Modelling climate change impacts on lake ice and snow demonstrates breeding habitat loss of the endangered Saimaa ringed seal

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Intro

- The Saimaa ringed seal (*Pusa hispida saimensis*) is an endangered land-locked seal inhabiting a freshwater Lake Saimaa in Finland.
- Subnivean lairs provide protection for pups against predators and harsh weather.
- Due to lack of sufficient snow lairs, over one-third of pups may die before weaning.
- Mild winters are becoming more common causing increased pup mortality.

Methods

Climate change effects on the seal's breeding habitat were studied by modeling lake ice and snow accumulation using different climate scenarios.

- A lake ice model of Watershed Simulation and Forecasting System (WSFS-Ice) was developed for improved estimation of ice and snow conditions in Lake Saimaa.
- A simple snow drifting model was used to simulate the formation of snowdrifts.
- The impacts of climate change were studied using six different regional climate models with three different representative concentration pathways RCP2.6, RCP4.5 and RCP8.5

Results

From the 1981-2010 to 2070-99 period, based on climate scenarios with intermediate representative concentration pathway (RCP4.5):

- The mean depth of the snowdrifts is projected to decrease approximately to half.
- The ice-covered period is reduced by one and a half months.
- In the mildest winters, the lake ice melts even before the pupping season has ended (**Fig. 1**).
- The probability of snowless winters increases in the future.

Discussion

- The results highlight the importance of active conservation measures to enhance the growth of the Saimaa ringed seal population, enabling it to survive in a changing climate.
- Climate change mitigation efforts play an important role in the changes of the natural breeding habitat of the seals (**Fig. 1**).

Breeding habitat (ice & snowdrifts) of this endangered seal is deteriorating and disappearing

- **The change is fast**
- **Climate actions have a significant effect on the outcome**

Active seal conservation measures are needed

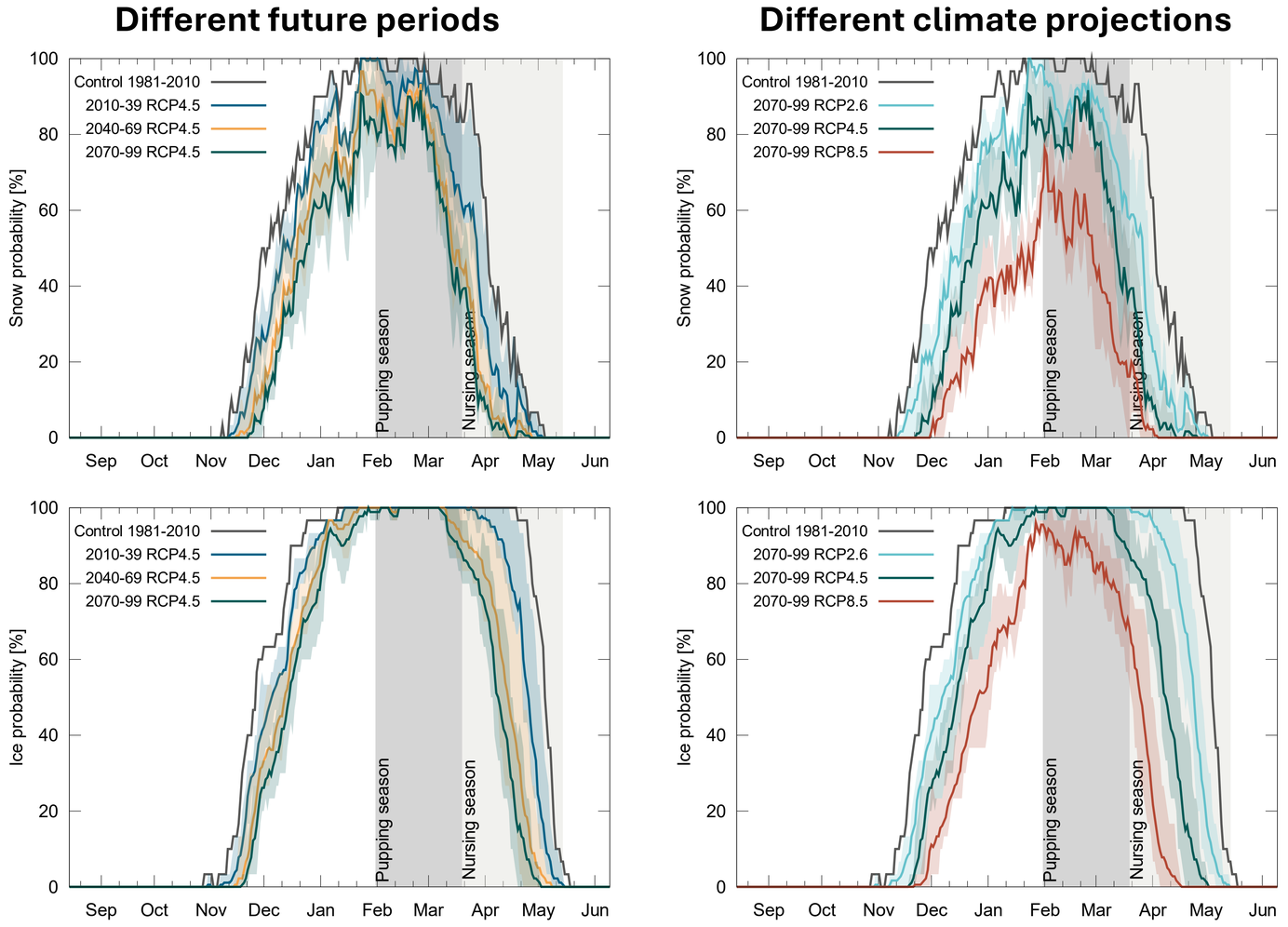

Fig. 1. Daily probability of the presence of snow on ice and ice cover in central Lake Saimaa in the control period and climate projections (RCPs). The figure shows the averages of the six regional climate models in bold and the total ranges in lighter colors.

Fast change:
Snow- and ice-covered season is getting shorter.

Climate actions matter:
Mitigation of climate change affects the magnitude of the changes in snow and ice cover.

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