

# Ringed, bearded, and spotted 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 ice associated seals (ringed, *Pusa hispida*, bearded, *Erignathus barbatus*, and spotted, *Phoca largha*), important to Alaska Natives for food and materials, by reducing their time to rest, pup, nurse, and molt on sea ice. Concurrent with declines in sea ice are predicted reductions in snow depth used by ringed seals to construct pupping lairs. This is expected to lower productivity and pup survival by providing less protection from weather and predators. Estimates of ice seal abundance cannot be used to detect population trends in Alaska; however, data from the subsistence harvest can be used as an index of population health and status. We compared seal productivity during the 2000s to the 1960s and 1970s, before sea ice decline.

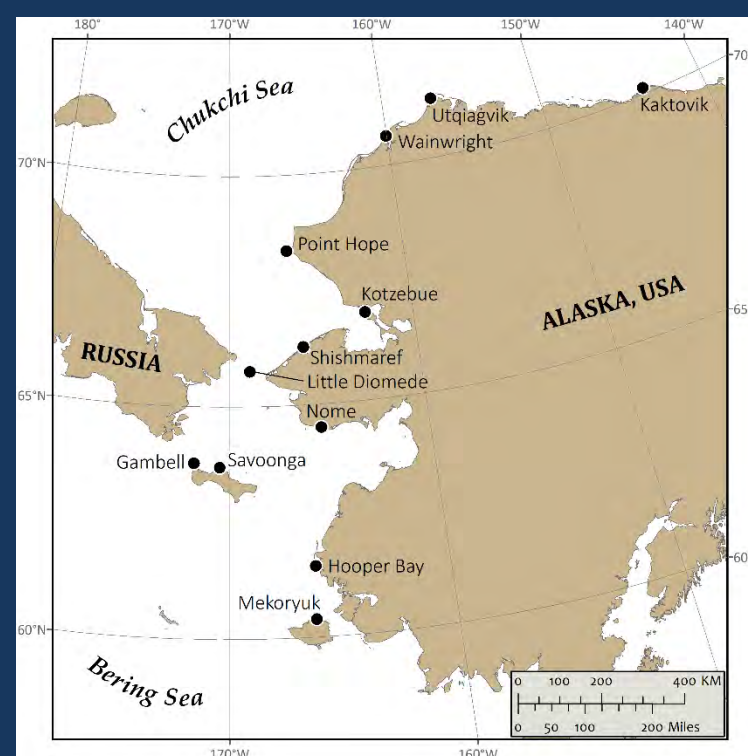
## Methods

Subsistence harvested seals were sampled at 12 villages in Alaska along the Bering, Chukchi, and Beaufort sea coasts from 2000–2018. Female reproductive tracts and canine teeth were collected. These data were compared to data previously collected from the same region during 1963–1984. Data are grouped by decade:

- Ringed:** 1960s (7 yrs), 1970s (9 yrs), 1980s (3 yrs), 2000s (8 yrs), and 2010s (9 yrs)
- Bearded:** 1960s (6 yrs), 1970s (9 yrs), 2000s (8 yrs), and 2010s (9 yrs)
- Spotted:** 1960s (4 yrs), 1970s (5 yrs), 2000s (9 yrs), and 2010s (9 yrs)

### 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 seals were sampled (2000–2018).

### Pregnancy rate

- Pregnancy rate was defined as the proportion of mature females that were pregnant in the year of harvest. If a corpora lutea was present but no fetus was evident by November 1<sup>st</sup>, the seal was considered not pregnant.
- 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.
- Age of seals was determined by counting annuli in the dentine or cementum layers of sectioned teeth.
- We evaluated differences in the proportion of pups harvested during each period (PROC FREQ).

