Postpartum period in the Steller Sea Lions of the Commander Islands: the connection with decline in natality

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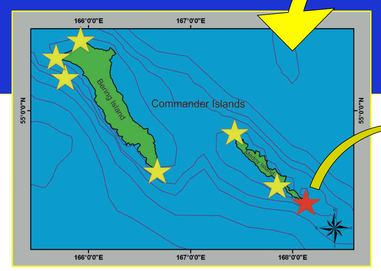
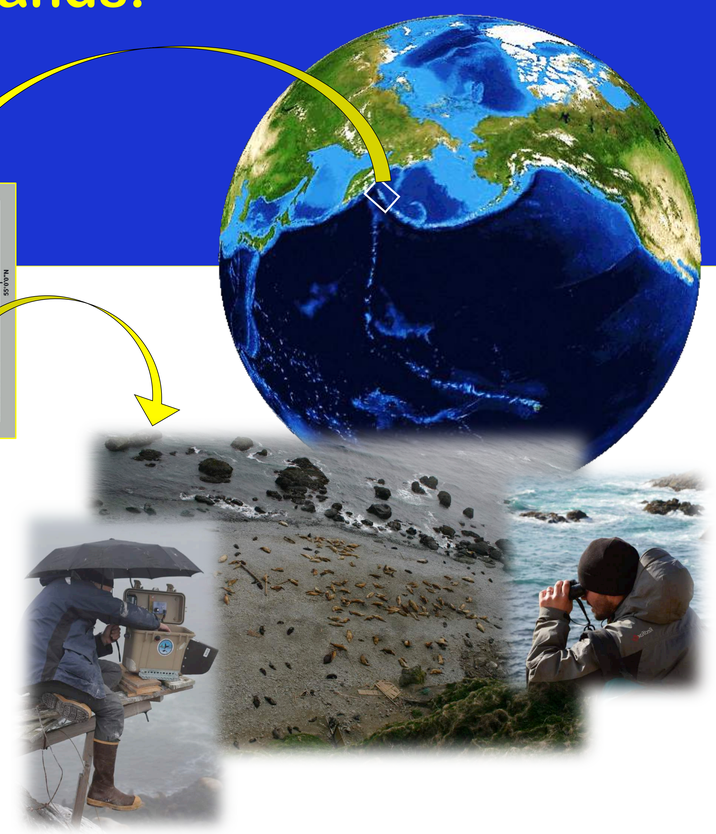


Fig. 1. Study area



Introduction

The Commander Islands are located at the western end of the Aleutian Island chain (Fig.1), and are inhabited by a small subpopulation of Steller sea lion (SSL) belonging to the western stock. There is only one rookery at southeast point of Medny I. In contrast to the severe population decline of western stock SSL during the late 20th Century, pup production at the Commander Islands steadily increased until 1998 (Fig 2). Several subsequent sharp drops in pup numbers in first decade of new century led to a negative trend in abundance, likely due to irregular female reproduction. We suggest this decline occurred due to decreased quality of SSL habitat at the Commander Islands and SSL female wintering grounds. The duration of postpartum period (PPP, the period between parturition and the first foraging trip) in SSL is considered to reflect environmental conditions in SSL female wintering grounds.

Methods and materials

We measured PPP of SSL branded females in the Commander Islands regularly in 2009-2012 and 2014 using visual observation, an array of custom made high resolution automatic time-laps photo, and off the shelf PlotWatcher PRO game cameras in video mode. In total we obtained 106 PPP values of 58 SSL females of different age. We compared these data with published information for the period of relatively stable pup production (Burkanov et al. 2011). We also analyzed the effects of year, birth date, female age, maternal experience, pup sex and all paired combinations of these predictors using generalized liner models.

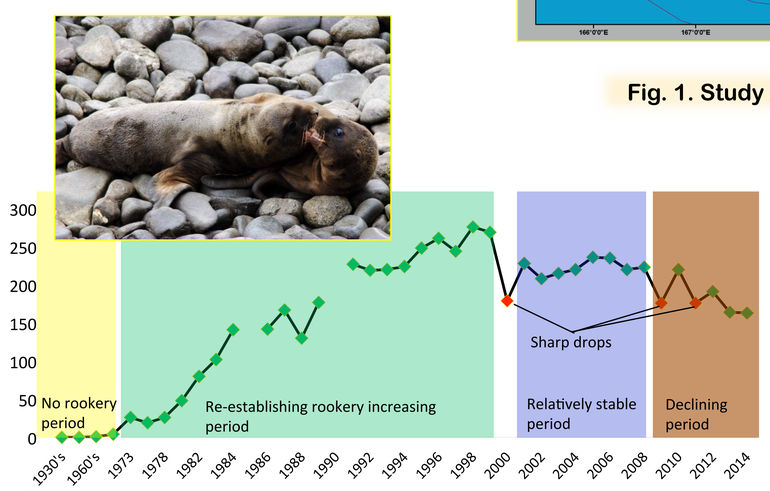


Fig. 2. Pup production at the Commander Islands, 1930s-2014.

