Responses of arctic shorebirds to climate change

Convention on Migratory Species - Workshop, Edinburgh UK

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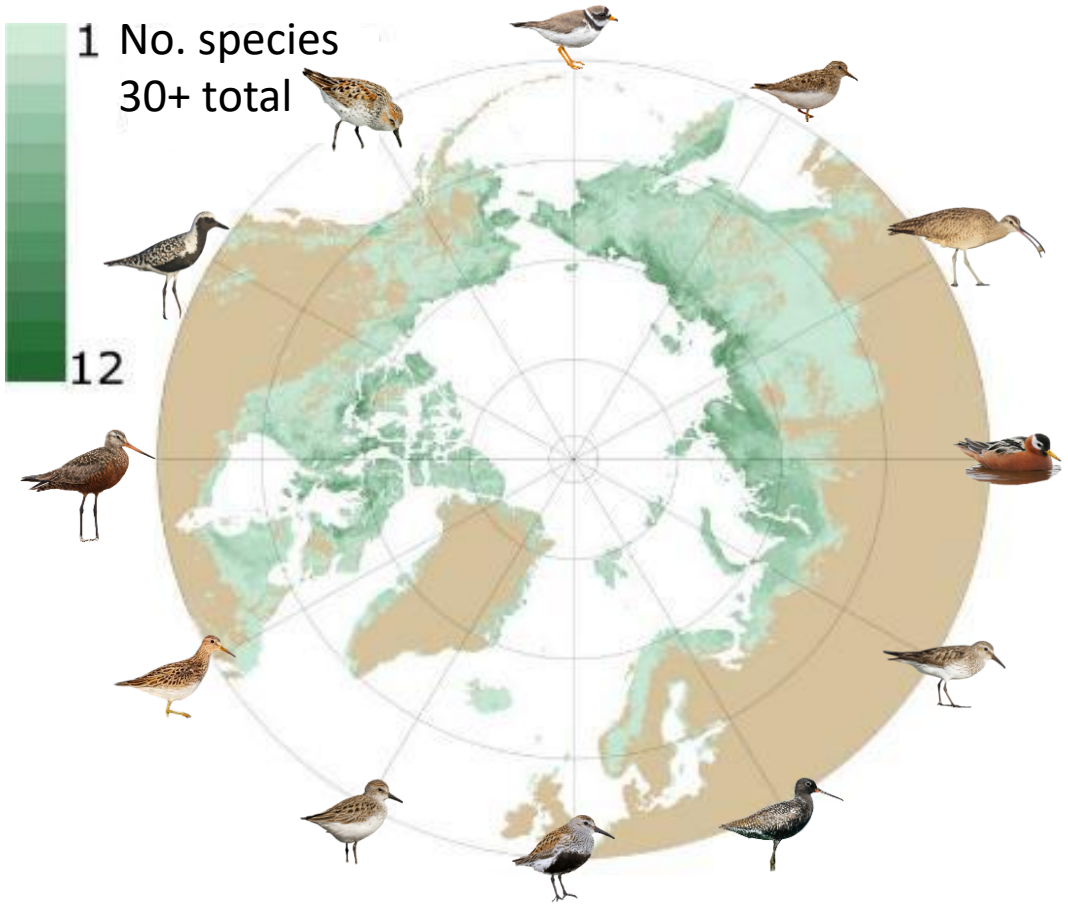
Norwegian Institute for Nature Research





