

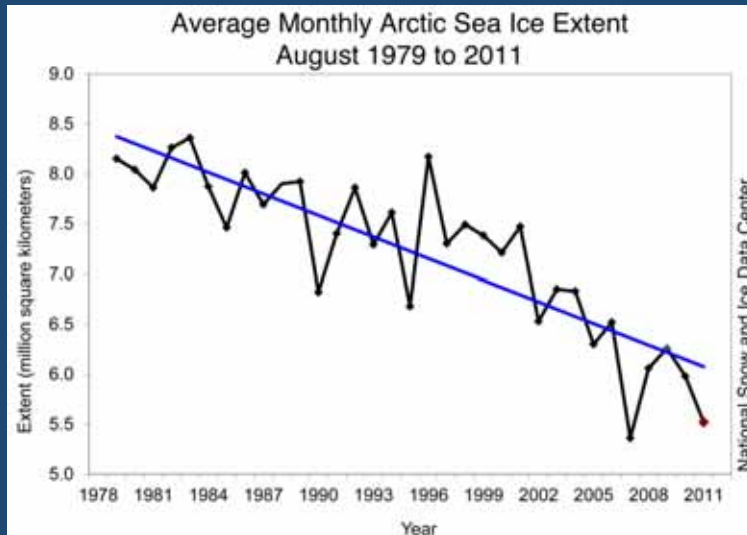
A photograph of two seabirds, likely Arctic Skuas, perched on a small, melting ice floe in the Arctic. The birds are silhouetted against the bright, overcast sky. The ice floe is surrounded by dark, calm water, and its reflection is visible. The overall scene is somber and highlights the impact of climate change on Arctic ecosystems.

Shifting Prey in a Melting Arctic

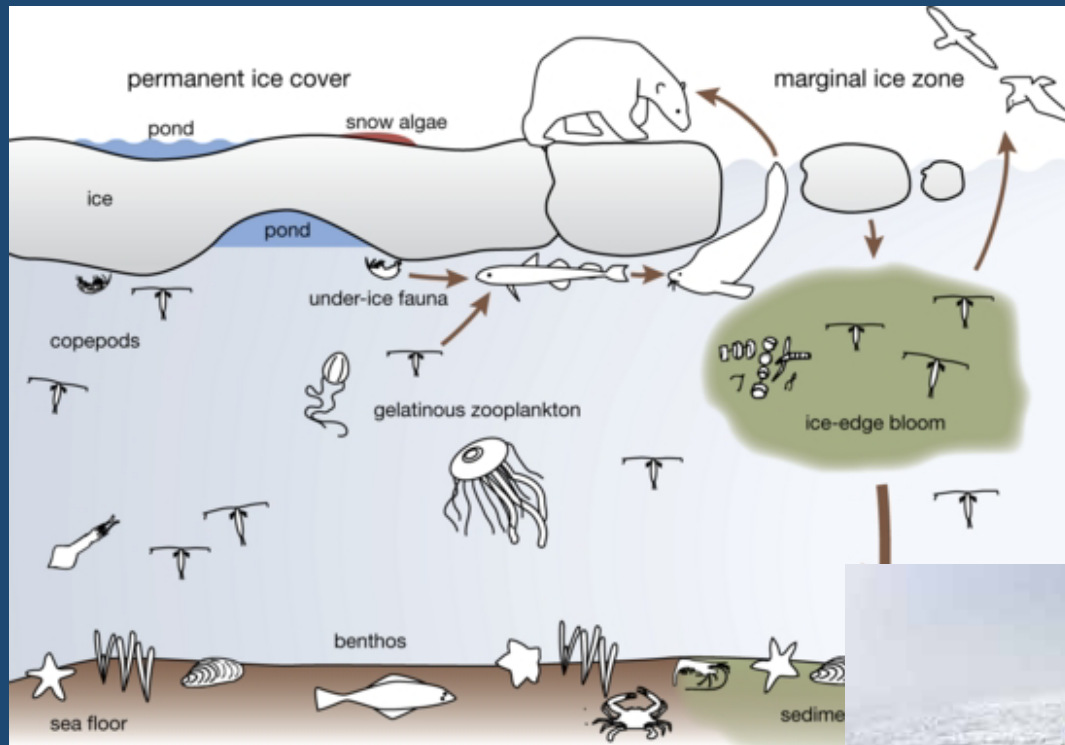
Breeding seabirds adapt to the loss of summer ice

G. J. Divoky

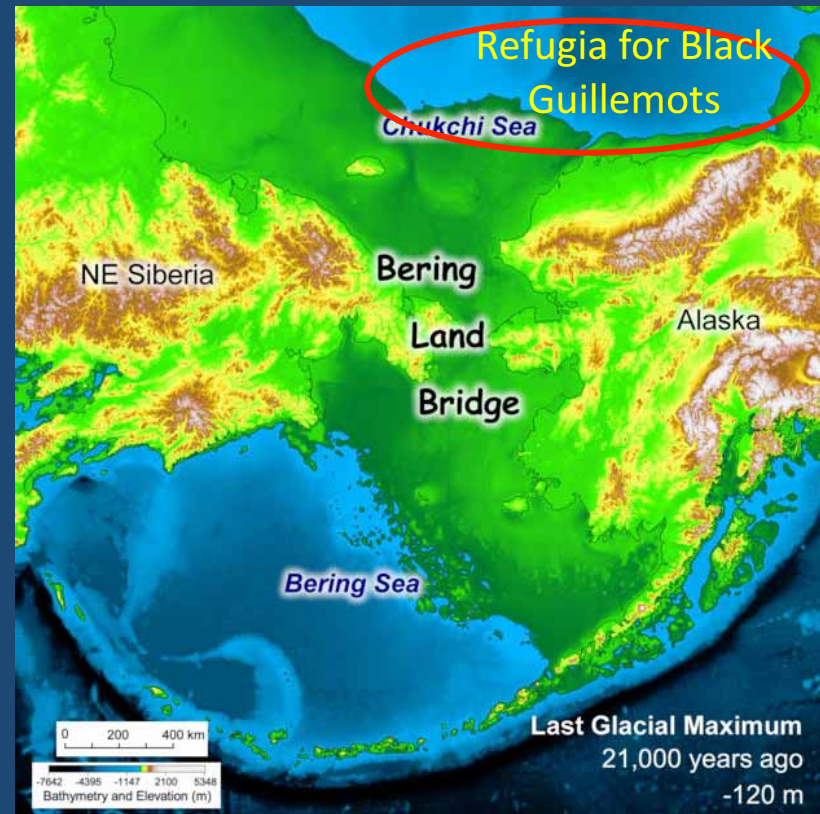
Friends of Cooper Island
Seattle, WA



The Arctic's cryopelagic ecosystem



The Black Guillemot a cryopelagic seabird



The Black Guillemot experienced a bottleneck in the Western Arctic during the Last Glacial Maximum when region was unglaciated but not ice-free