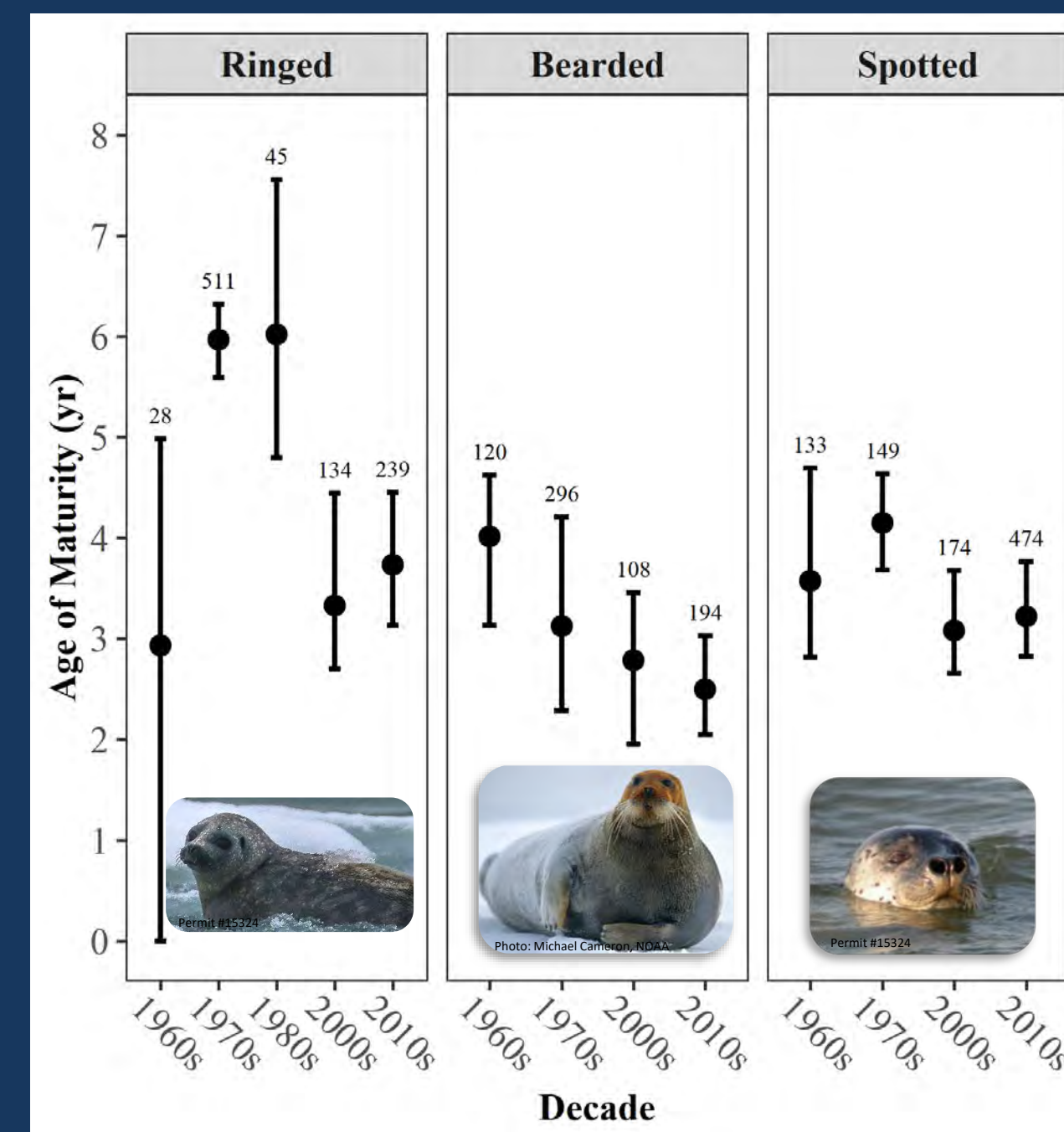
## Acknowledgements

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## References

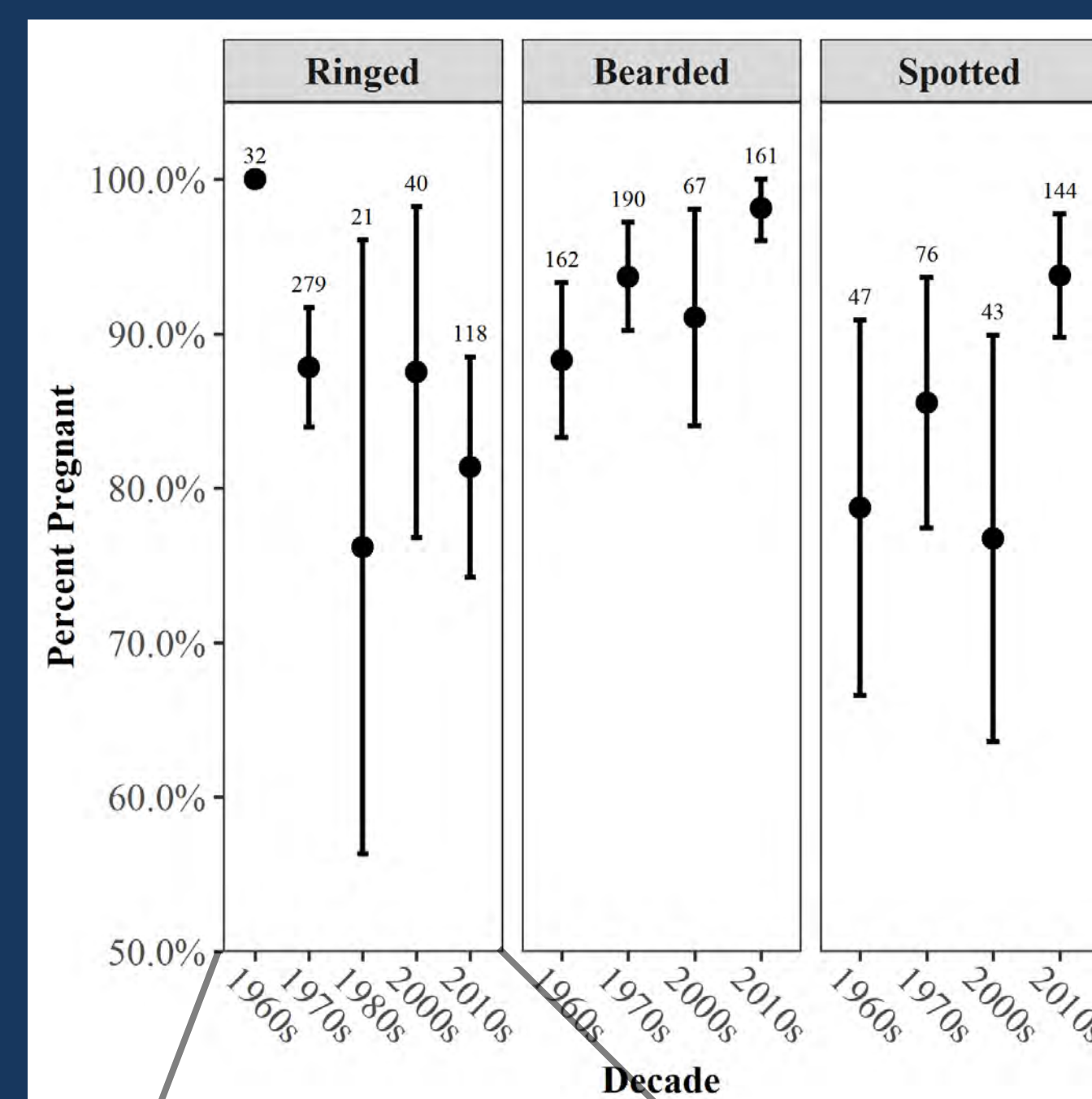
DEMASTER, D. P. 1978. Calculation of the average age of sexual maturity in marine mammals. *Journal of Fisheries Research Board Canada* 35: 912–915.