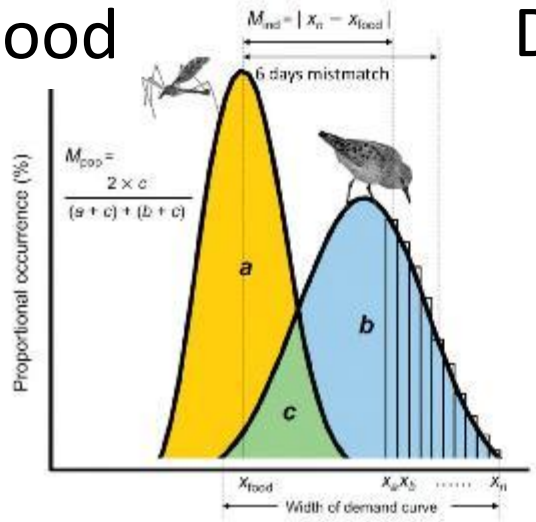

Arctic is a biodiversity hotspot with rapid environmental change

Species richness of arctic shorebirds

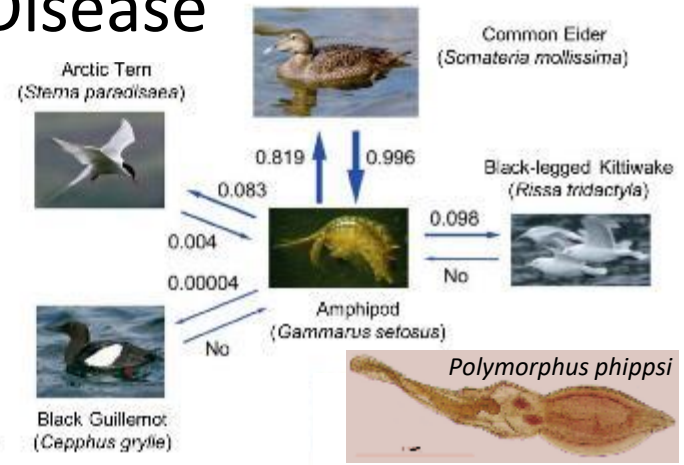


Wauchope *et al.* 2017 *Glob. Change Biol.*

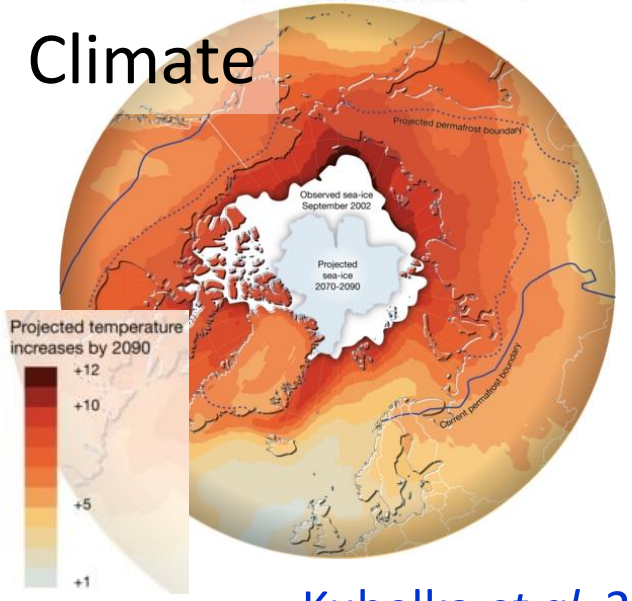
Food



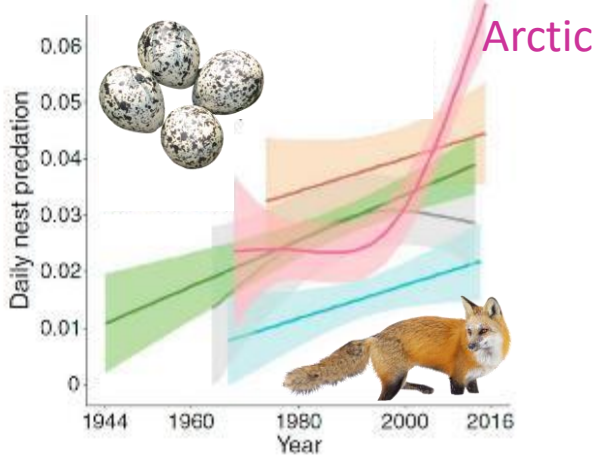
Disease



Climate

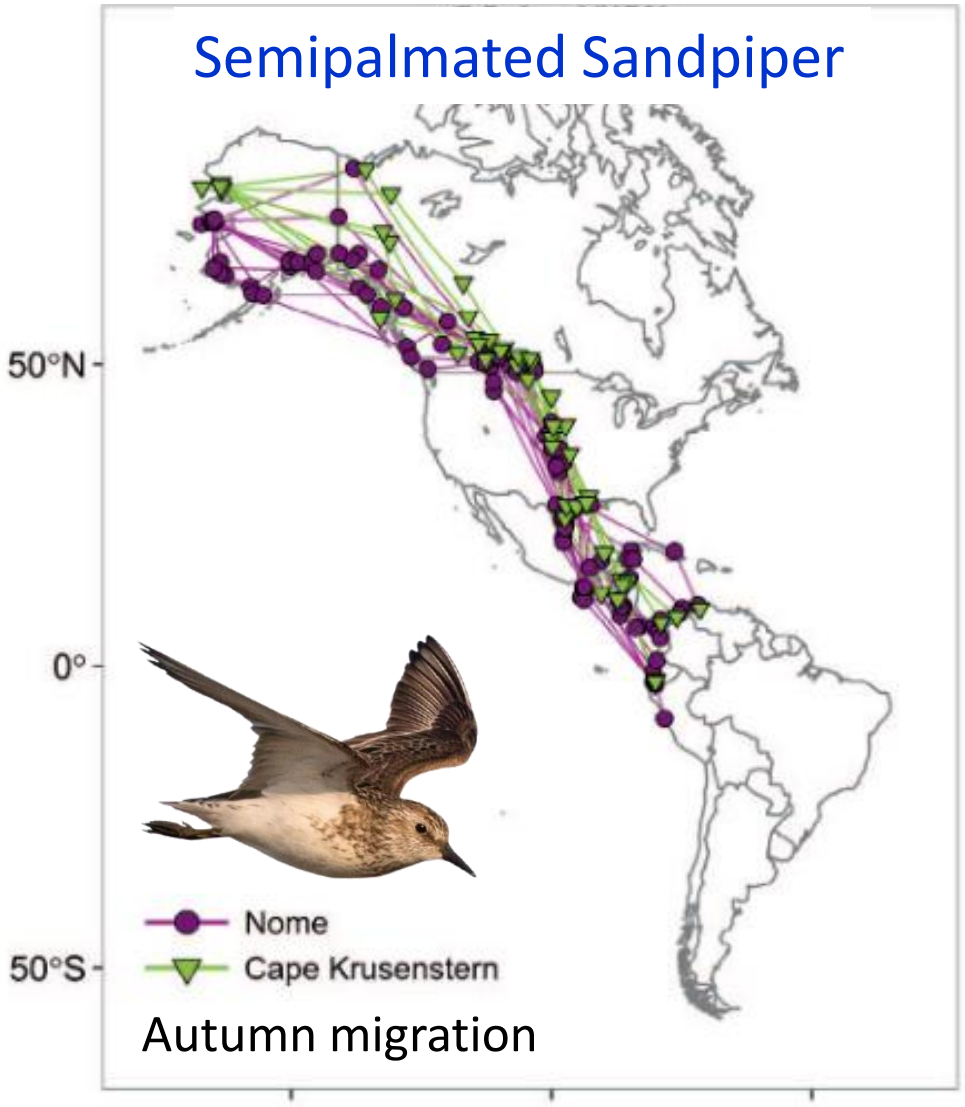


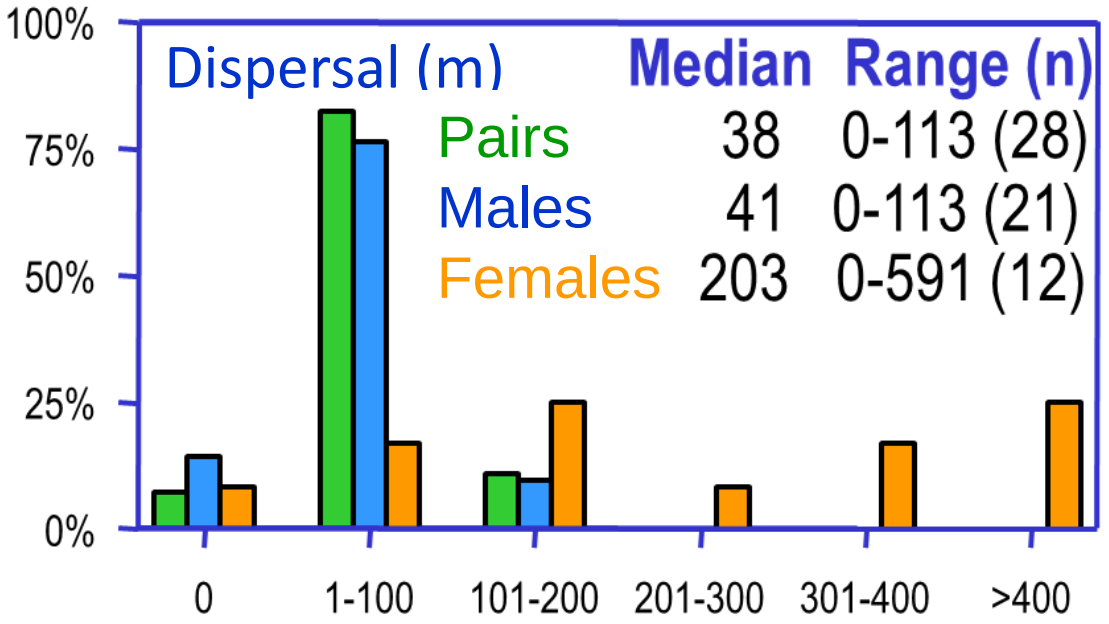
Nest predation

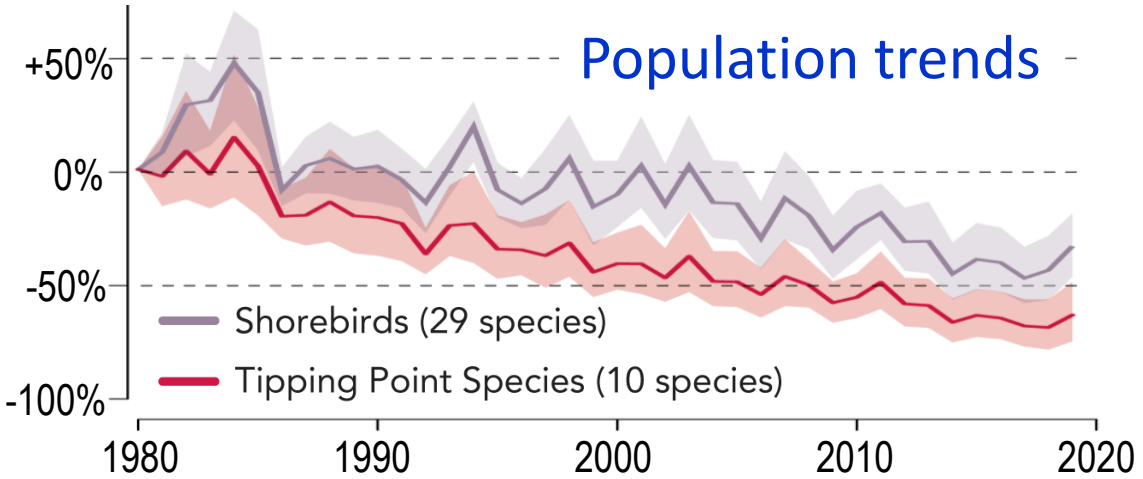


Kubelka *et al.* 2022 *Trends Ecol. Evol.*

Shorebirds migrate long distances but have strong site fidelity

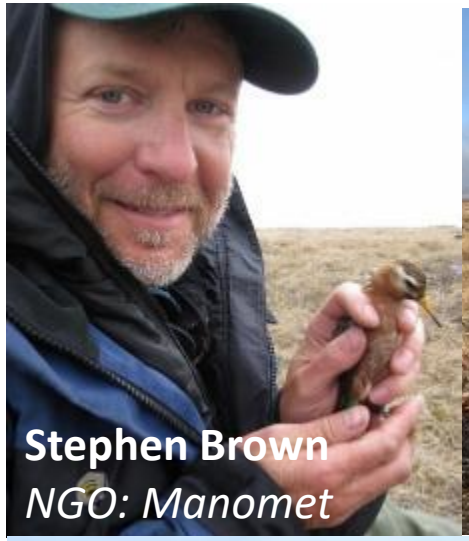






Sandercock *et al*. 2000 *Can. J. Zool.,* Brown *et al*. 2017 *Condor,* State of the Birds 2022