Point
Barrow

Cooper
Island

March 2006



Cooper Island

a two-mile long barrier island in the Western Beaufort Sea



Black Guillemots are opportunistic cavity-nesting seabirds that breed in boxes on Cooper Island



Ten pairs of guillemots found breeding in boxes on Cooper Island in 1972



**Nest-site creation program
began in 1972**



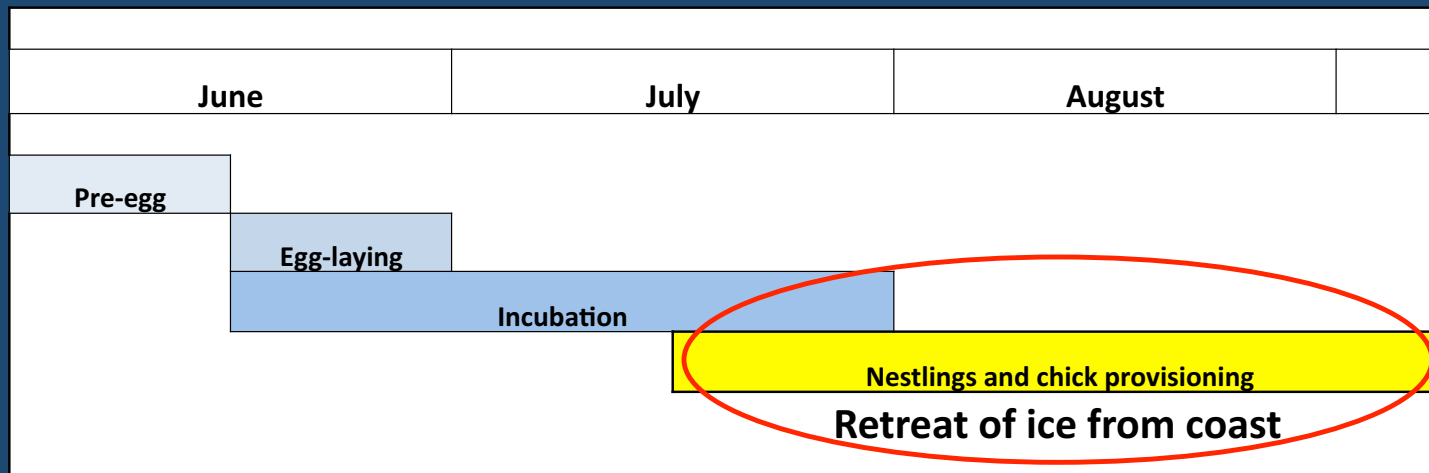
Creation of nest sites increased colony size to >150 breeding pairs and is largest (and least attractive) Black Guillemot colony in Alaska