## Age of maturity

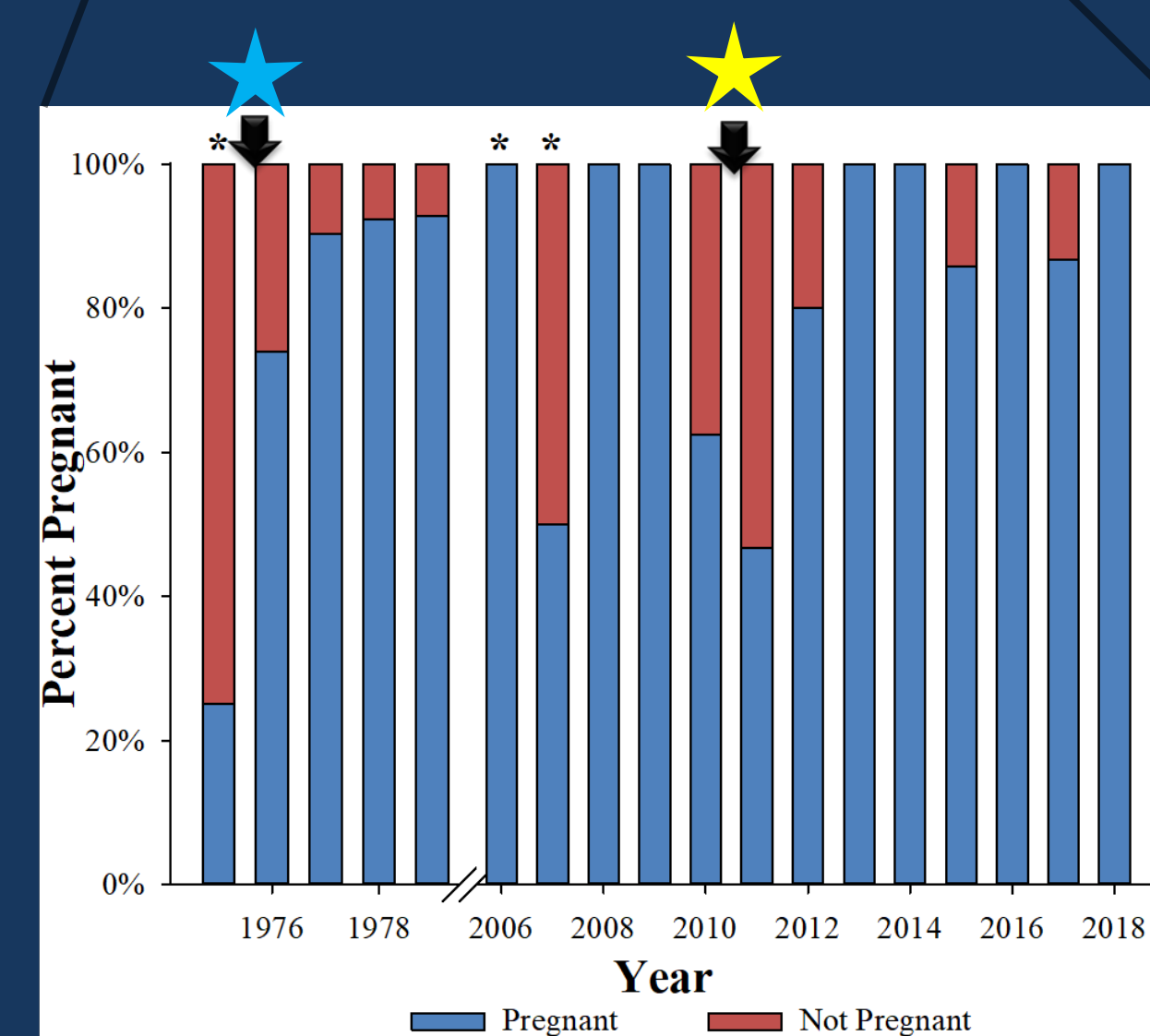


Average age of maturity by decade. Number of seals analyzed by decade is listed above the 95% confidence limits.

## Pregnancy rate



Average pregnancy rate by decade. Number of seals analyzed by decade is listed above the 95% confidence limits.



Annual percent pregnant for ringed seals.

\*Only 4 mature seals were analyzed in these years. All other years had at least 7 mature seals.