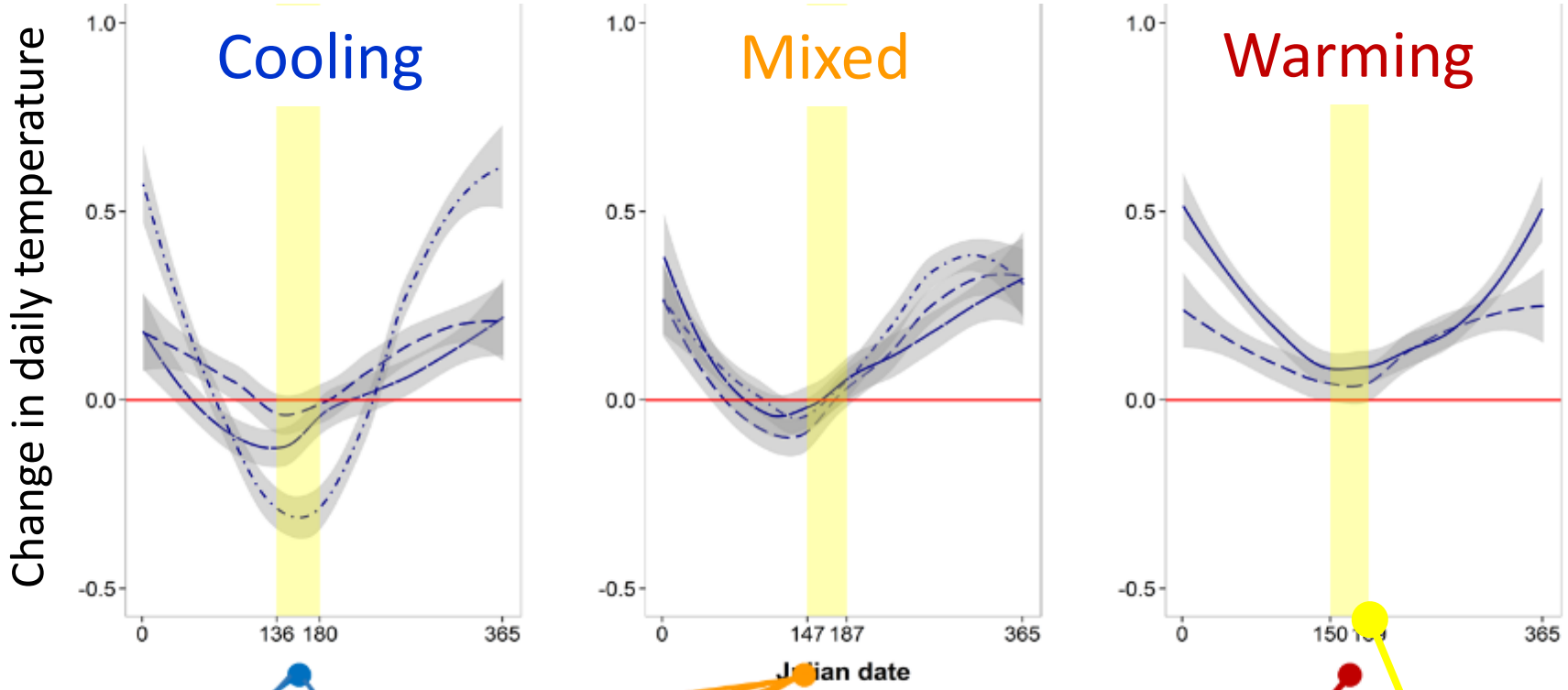
Arctic Shorebird Demographics Network

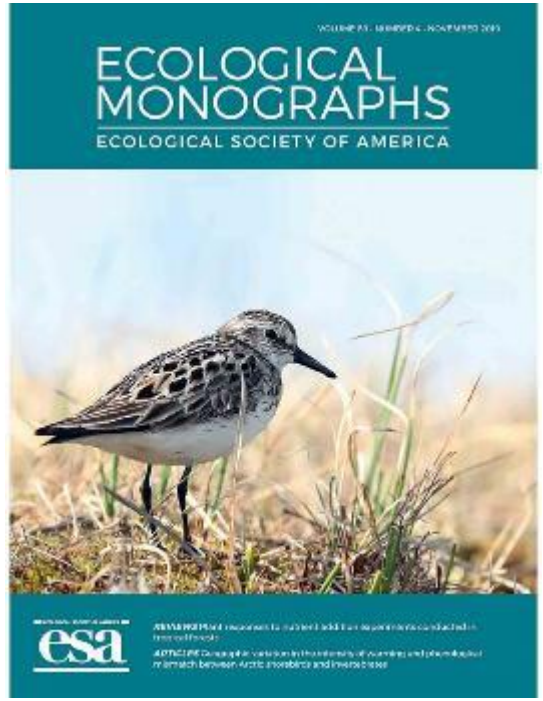


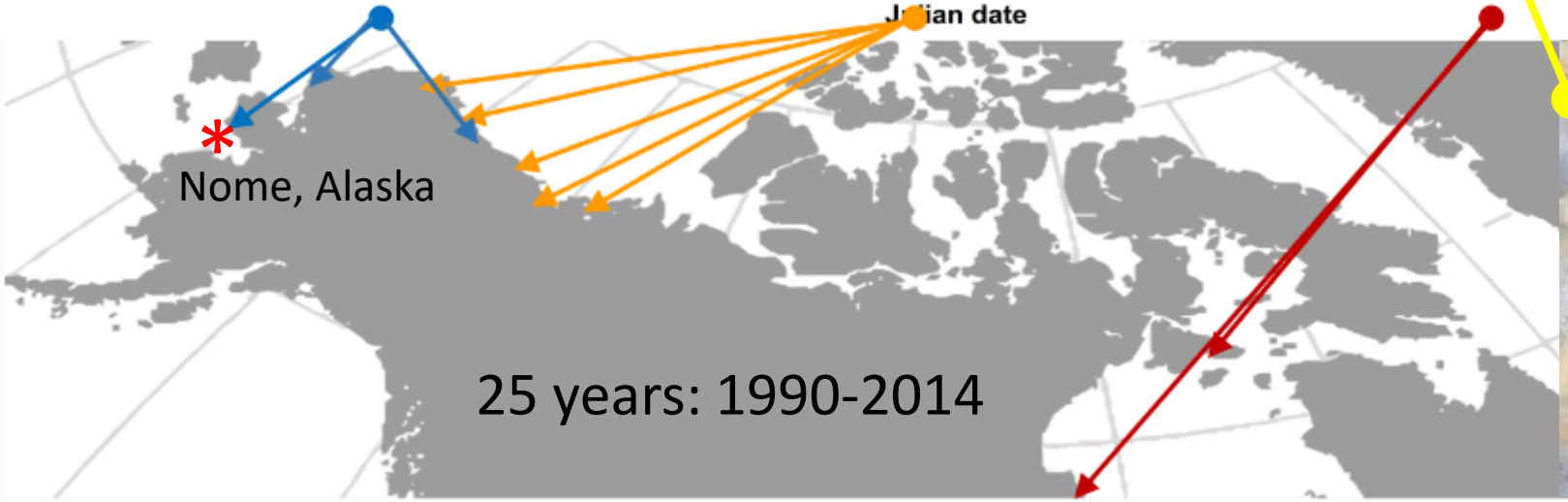
Research objectives

- *Climatic conditions*: timing of snowmelt, temperatures during breeding
- *Shorebird demography*: timing of breeding, clutch size, nest survival, and adult survival for 30+ species
- *Arctic animals*: timing of arthropods, numbers of lemmings and predators
- *Network projects*: population genetics, ecotoxicology, gut microbiomes, and migratory tracking