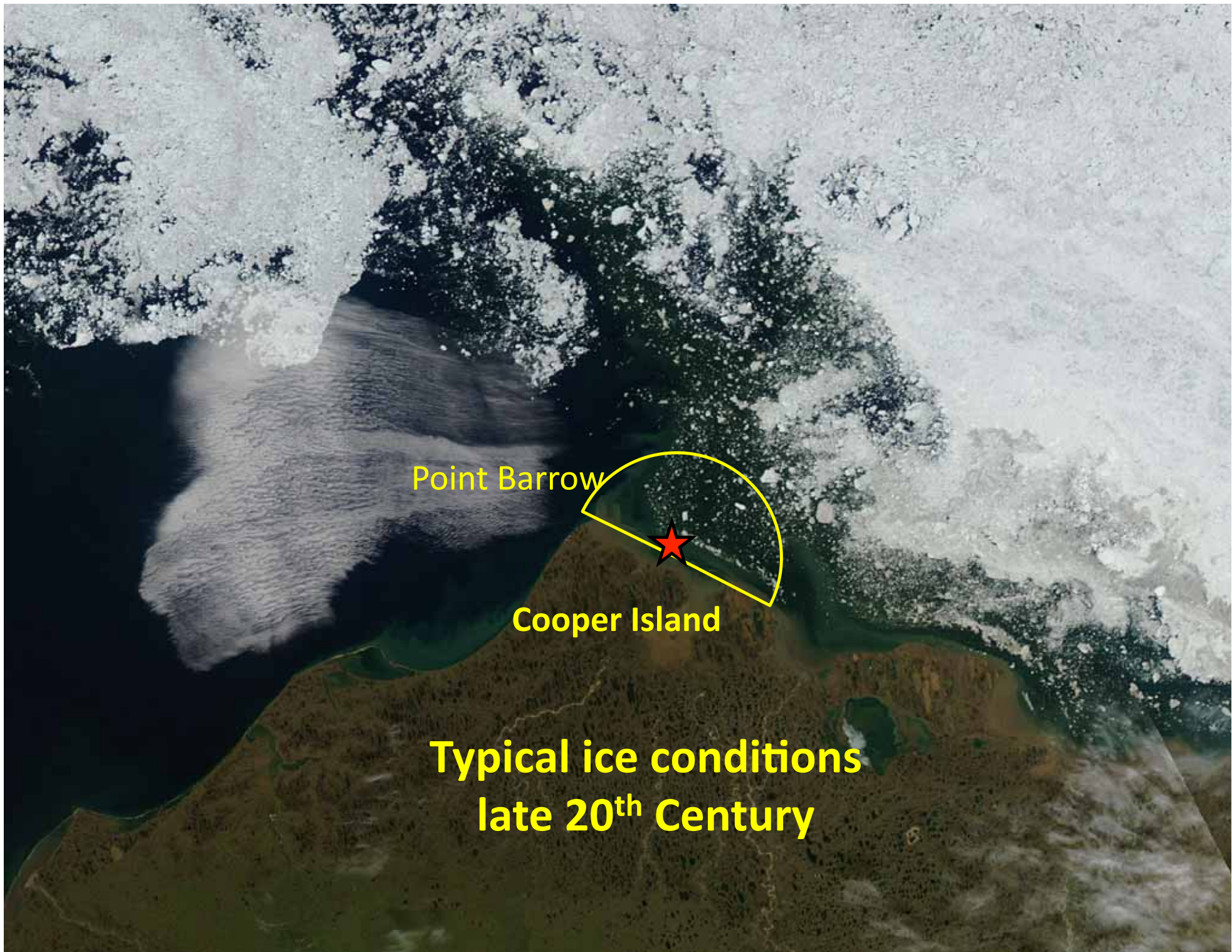


All nest contents on Cooper Island easily accessible for measurement



Black Guillemot Breeding Season in the Alaskan Arctic





Point Barrow

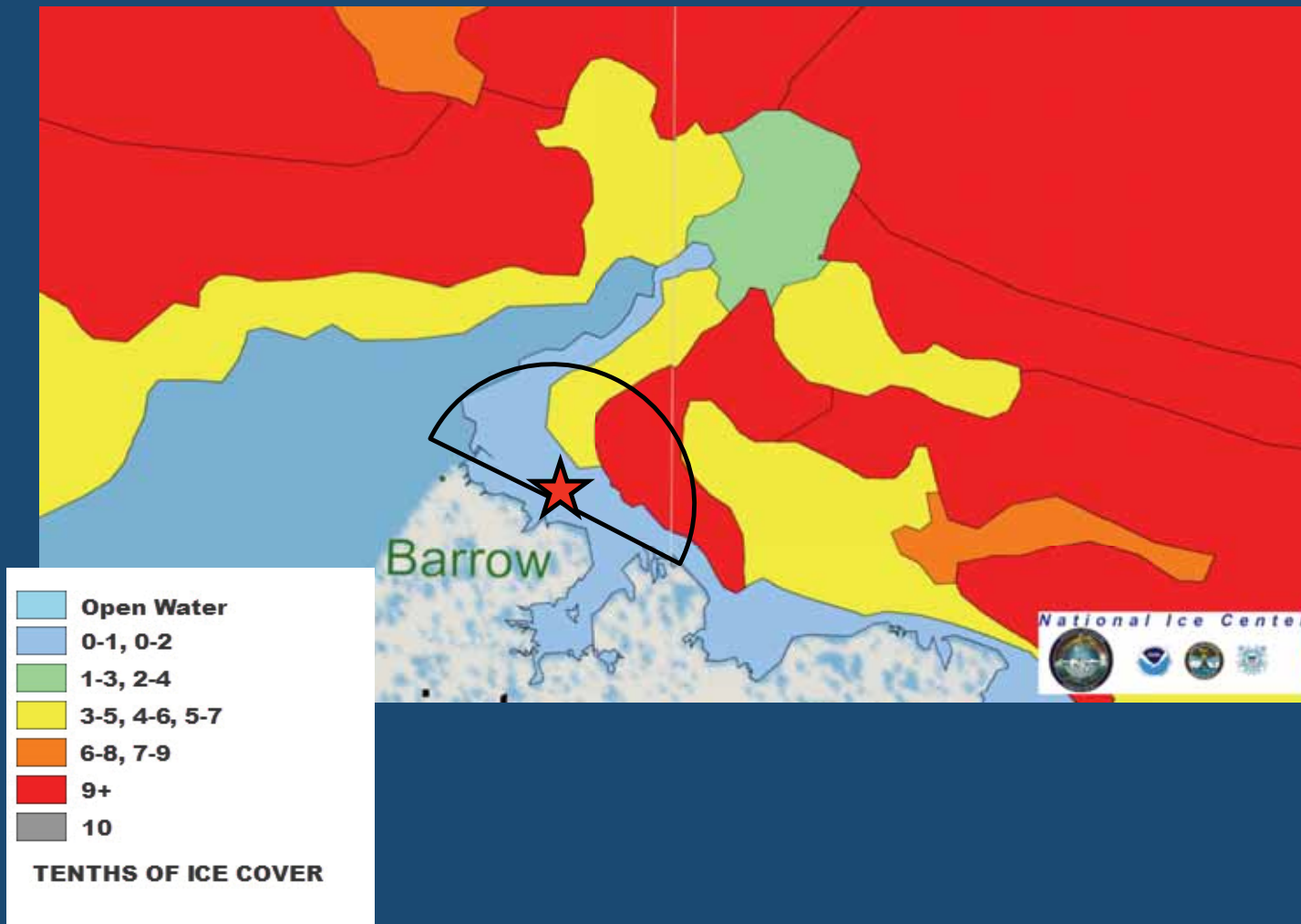
Cooper Island

Typical ice conditions
late 20th Century

**From 1975-2001
parent guillemots fed
their young Arctic Cod
almost exclusively**



Foraging Range of Black Guillemots on Cooper Island approximately 40 km





Typical prey selection for parent guillemots provisioning nestlings 1975-2001



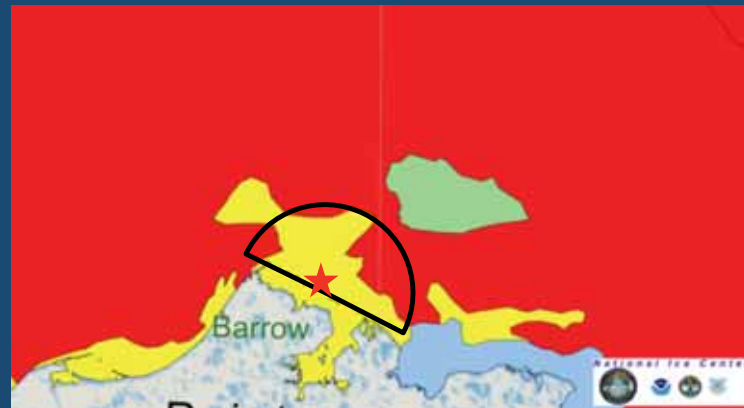
Percent of observed fish per day

20 JULY

Hatching



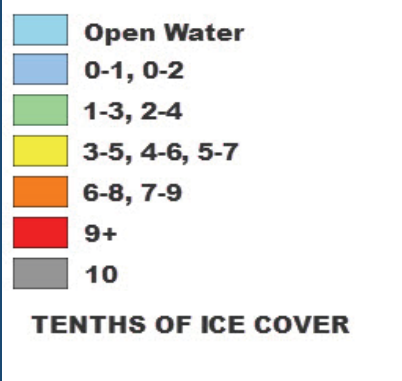
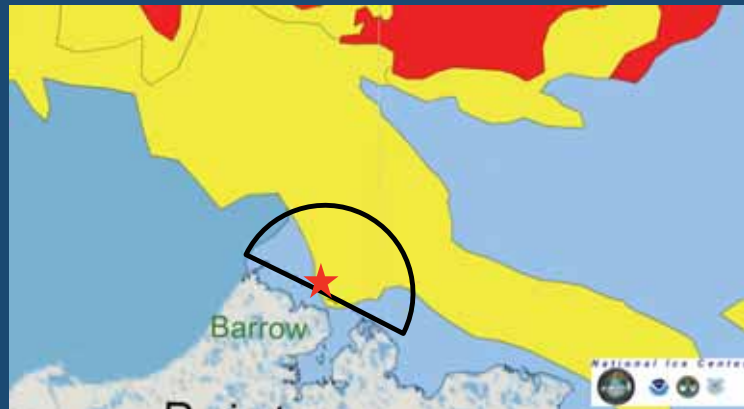
2006



