

Ringed seal productivity in Alaska using harvest-based monitoring, 1960s–1980s and 2000s–2010s



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Introduction

Declines in sea ice are predicted to negatively affect ringed seals (*Pusa hispida*) by reducing their time to rest, pup, nurse, and molt on sea ice. Concurrent with declines in sea ice are predicted reductions in snow cover used by ringed seals to construct pupping lairs on top of sea ice. Less snow is expected to lower ringed seal productivity and pup survival by providing less protection from weather and predators. Estimates of ringed seal abundance cannot be used to detect population trends in Alaska; however, the Alaska Department of Fish and Game has worked with Alaska Native hunters since the 1960s to collect data from subsistence harvested ringed seals that can be used as an index of population health and status.

Methods

Ringed seals from the subsistence harvests were sampled at 12 villages in Alaska along the Bering, Chukchi, and Beaufort sea coasts from 2000–2016. Female reproductive tracts and canine teeth were collected. These data were compared to data previously collected from seals in the same region during 1963–1984. Data are grouped by decade 1960s (1963–1969), 1970s (1970–1979), 1980s (1980–1984), 2000s (2000–2009) and 2010s (2010–2016). We examined reproductive tracts for sexual maturity and reproductive condition. Age of seals was determined by counting annuli in the dentine or cementum layers of sectioned teeth.

Age of maturity

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



Villages where harvested ringed seals were sampled (2000–2016).

Pregnancy rate

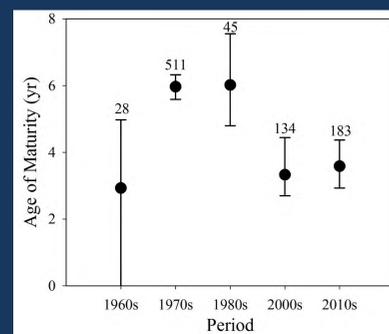
- Pregnancy rate was defined as the proportion of mature females that were pregnant in the year of harvest.
- Differences in average pregnancy rate among time periods were evaluated using a logistic regression model (PROC LOGISTIC).

Proportion of pups harvested

- Proportion of pups (<1 year of age) in the sampled harvest is representative of their presence in the population. If pups do not survive weaning, their presence in the harvest would decrease.
- We evaluated differences in the proportion of pups harvested during each period (PROC FREQ).



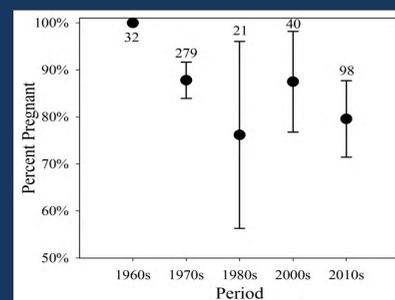
Age of maturity



Average age of maturity by time period.

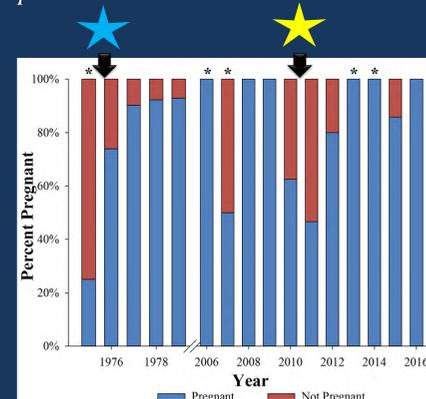
- Average age of maturity was significantly lower in the 1960s and since 2000 than during the 1970s and 1980s.

Pregnancy rate



Average pregnancy rate by time period.

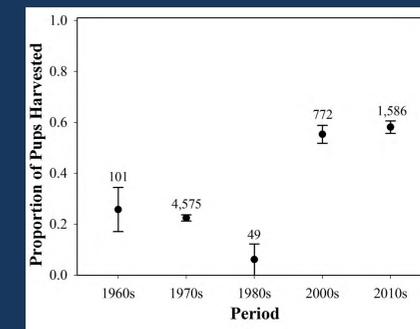
- Pregnancy rates have decreased slightly over time but remain high.
- The drop in pregnancy rate for the 2010s is driven by low annual pregnancy rates in 2010 and 2011, see below.



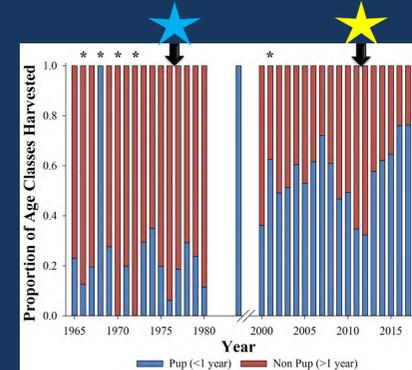
Percent pregnant by year. *Only 4 mature seals were analyzed in these years. The other years had at least 7 mature seals.

- Pregnancy rate was low prior to the 1977 regime shift.
- It was also low in 2010 and 2011 during the Unusual Mortality Event (UME). During these years, reproductive tracts from six mature (13–30 yrs.) females were senescent. The thickness of their uterine horns indicated previous reproductive activity, but no corpora lutea or albicans were present.

Proportion of pups harvested



Proportion of pups harvested by time period. Number of seals harvested by time period is listed above the error bars.



Annual proportions of age classes harvested. *Sample size in these years were <10 seals. All other years had >40 seals harvested.

- The proportion of ringed seal pups harvested has been significantly higher since 2000 than it was in the 1960s, 1970s, or 1980s.
- The proportions of pups harvested was low in 1976 and 1977 (★) and 2010 and 2011 (★) which corresponds with the low pregnancy rates in 1975, 1976, 2010, and 2011.

Conclusions

Ringed seal of productivity and pup survival remain high.

- Seals are currently maturing at a young age, similar to the 1960s.
- Pregnancy rate remains high.
- Proportion of pups in the sampled harvest is high.

- Ringed seals had low reproductive success during the UME (2010 and 2011), but have recovered since then.

- Monitoring in future years will be important as environmental conditions continue to change.

Acknowledgements

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References

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