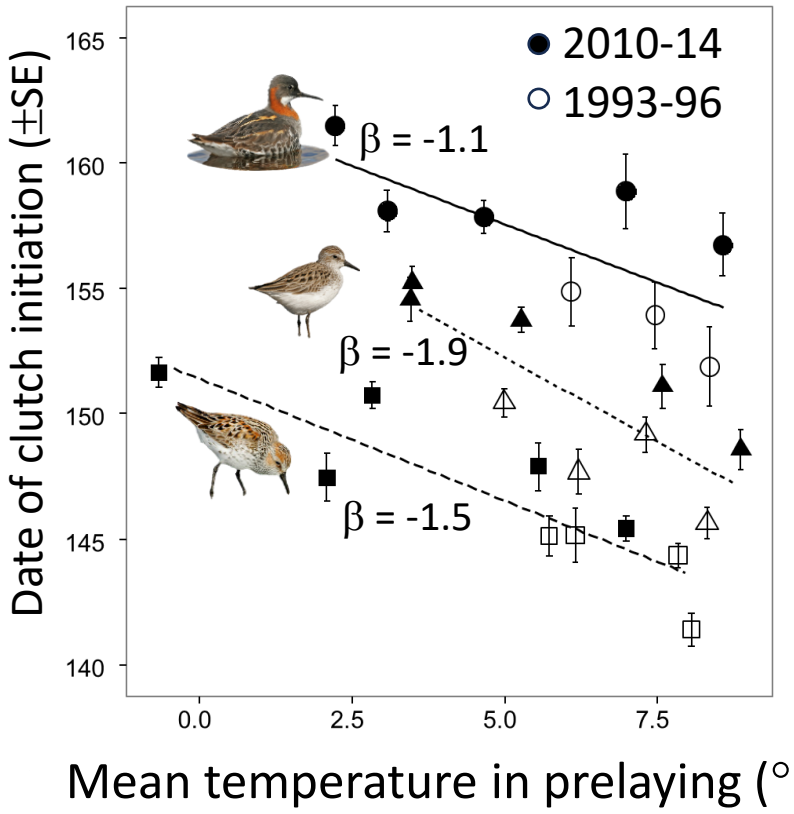
Patterns of climate change vary across the arctic

