How does shifting capelin biomass affect gull predation on seabird offspring?

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Background

Animal foraging behavior has a major impact on population dynamics

Optimal foragers maximize net energy gain (energy expenditure minus energy gained from prey) while foraging[1,2]

- Ability to respond to changes in prey population dynamics is important to fitness

Migratory prey species drive changes in the diet niche of Predators[3,4,5]

Fig. 1 On-shore capelin spawning site.

Capelin (*Mallotus villosus*)

- Keystone forage fish species on Northeast Newfoundland coast
- Acts as pulsed resource when migrates inshore to spawn
- Decreased biomass since significant population collapse[6]

Study Species

Fig. 2 Great black-backed gull (left) and European herring gull (right).

Great black-backed gull (*Larus Marinus*) and **European herring gull** (*Larus argentatus*) are colonial central place foragers

- Surface-feeders
- Dietary generalists:
  - Spawning capelin
  - Seabird eggs and chicks[7]

Black-backed gulls larger, more intimidating than herring gulls

- Less risk of injury during predation of seabird offspring

Fig. 3 Common murre breeding colony and close-up.

Common murre (*Uria aalge*):

- Dive up to 200m
- Lay one egg per year
- Abundant near Newfoundland gull breeding colonies

Objective, Hypothesis & Prediction

Determine how gull predation of murre offspring and kleptoparasitism of adult murres changes before and after capelin arrival

Hypothesis: Capelin inshore arrival influences rates of gull predation and kleptoparasitism on common murres

Prediction: Capelin arrival will cause a shift from high gull predation of murre eggs to high kleptoparasitism and lower predation of murre chicks

Study Site & Methods

Study site:

- Northeast Newfoundland coast
- **South Cabot Island** murre colony (10,000 breeding pairs)
- Observations from North Cabot Island gull colony

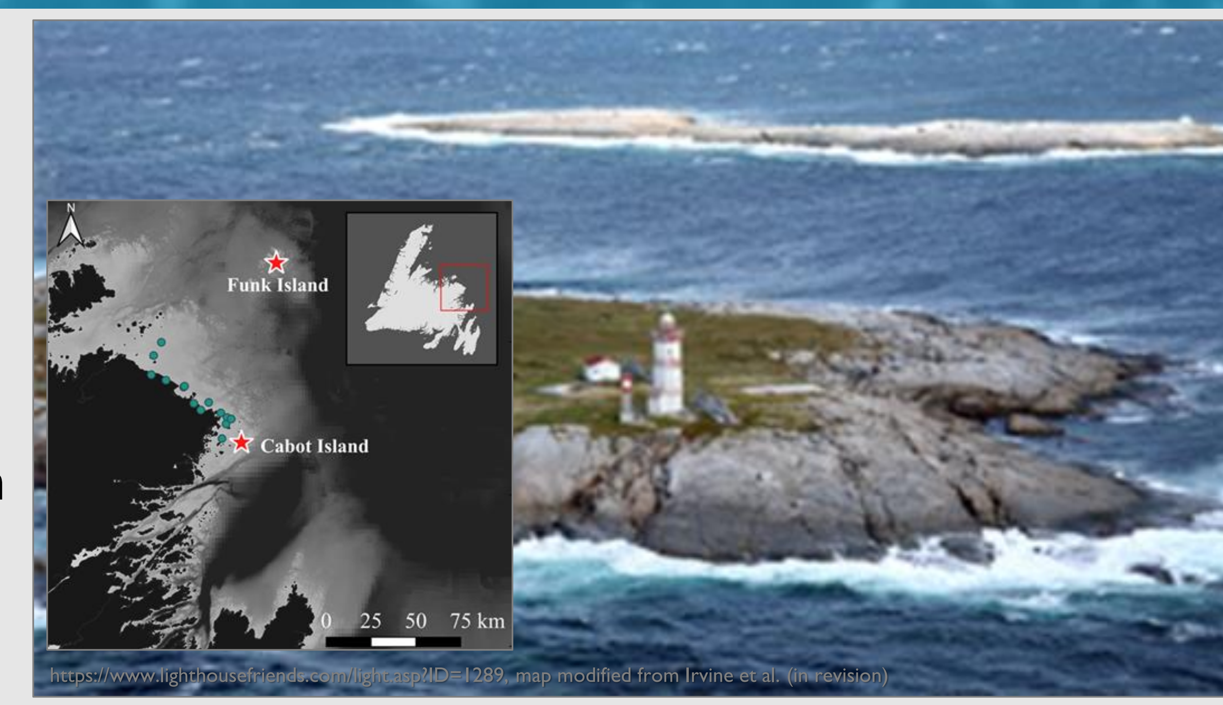

Fig. 4 Aerial shot of North (bottom) and South Cabot Island (top) with a map of Northeast coast of Newfoundland. Murre breeding colonies (red stars) and annually persistent capelin spawning sites (blue circles).