Results and discussion

In 2009-2014 PPP varied from 4-16 (median=10.44, IQR=7.19-11.91) days and was significantly shorter than PPPs from published data for 2005-2007 ($p<0.001$) (Fig. 3). PPP varied significantly only with female age and the combination of female age and pup sex. Young females (4-6 y.o.) had shorter PPP in comparison with older females (>6 y.o.) (fig. 4), explainable by their relative inexperience affecting seasonal increase in body condition. Young females nursing male-pups had shorter PPP than all others (Fig. 5), perhaps driven by higher energetic demands of male-pups. However, this could also be an artifact of small samples of young females with known pup sexes (n=14). Decrease in natality and PPP in the last decade were probably driven by the same factors. The ability of females to adapt to worsening environmental conditions during winter is obscure, but is somehow connected with decreased natality. This could be due to a decrease in hormone stimulation such that females reduce or skipping copulation (we observed reduced numbers of copulations in seasons preceding sharp drops in pup production), embryo resorption or abortion during winter, or a combination of all these factors.

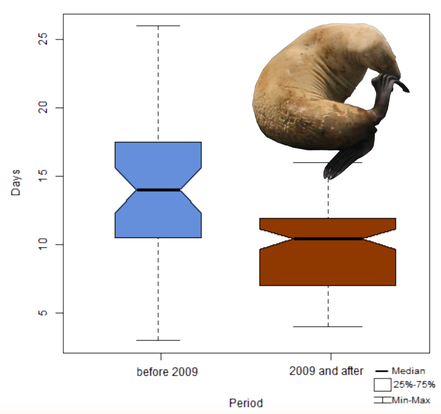


Fig. 3. The comparison of PPP index in SSL females in the Commander Islands during relatively stable (2005-2007), and during decline in pup production (2009-2012, 2014). Boxes width presents sample size proportion. The absence of notches intersections presents significant level of difference.

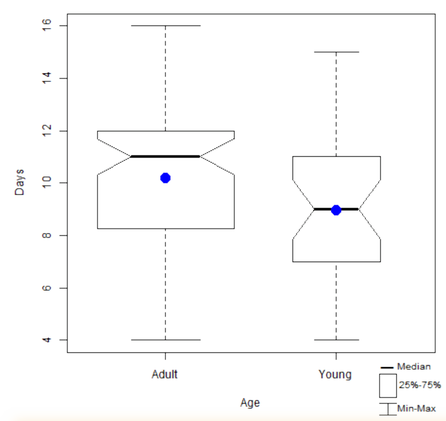


Fig. 4. The effect of mom age to PPP index in 2009-2012 and 2014. Boxes width presents sample size proportion. The absence of notches intersections presents significant level of difference. Blue points presents values predicted by generalized liner model.

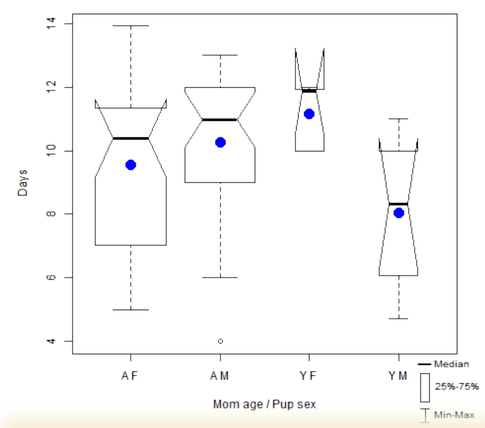


Fig. 5. The effect of mom age and pup sex combination on PPP index. The absence of notches intersections presents significant level of difference. Blue points presents values predicted by generalized liner model.
AF- adult female with female pup, AM - adult female with male pup, YF - young female with female pup, YM - young female with male pup.

Conclusions

- **PPP index in SSL females in Commander Islands was reduced substantially since 2009 following the decline in SSL pup production and both perhaps driven by same factors.**
- **Young females have shorter PPP in comparison with older females.**
- **Young females with male-pups might have shorter PPP in comparison with all others mature females perhaps driven by higher energetic demands of male-pups.**

The authors are grateful to Mamaev E.G., Zakharova D.N., Laskina N.B., Kirillova A.D., Belonovich O.A., Fomin S.V., Altukhov A.V., Vatagina M.A., Gaev D.N., Shostak A.A., Yakovlev V.M., Ososkova M.N., Titova O.V., Chizhov A.N. and many other participants of Russian Far East Marine Mammal Research Project who helped as in the field.
Research funded by National Marine Mammal Laboratory, AFSC,NMFS, NOAA.

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