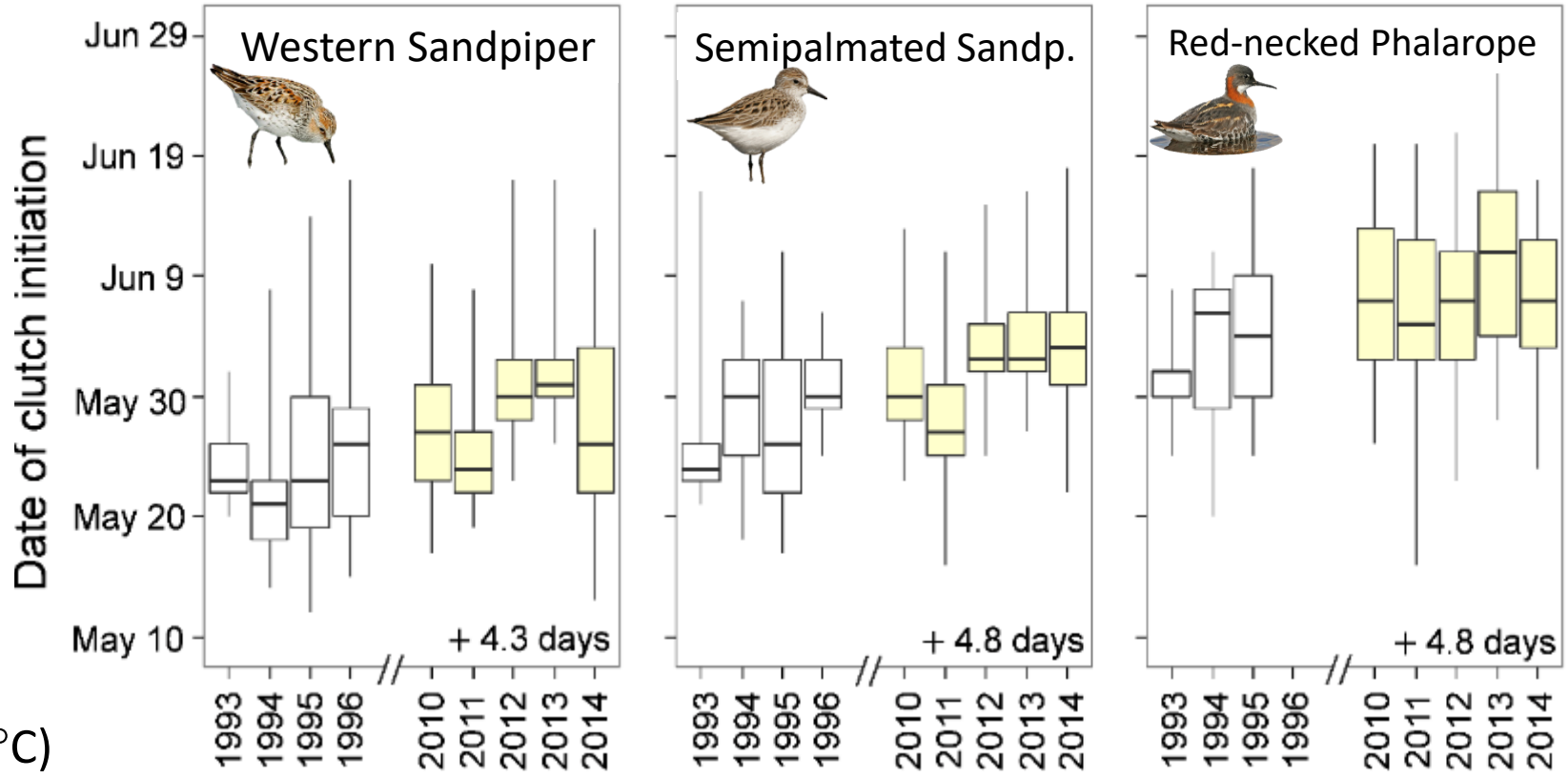






Climatic change affects timing of nesting at Nome, Alaska





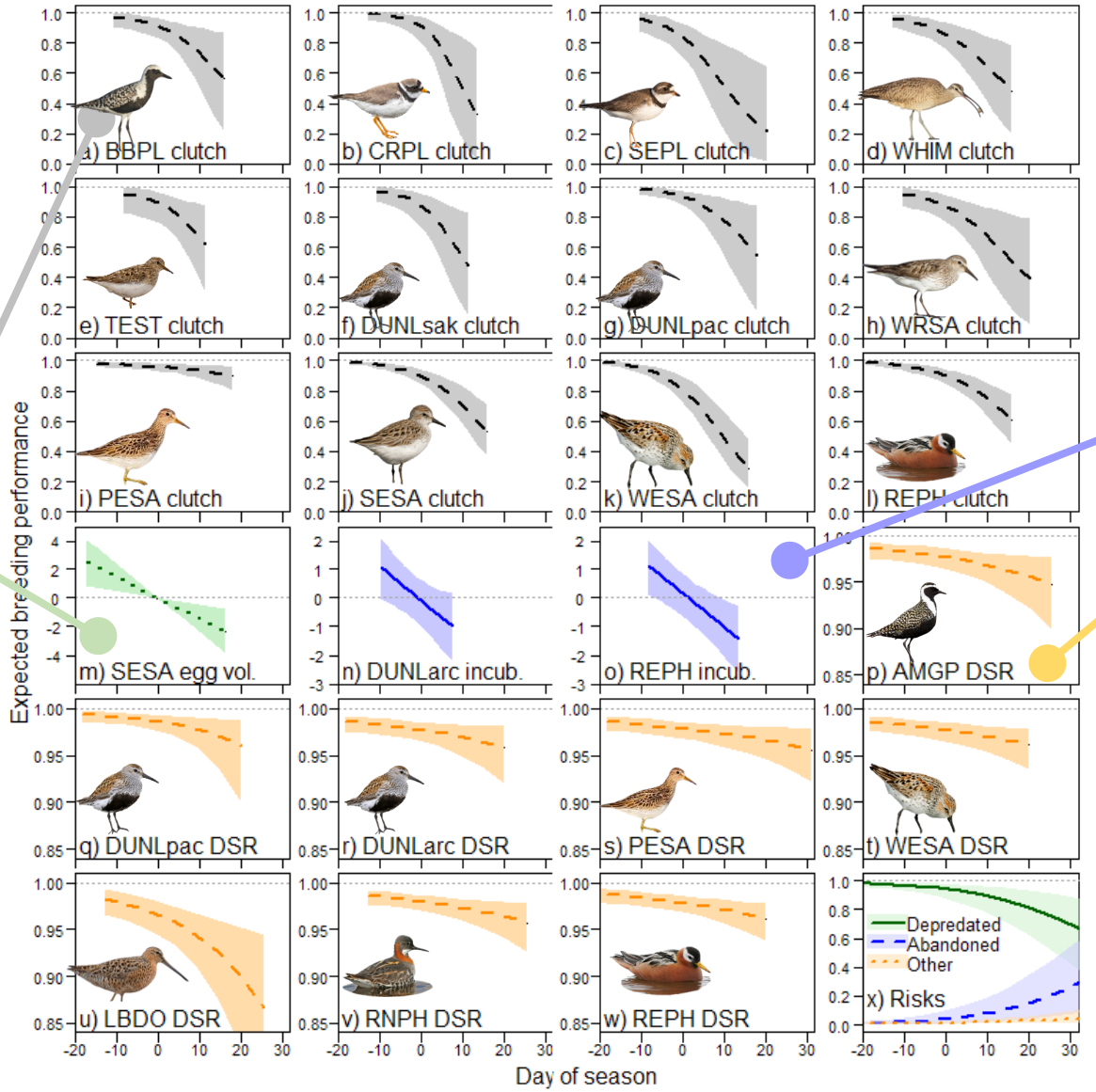
- Timing of nesting is determined by temperatures in prelaying
- Climatic cooling has delayed timing of nesting by 4-5 days