Study period:

- Before and after inshore arrival of capelin (Fig. 5)
- Annually persistent capelin spawning sites monitored for inshore arrival
- Capelin spawning begins before murre hatching

Survey methods:

Scans: count all gulls on South Cabot by spotting scope

- Focus on single field of view for 60s, record number and species of gulls present, proximity to murres, and behaviours
- Shift field of view until entire island scanned

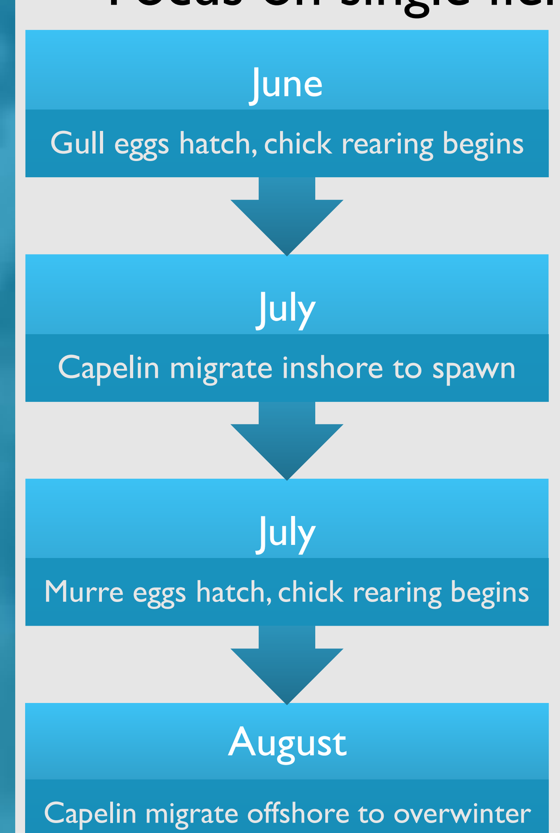

Fig. 5 Timeline of seabird hatching and capelin migration.

Focal observations: pick one gull, record behaviours for 10min

Behaviours recorded:

- Non-aggressive: flying, walking, on water, preening, foraging, or social behavior
- Aggressive: attempted or successful predation of egg/chick, attempted or successful kleptoparasitism, hovering over or walking in murre colony

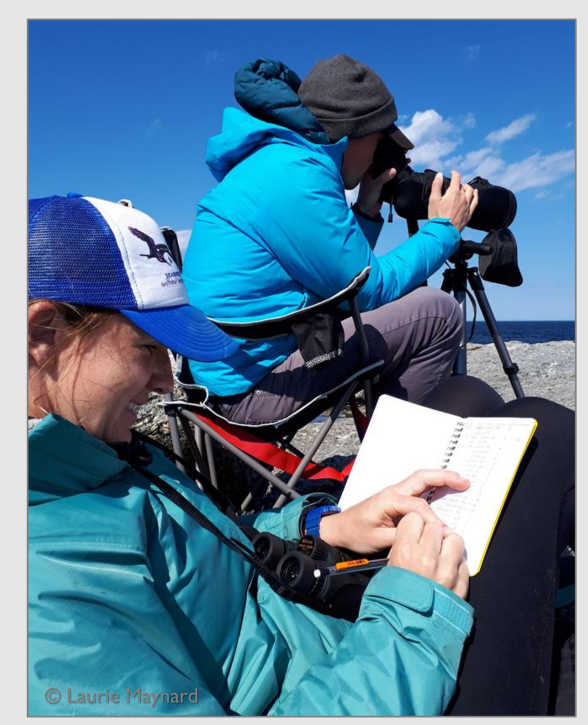

Fig. 6 Observations from N. Cabot Island.