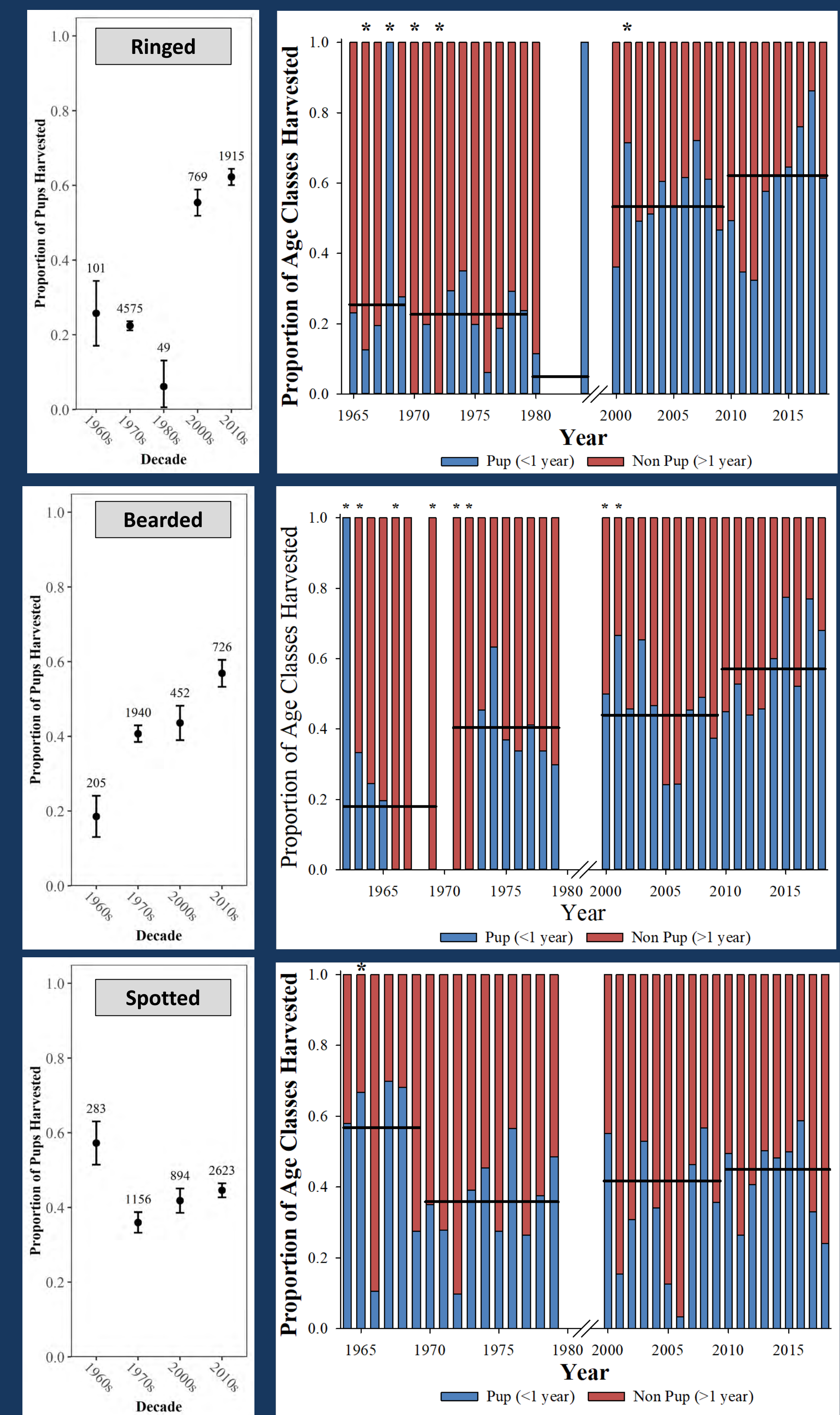
Seals matured at younger ages since the 2000s than in the 1970s.

Pregnancy rate in the 2010s was similar to other decades for ringed seals and was higher for bearded and spotted seals than all other decades.

★ Ringed seal 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 decade. Number of seals analyzed by decade is listed above the 95% confidence limits.

Annual proportions of age classes harvested. \*Sample size in these years were <10 seals. All other years had >40 seals harvested. Bold black lines represent the average proportion of pups by decade.

➤ The proportion of pups in the sampled harvest remains high for all three seal species in the 2010s.

## Conclusions

- **Productivity and pup survival remain high in the 2010s.**
  - Ringed, bearded, and spotted seals are currently maturing at younger ages than in the 1970s.
  - Pregnancy rates remain high at 81% for ringed, 98% for bearded, and 94% for spotted seals.
  - 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.**