Loss of Connectivity Among Peary Caribou Following Sea Ice Decline

Deborah A. Jenkins[1], Nicolas Lecomte[2], James A. Schaefer[1], Steffen M. Olsen[3], Didier Swingedouw[4], Steeve D. Côté[5], Loïc Pellissier[6,7] and Glenn Yannic[8]

[1] Trent University, [2]Université de Moncton, [3]Danish Meteorological Institute, [4]Universite de Bordeaux, [5]Université Laval, [6]Institute of Terrestrial Ecosystems, [7]Swiss Federal Institute for Forest, Snow and Landscape Research, [8]Université de Savoie

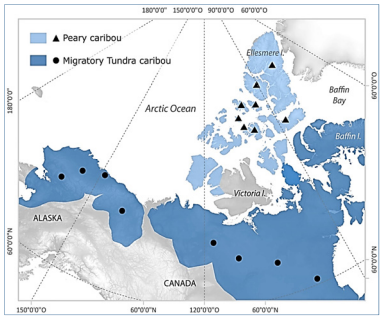
BACKGROUND

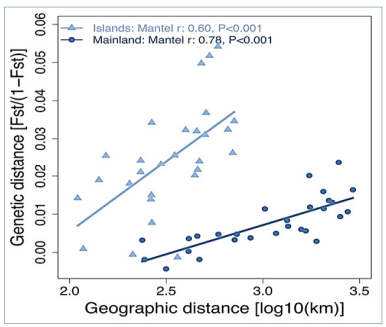
Global warming threatens to reduce population connectivity for terrestrial wildlife through significant and rapid changes to sea ice. **Connectivity is important.** It allows the demographic and genetic rescue of declining populations, alleviating the potential for inbreeding depression and increasing persistence time. For some caribou, sea ice provides connectivity and represents an important platform for dispersal and seasonal migrations. Its loss could impede movement and induce a cascade of unprecedented effects.

OBJECTIVES

- to evaluate if genetic structure among island dwelling Peary caribou differs from migratory mainland caribou.
- to assess whether genetic exchanges among Peary caribou are limited by the ice-free surface.
- to predict how climate change and the retreat of sea ice affect connectivity among caribou in **the Canadian Arctic Archipelago.**

GENETIC STRUCTURE





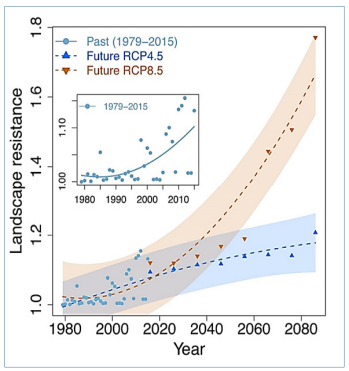
We genotyped 16 microsatellite markers from continental migratory caribou and island dwelling Peary caribou sampled across a broad expanse of the Arctic and Subarctic.

Our analysis of pairwise Fst, geographic distance, and Least Cost Path were estimated separately among Peary and mainland caribou.

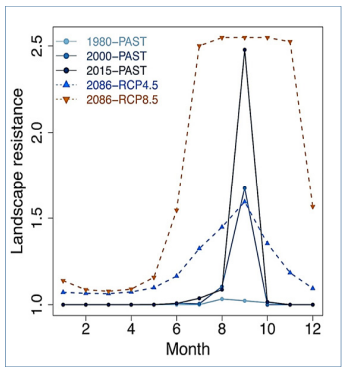
We found a significant correlation ($r \geq 0.6$) between genetic and geographic distances among each group of caribou – ***Isolation-by-Distance***. Least Cost Path was not significantly correlated with genetic distance after controlling for Isolation-by-Distance.

CONNECTIVITY CHANGES OVER TIME

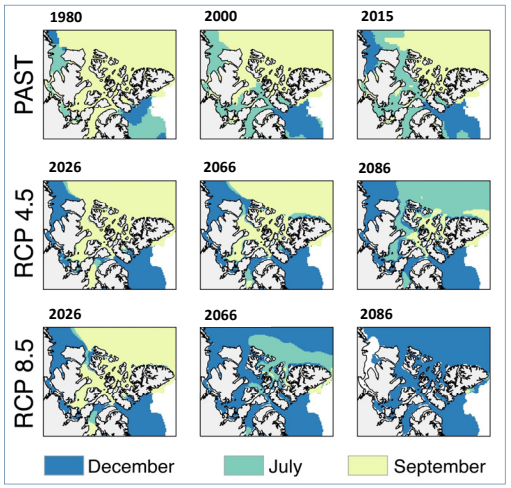
Analyses of past and future connectivity were based on resistance distance calculated using Least Cost Path with cost values of 1 for sea ice and land surfaces, and 0.01 for ice-free surfaces. **Sea ice data** for 1979-2015 was provided by the National Snow and Ice Data Center. We predicted future sea ice from the climate EC-Earth model following moderate (RCP4.5) and high (RCP8.5) emission scenarios.



Landscape resistance has **increased by ~15%** between 1979-2015. By 2086, resistance is predicted to **increase 20-77%.**



Landscape resistance for 1979-2015 was maximal during the ice-free season, mostly September. In the future, **resistance could increase ~150%** from July-November.



Past and projected maximum sea ice extent show a dramatic loss of sea ice particularly during September.

HIGHLIGHTS

- **Isolation-by-Distance indicates that sea ice has been an effective corridor allowing connectivity among Peary caribou.**
- **Following RCP 4.5 and 8.5 projections, the ice-free season will increase in the future particularly between July and November.**
- **The loss of sea ice may hamper dispersal, annual migrations and escape from unpredictable but reoccurring episodes of severe weather.**

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