2007



2011



1 AUGUST

Early growth
with some
hatching

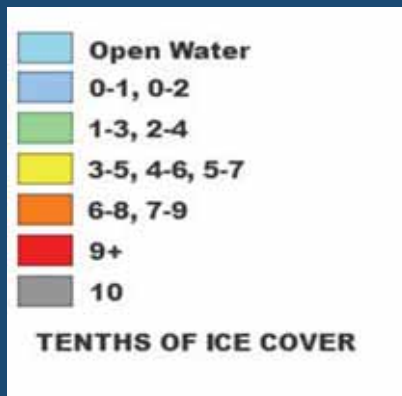
2006



2007

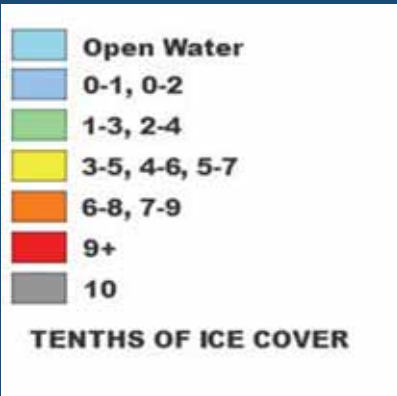


2011



15 AUGUST

Rapid nestling growth



2006



2007



2011



1 SEPTEMBER

Chicks at maximum weight and fledging



2006



2007



2011



Arctic Cod
cryopelagic





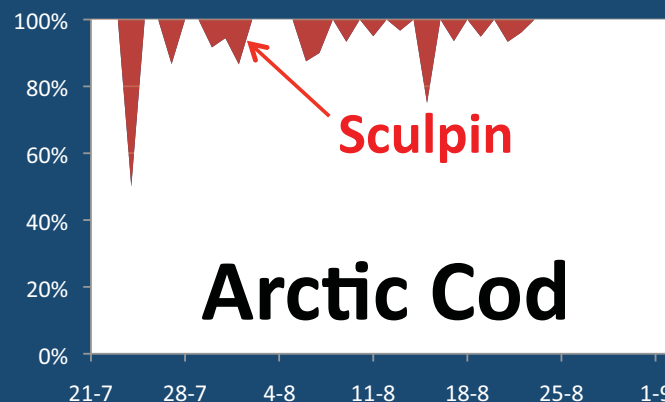
Four-horned Sculpin
demersal



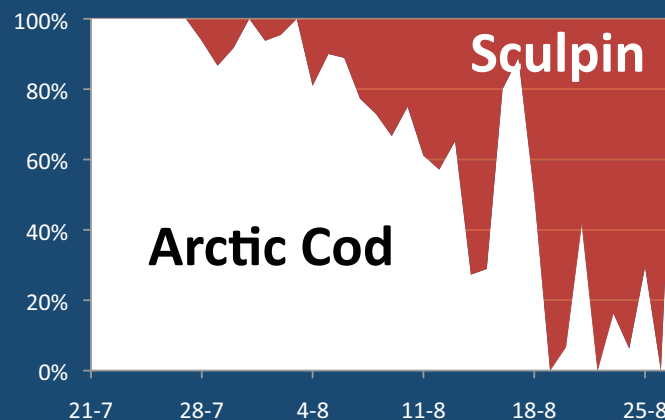
Percent of observed fish per day



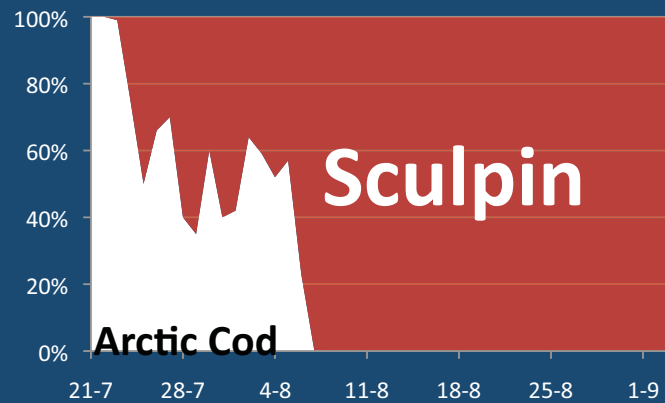
2006



2007



2011



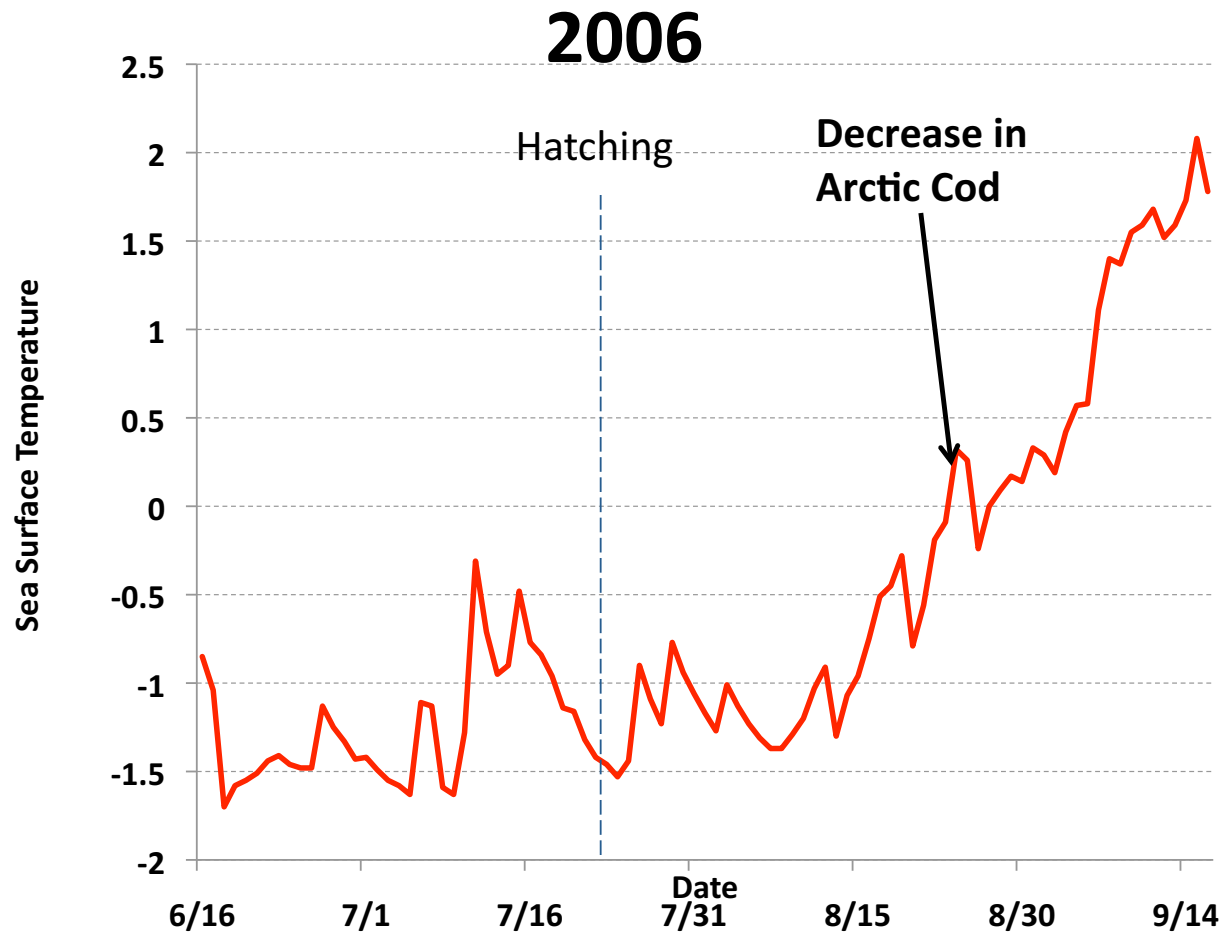


**Sculpin are not preferred by
guillemot parents and
frequently rejected by
nestling guillemots**

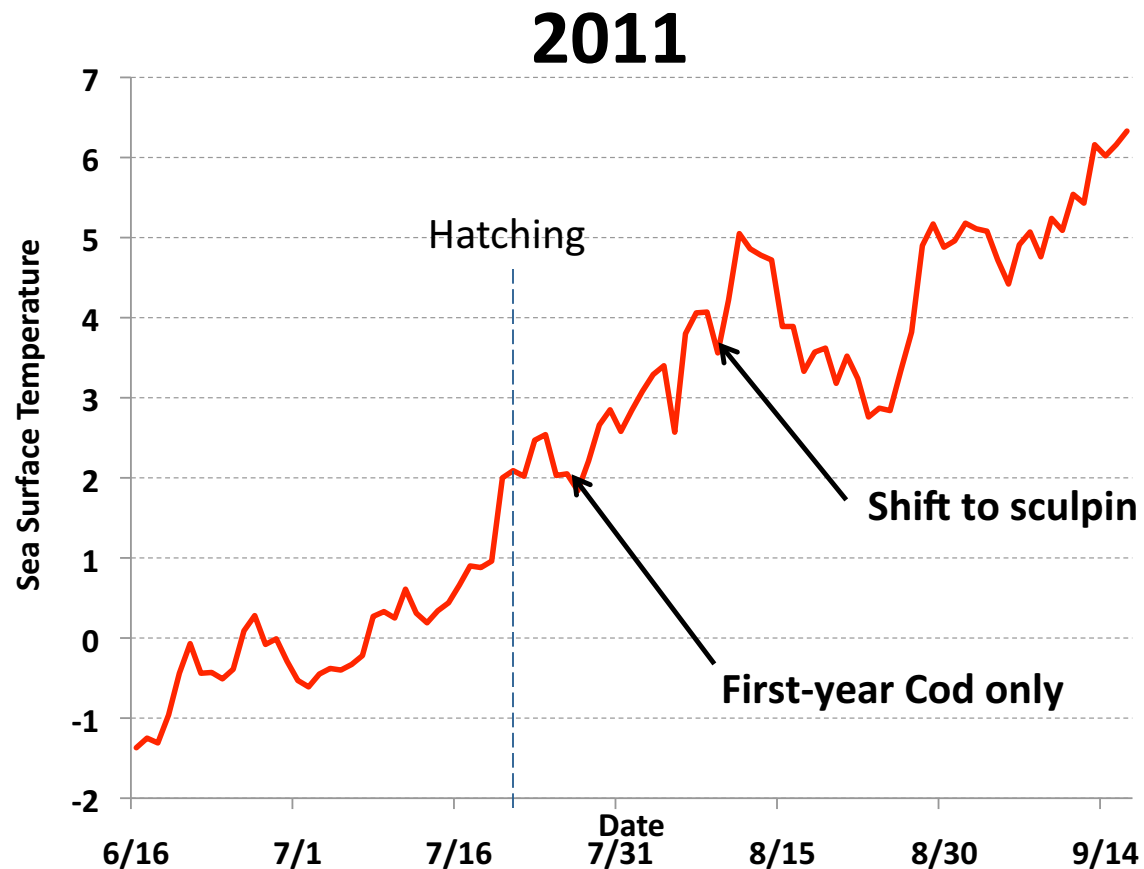
**Sculpin energy
density is less than
Arctic cod and not
easily swallowed by
nestlings**



Arctic Cod availability decrease with increasing sea surface temperature



Prey shifts correlated with increasing sea surface temperature



The Prey Shift in the nearshore Beaufort Sea

Adult Arctic Cod → First-Year Arctic Cod → Sculpin



Mid-season transitions result in the greatest decrease in measures of breeding quality for guillemots

Range changes related to decreasing summer ice extent complicated the assessment of guillemot diet from 2002-2010



Summer 2009

- Black Guillemot chicks hatched 183
- Eaten or killed by polar bear 90
- Killed by horned puffin 80
- Die of other causes 12
- Fledge 1



Adapting to a changing Arctic



2008-08-17 06:55:59 M 1/20 ● 38°F



This video can be viewed separately from this presentation and is attached (See polar bear at cabin 17 aug 08.avi)