Kwon *et al.* 2018 *Ecol. Evol.*

Timing of nesting determines reproductive success

Clutch size

Egg volume

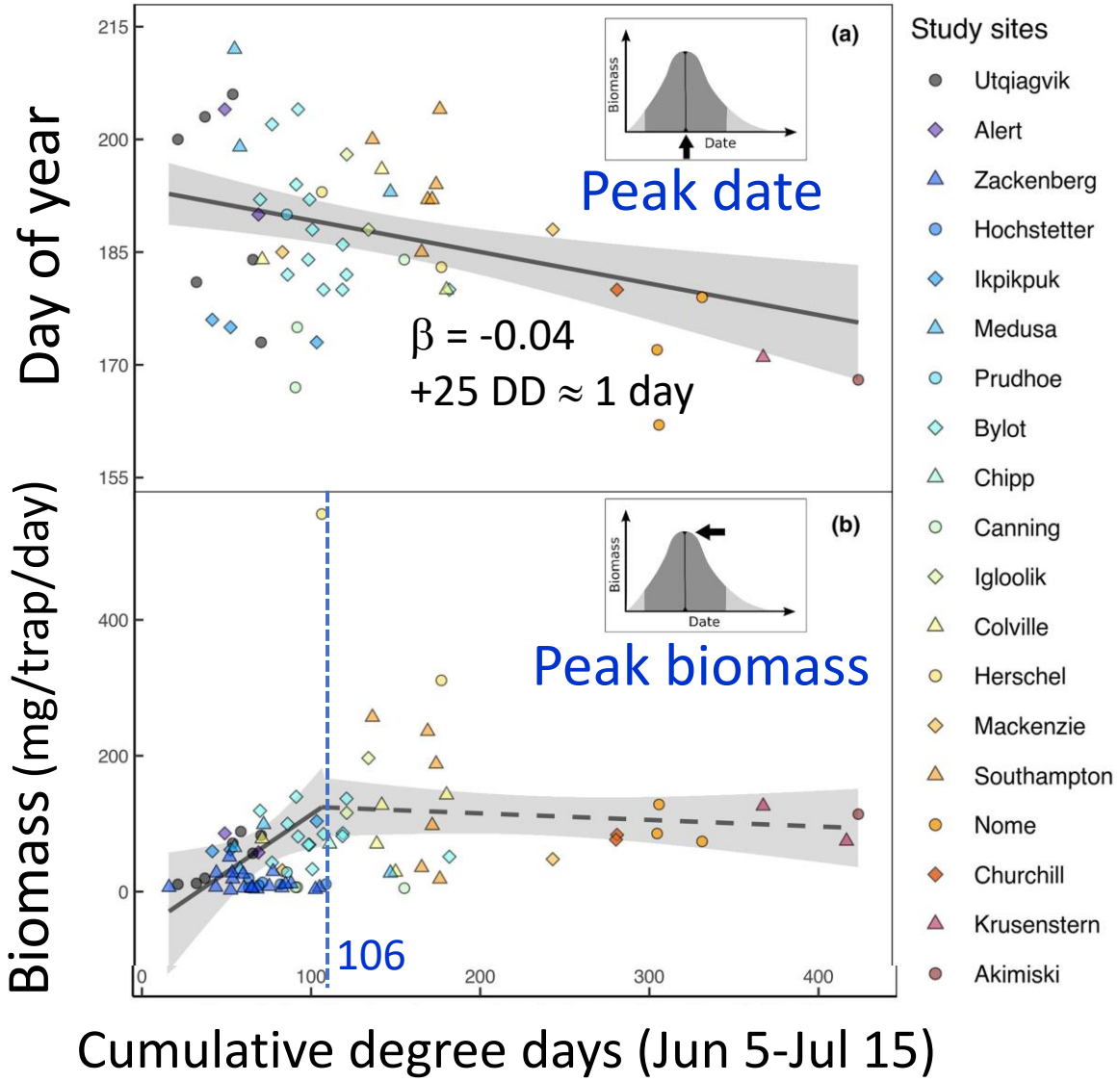


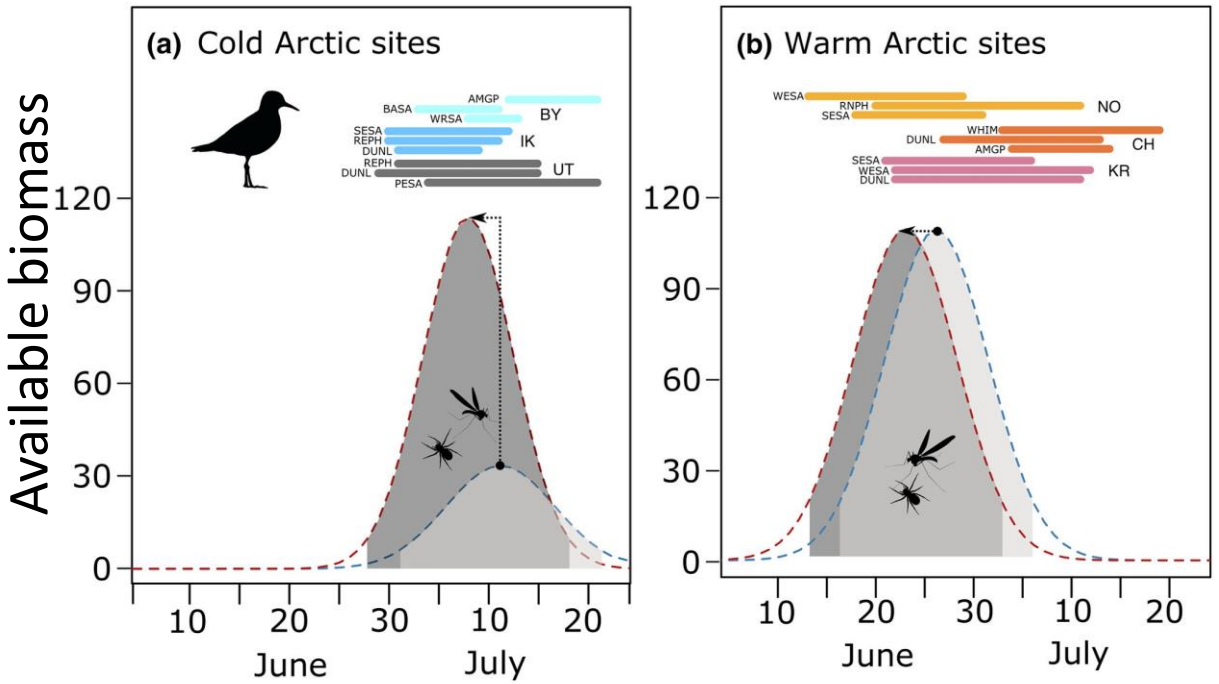
Incubation duration

Daily nest survival

Weiser *et al.* 2018 *J. Avian Biol.*

Climatic conditions drive timing and peak biomass of arthropods