Expected Results

Inshore arrival of capelin results in:

- Decreased predation on murre offspring and increased kleptoparasitism by herring gulls
- Continued predation of murre offspring and low rates of kleptoparasitism by black-backed gulls
- Both species maintain a similar proportion of time spent in aggressive behaviours

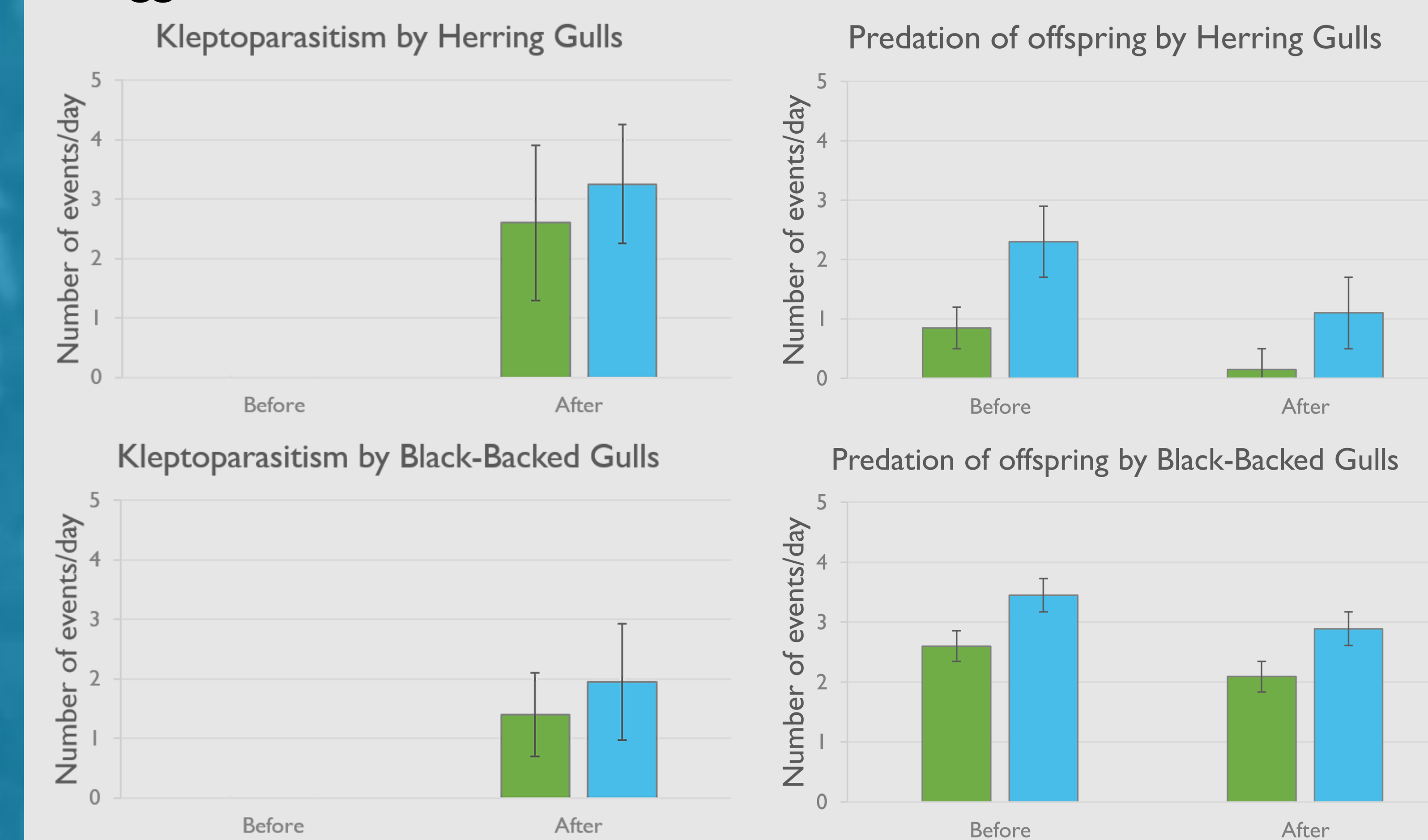

Fig. 7 Mean daily successful (green) and attempted (blue) kleptoparasitism and predation events by herring and great black-backed gulls before and after inshore capelin arrival on the Newfoundland coast.

Conclusion & Relevance

Changing abundance of keystone prey species puts strain on ecosystems

- Shifting gull predation in response to capelin population collapse is potentially damaging to murre populations

Results of our study can be used to inform gull management programs (e.g. culling of adults, eggs and/or nest removal) on the Newfoundland coast

References

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