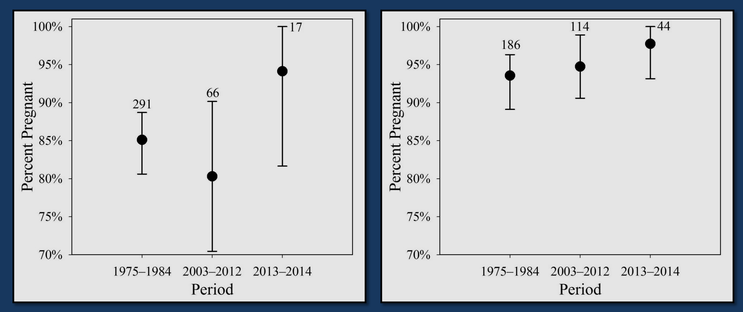

Figure 3. Average pregnancy rates of ringed and bearded seals by period (1975–1984, 2003–2012, and 2013–2014).

- For both ringed and bearded seals, pregnancy rate did not change among periods, including from 2003–2012 to 2013–2014 (*P*>0.05)

Proportion of Pups Harvested

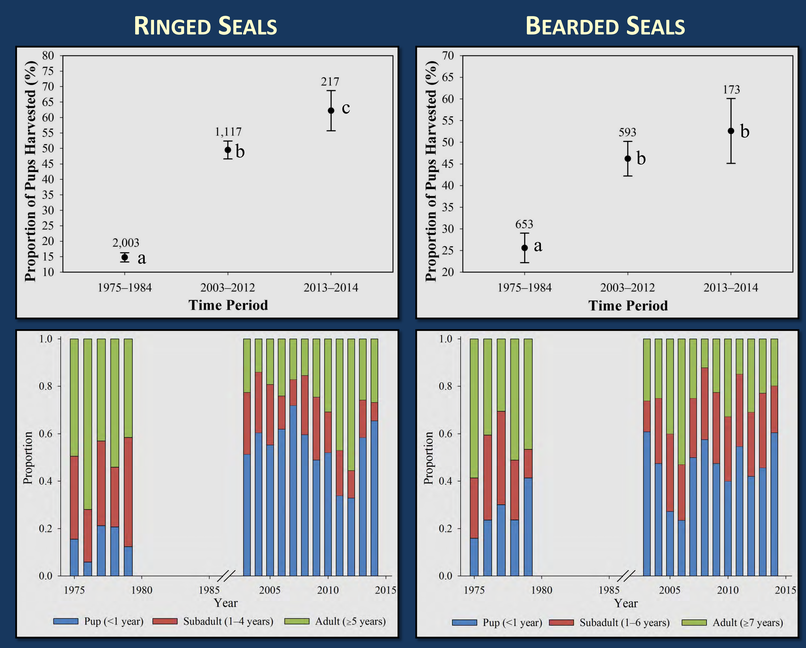

Figure 4. Top panel: proportion of ringed and bearded seal pups harvested by period (1975–1984, 2003–2012, and 2013–2014). Data with different letter labels are significantly different (P<0.05). Bottom panel: Annual proportions of ringed and bearded seal age classes harvested (1975–1984 and 2003–2014).

- The proportion of ringed and bearded seal pups harvested has been higher since 2003 than during 1975–1984 (P<0.05)

Conclusions

- Indices of seal productivity and weaning success have not declined in recent years. For both ringed and bearded seals,
  - Age of maturity remains younger since 2003 than during 1975–1984
  - Pregnancy rates remain unchanged
  - Proportion of pups harvested remains higher since 2003 than during 1975–1984
- These results are not consistent with predicted effects of climate change for ringed and bearded seals
- **Continued monitoring and retrospective comparisons provides a means to detect effects of changing conditions on ice seals**

Acknowledgements

This project would not be possible without the willingness of hunters to contribute samples from their harvest, the support of their communities, local governments, and Tribal Councils. We appreciate the support from the North Slope Borough and the Ice Seal Committee. John Burns, Kathy Frost, Lloyd Lowry, and others (ADF&G) were instrumental in the early development of this monitoring. We thank Mark Nelson, Louise Foster, Heidi Isernhagen, Letty Hughes, Gay Sheffield and our college interns for assistance in field collection and sample processing. Research was funded primarily by NOAA, but has also been supported by NSF, NPRB, and NSB. Research was conducted under NMFS Permits 358-1585, 358-1787 and 15324.