RECON 1

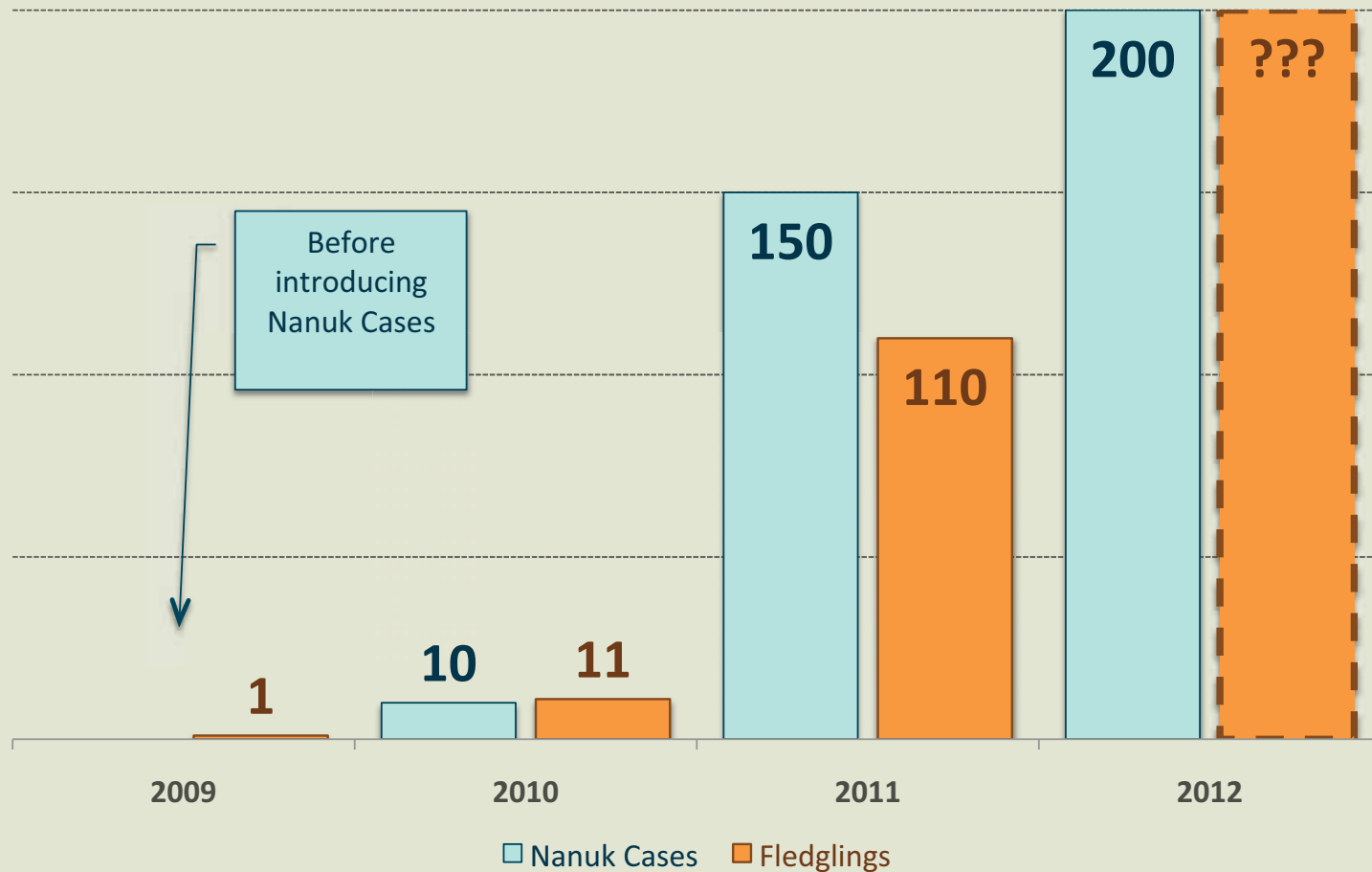
WWW.RECONYX.COM

Adapting to a changing Arctic



This video can be viewed separately from this presentation and is attached (See short bear clip.wmv)

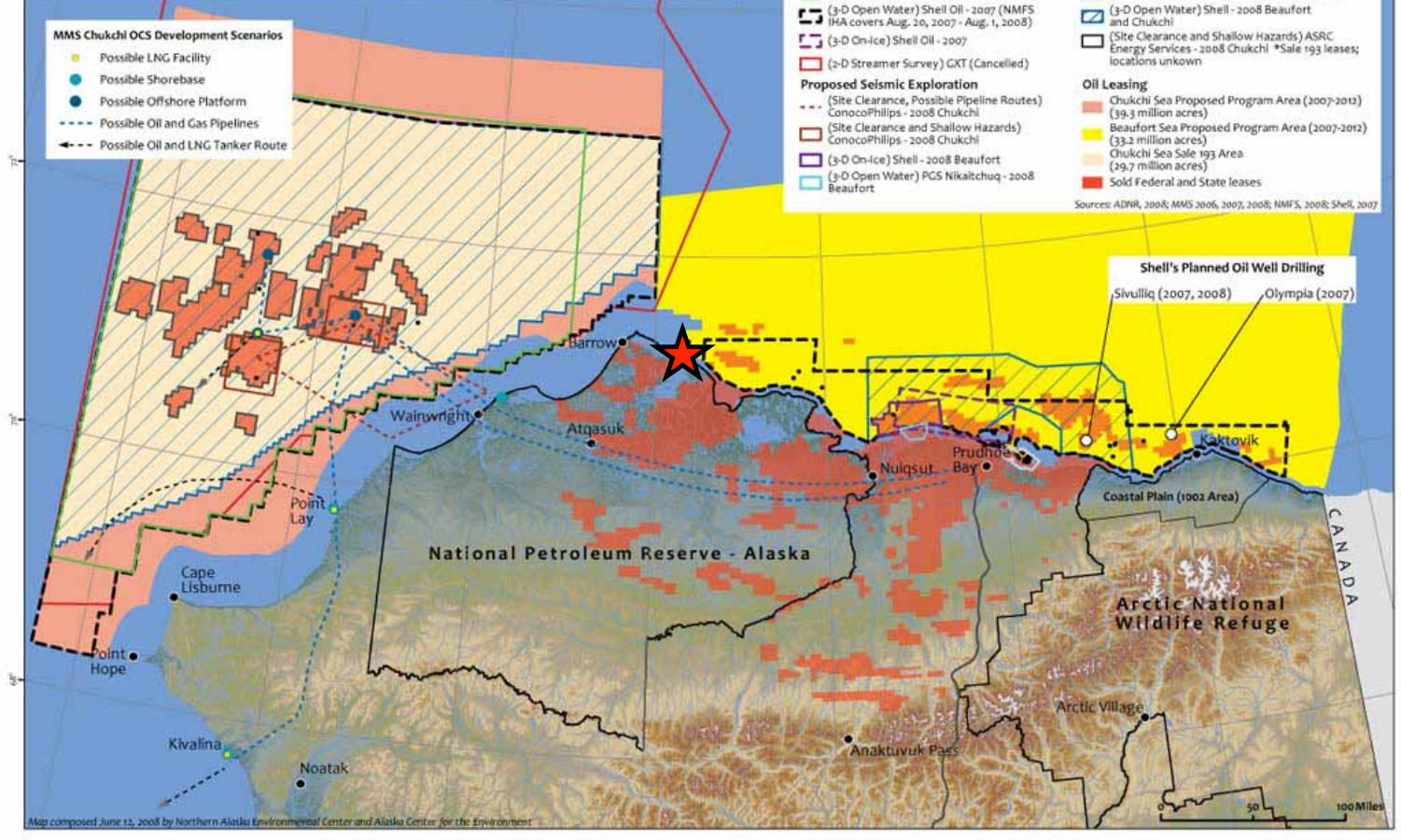
Effect of Nanuk Nest Cases on Black Guillemot Fledging Success