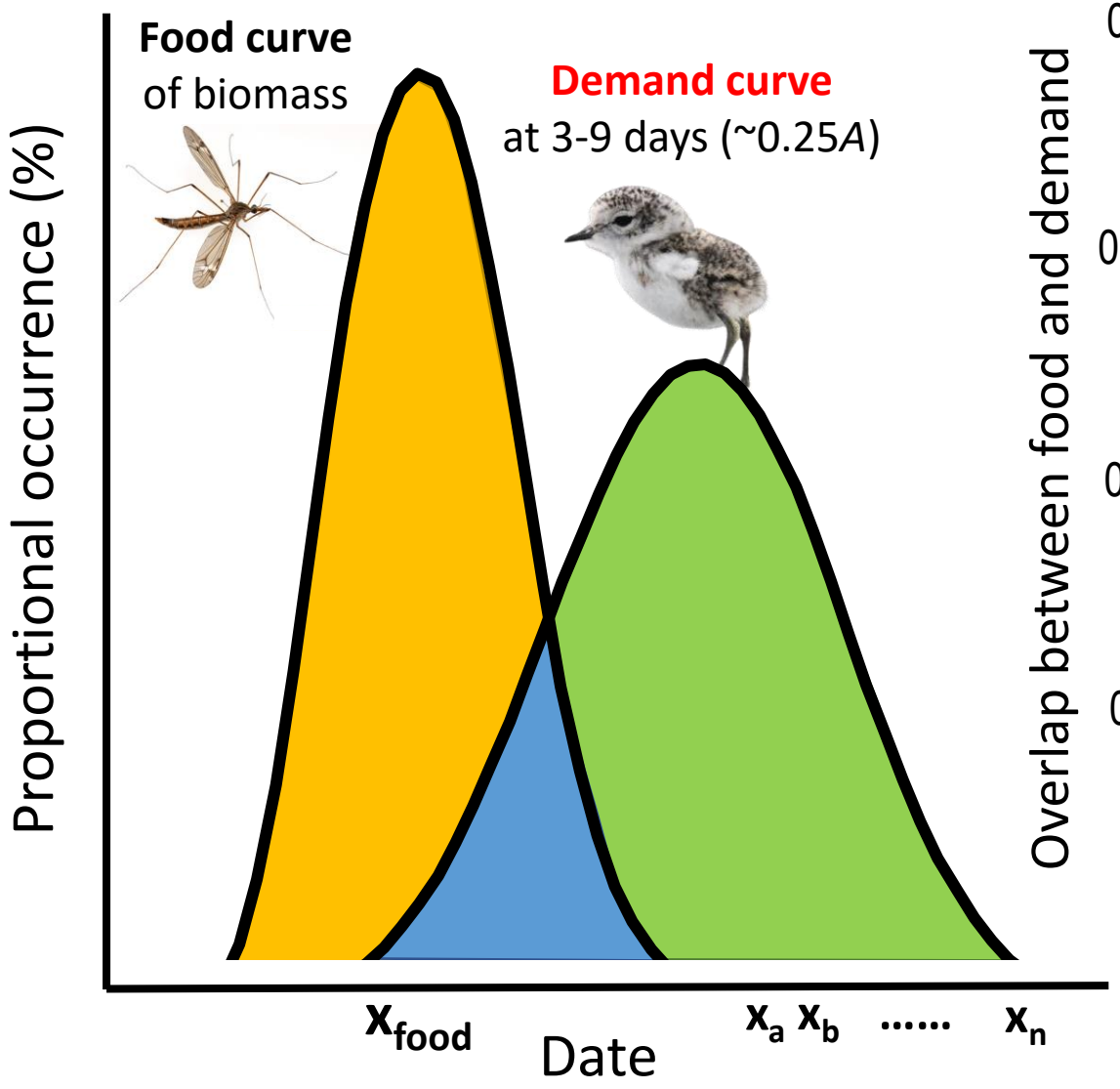


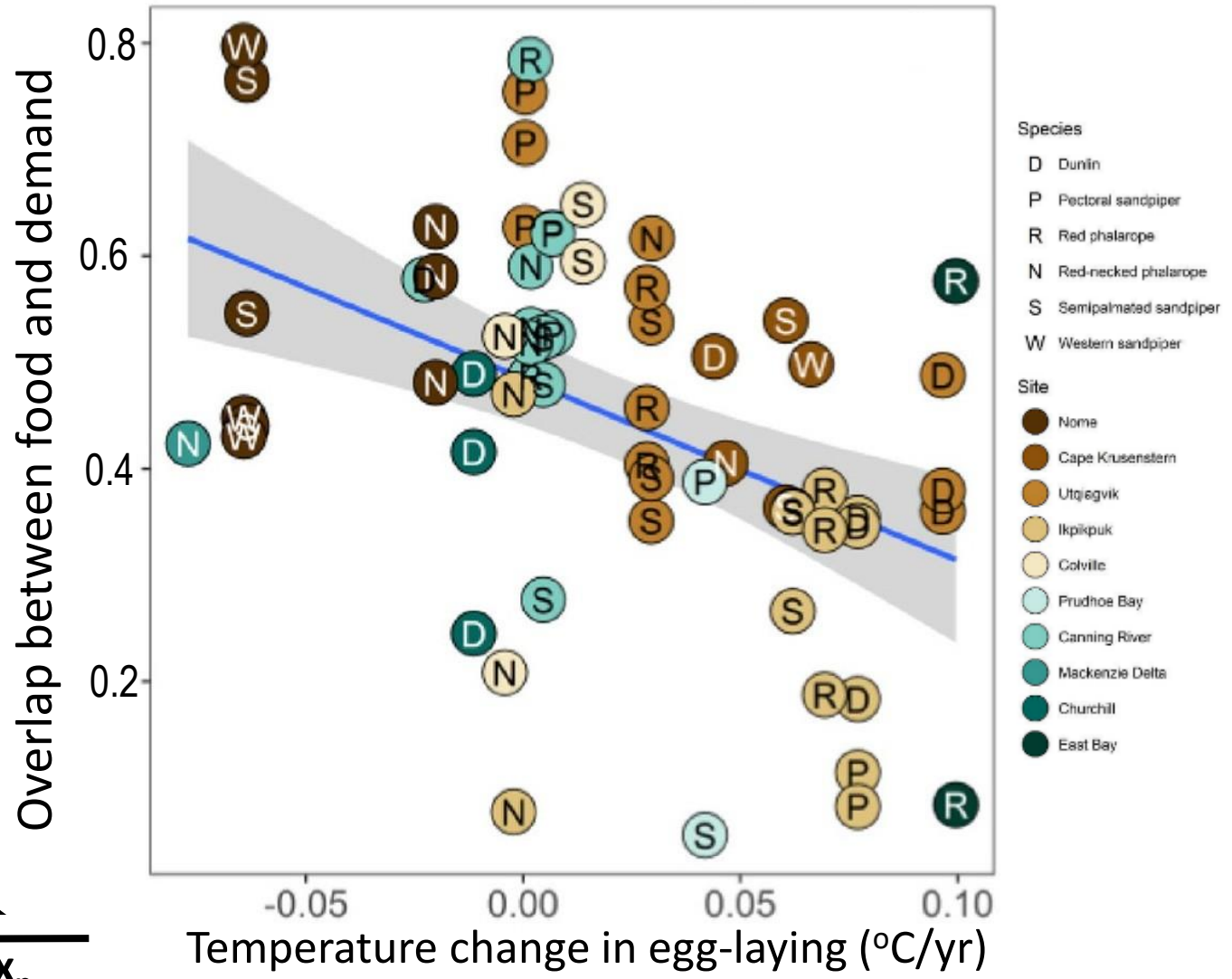


- Cold arctic sites: advances in timing of emergence and peak biomass
- Warm arctic sites: advances in timing of emergence only

Chagnon-Lafortune *et al.* 2024 *Glob. Change Biol.*

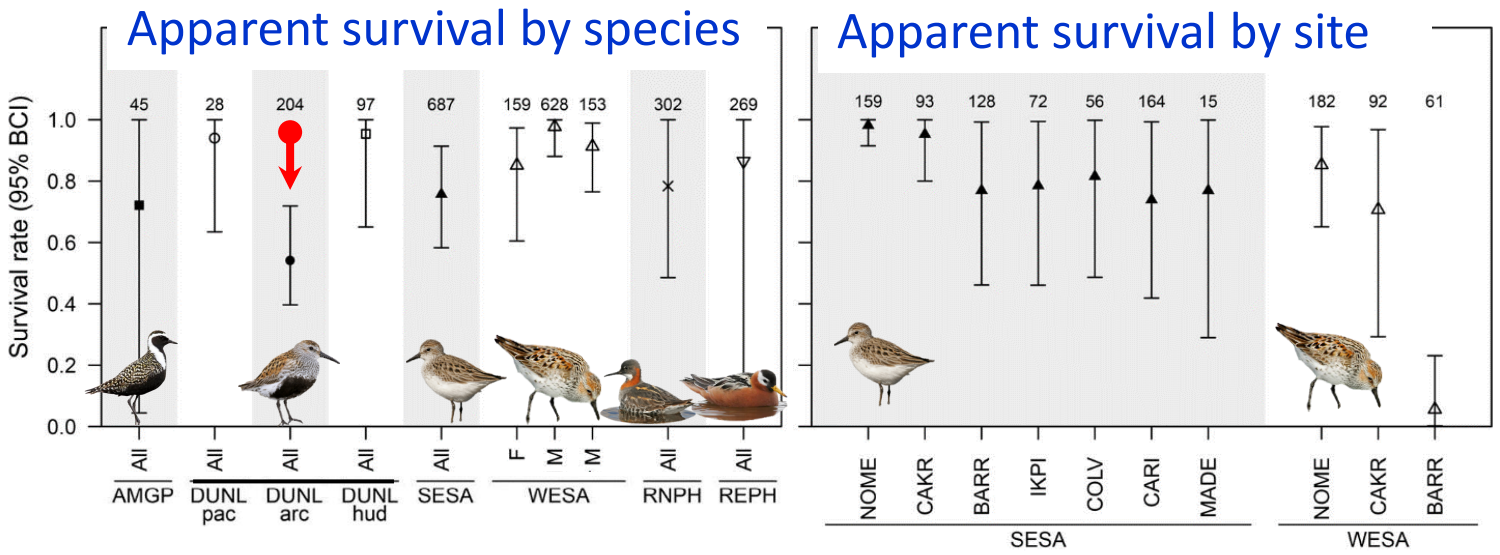
Increased mismatch between food availability and demand of young