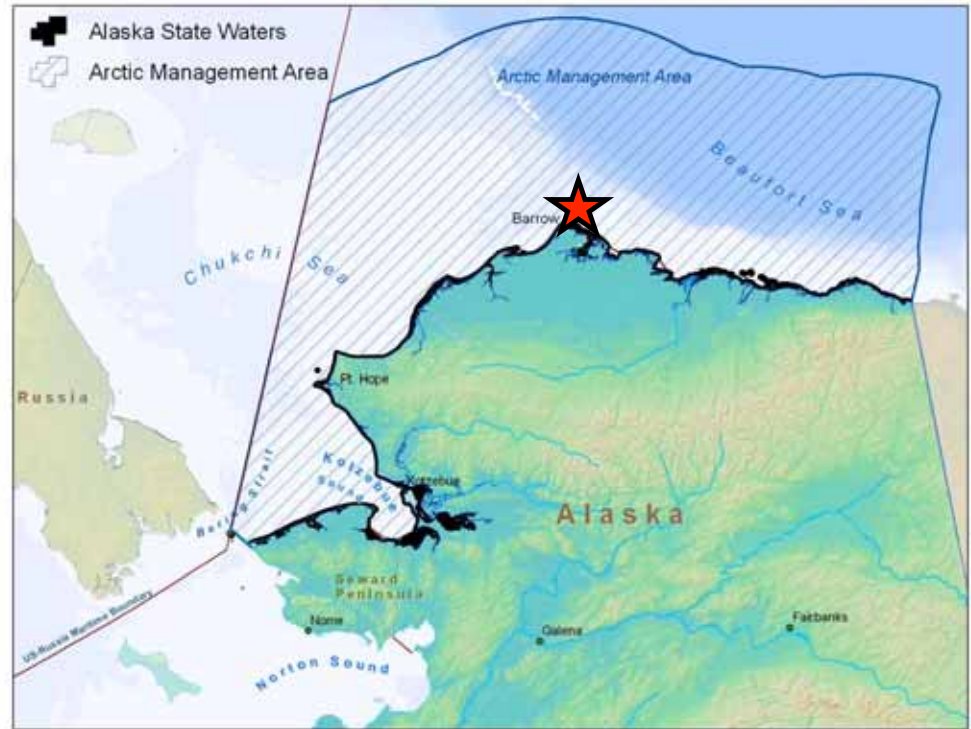


Find out how you or a school group can sponsor a nest case. Have your own arctic change story.

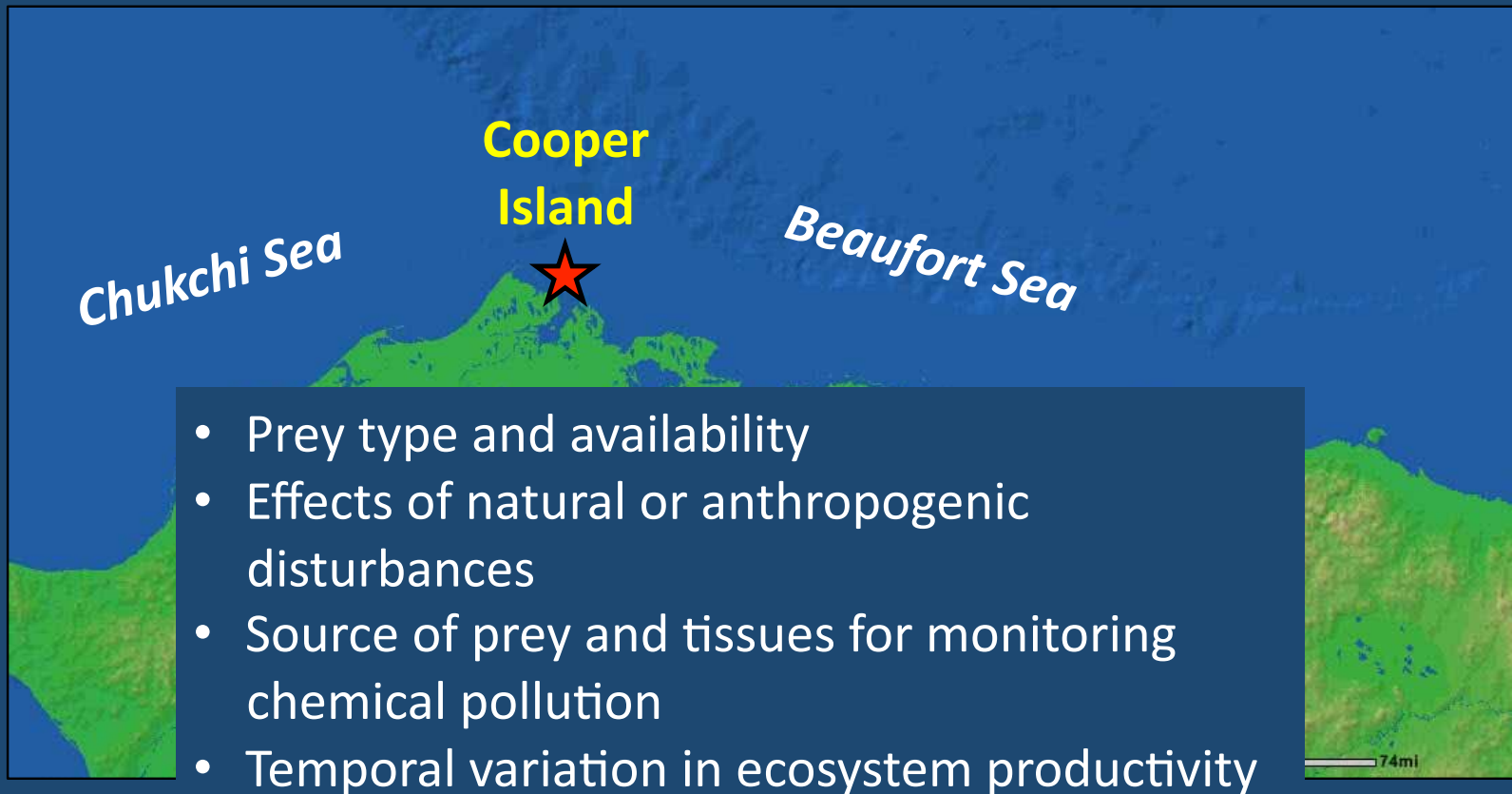
Proposed Offshore Seismic, Leasing, and Drilling in Arctic Ocean



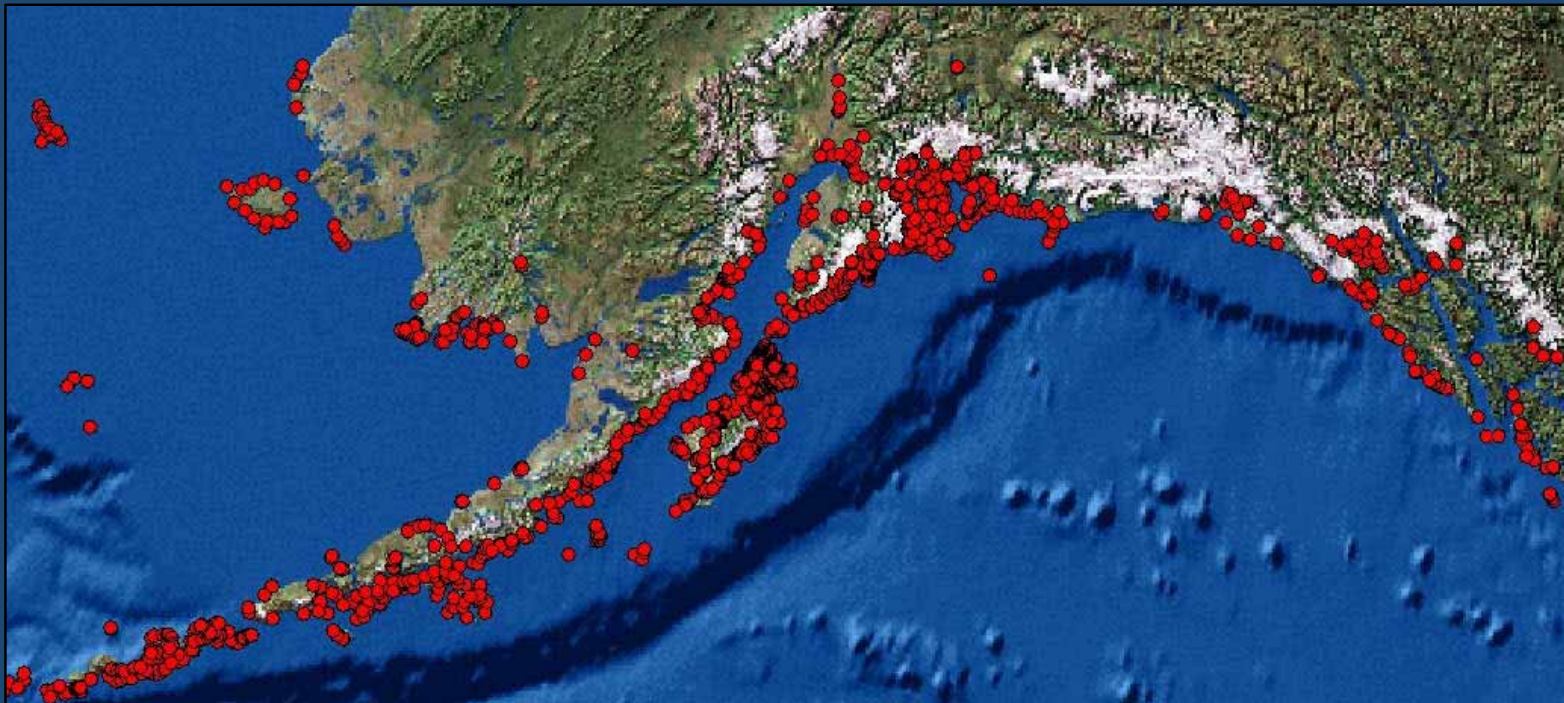
Projected Summer Sea Ice Extent and Potential Shipping Routes



Seabird colonies available for monitoring the marine environment

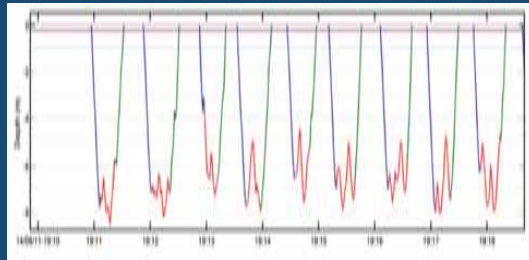
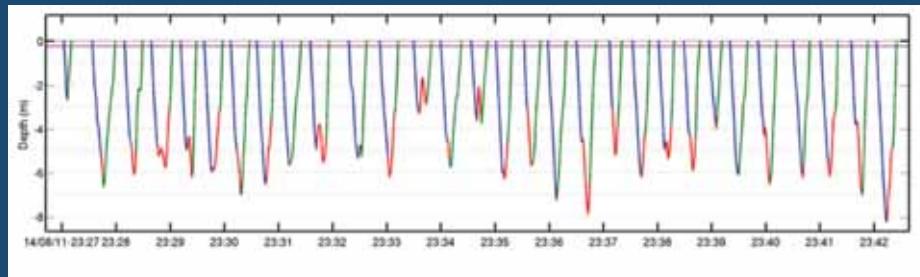


Cooper
Island



Monitoring feeding activity throughout the breeding season with data loggers and observations

Diving Bouts



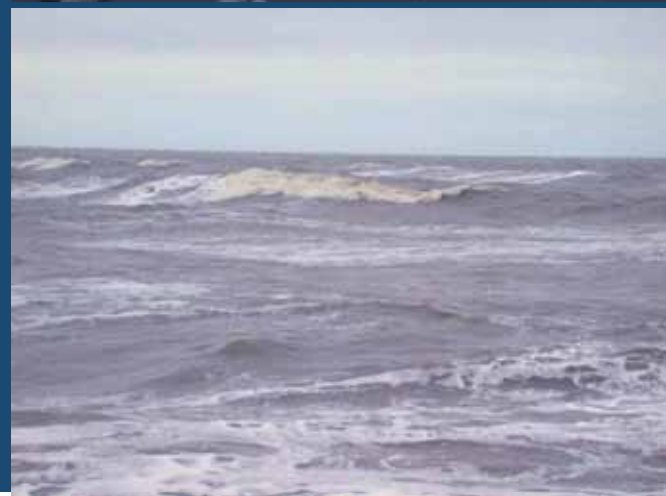
Conclusions

- In the last decade Arctic Cod have become far less available to diving seabirds in the Alaskan Arctic
- Decrease in Arctic Cod correlated, both annually and seasonally, with a decrease in sea ice and increasing sea surface temperatures
- Predicted loss of summer sea ice will have major implications for upper trophic levels throughout the Arctic Basin
- Invasive subarctic forage fish not yet available as a replacement for Arctic Cod but could be with increasing warming of the Arctic
- Major selection event occurring for an arctic seabird

The primary forage fish in the Arctic Basin is decreasing in availability (and probably abundance) with major implications for the marine trophic webs in the Arctic.



The cryopelagic ecosystem is undergoing major reductions and changes and will be soon be seasonally absent, with major implications for a number of arctic species.



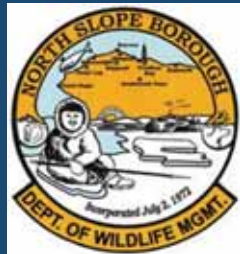
What is a “canary in a coal mine?”

A species that is responding to a change in the environment not being detected by you and whose response to the change is important to your future actions, plans or survival



Support and assistance

- Friends of Cooper Island
- Residents of Barrow
- North Slope Borough Wildlife Mgmt.



- North Slope Borough SAR
- Barrow Arctic Science Consortium
- Many field assistants and volunteers



Friends of Cooper Island
cooperisland.org

Adventures in Climate Change
adventures-in-climate-change.com