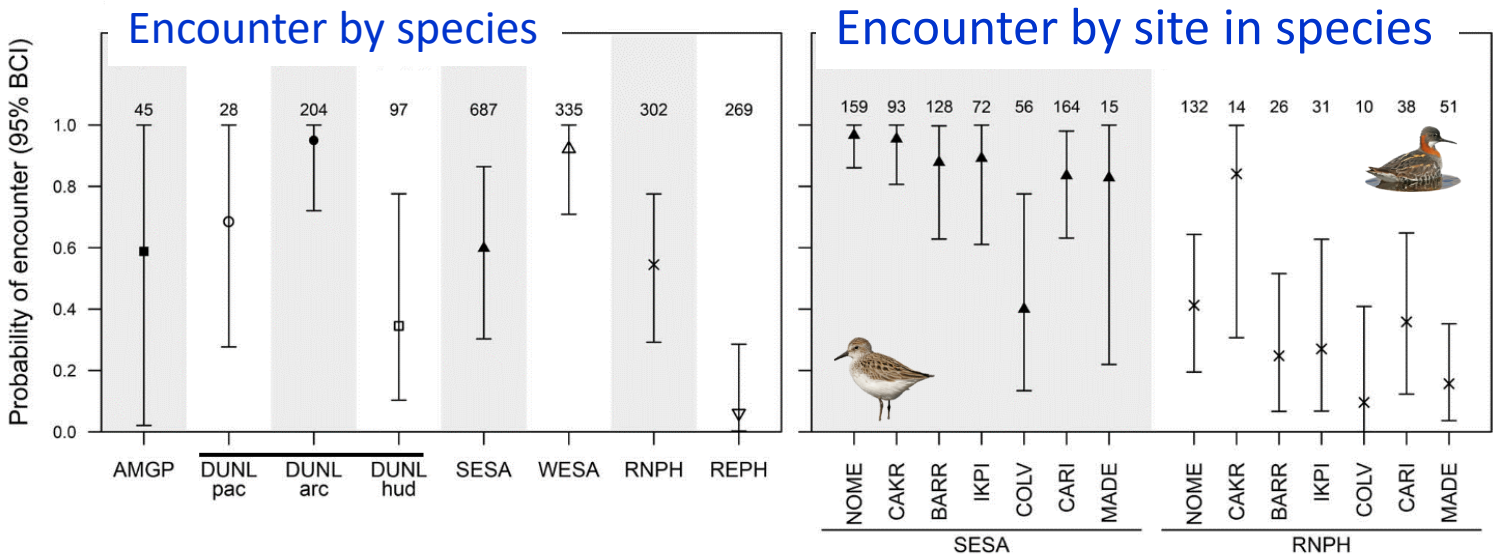




Kwon *et al.* 2019 *Ecol. Monographs*

Adult survival is buffered against environmental change





Weiser *et al*. 2018 *Auk*

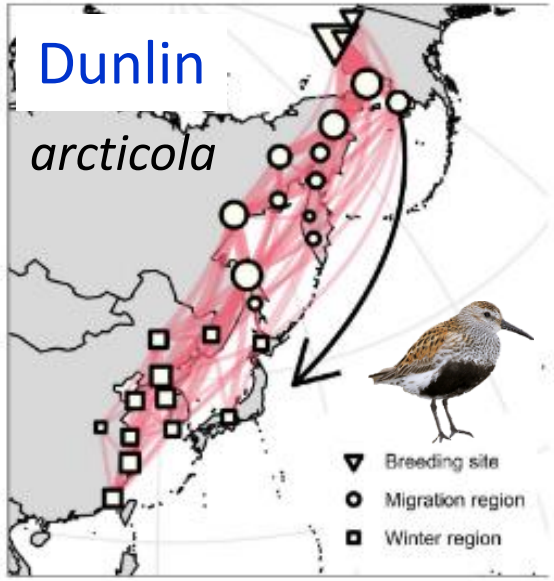
Lessons learned for migratory shorebirds

- *Slow life-history:* strong breeding site fidelity, fixed 4-egg clutch, high nest survival, and high adult survival
- *Climate change:* Temperature affects timing of nesting, seasonal declines in reproductive success, and mismatches between food and young

Knowledge gaps

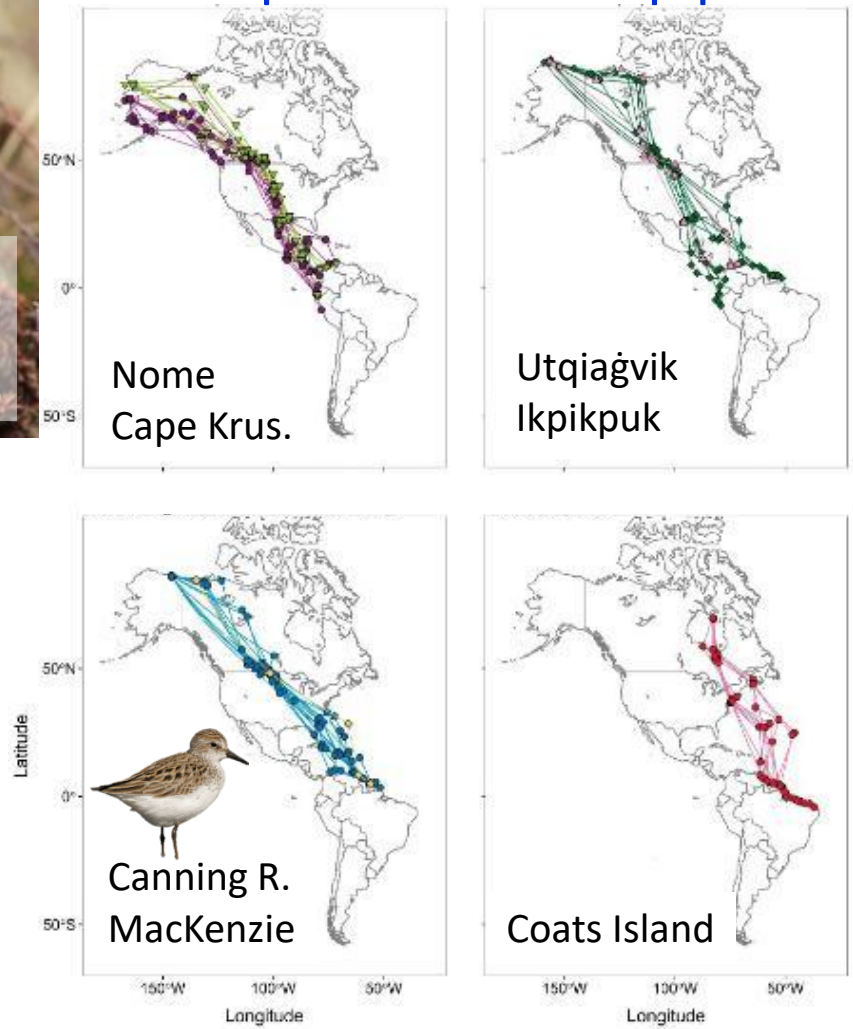
- *Events after hatching*: chick and juvenile survival are difficult to measure
- *Causes of mortality:* timing and drivers of population losses are unclear

Beyond the arctic to a full life-cycle perspective



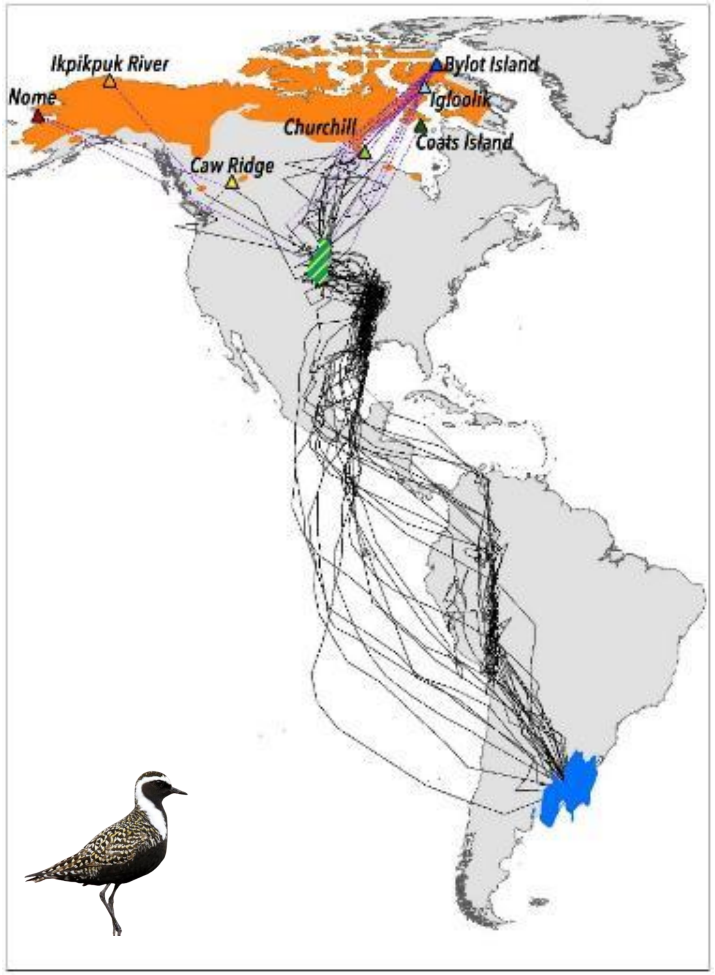
Lagassé *et al*. 2022 *Plos One*

Semipalmated Sandpiper



Brown *et al*. 2017 *Condor*

American Golden-Plover



Lamarre *et al*. 2021 *Front. Ecol. Evol.*

Lessons learned for conservation of migratory species

- *Block funding* was difficult to secure for network science
- *Simpler protocols* were easier to understand and follow in the field
- *Continuity* was a challenge for remote field sites in Alaska and Russia
- *Project success* was due to effective organization and goodwill among international research partners
- *Early career scientists* with strong quantitative skills were essential
- *Collaborative research networks* advance conservation science

Acknowledgments

Diverse funding sources

MANOMET Center for Conservation Sciences

K-STATE Kansas State University

U.S. FISH & WILDLIFE SERVICE

USGS science for a changing world

WILDLIFE CONSERVATION SOCIETY

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university of groningen
faculty of mathematics and natural sciences
centre for ecological and evolutionary studies

UQAR Université du Québec à Rimouski

SFU SIMON FRASER UNIVERSITY ENGAGING THE WORLD

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