

What Happens When There Is No “Murre” Cod? IPY, Seabirds and Climate Change in the Arctic



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Acknowledgments

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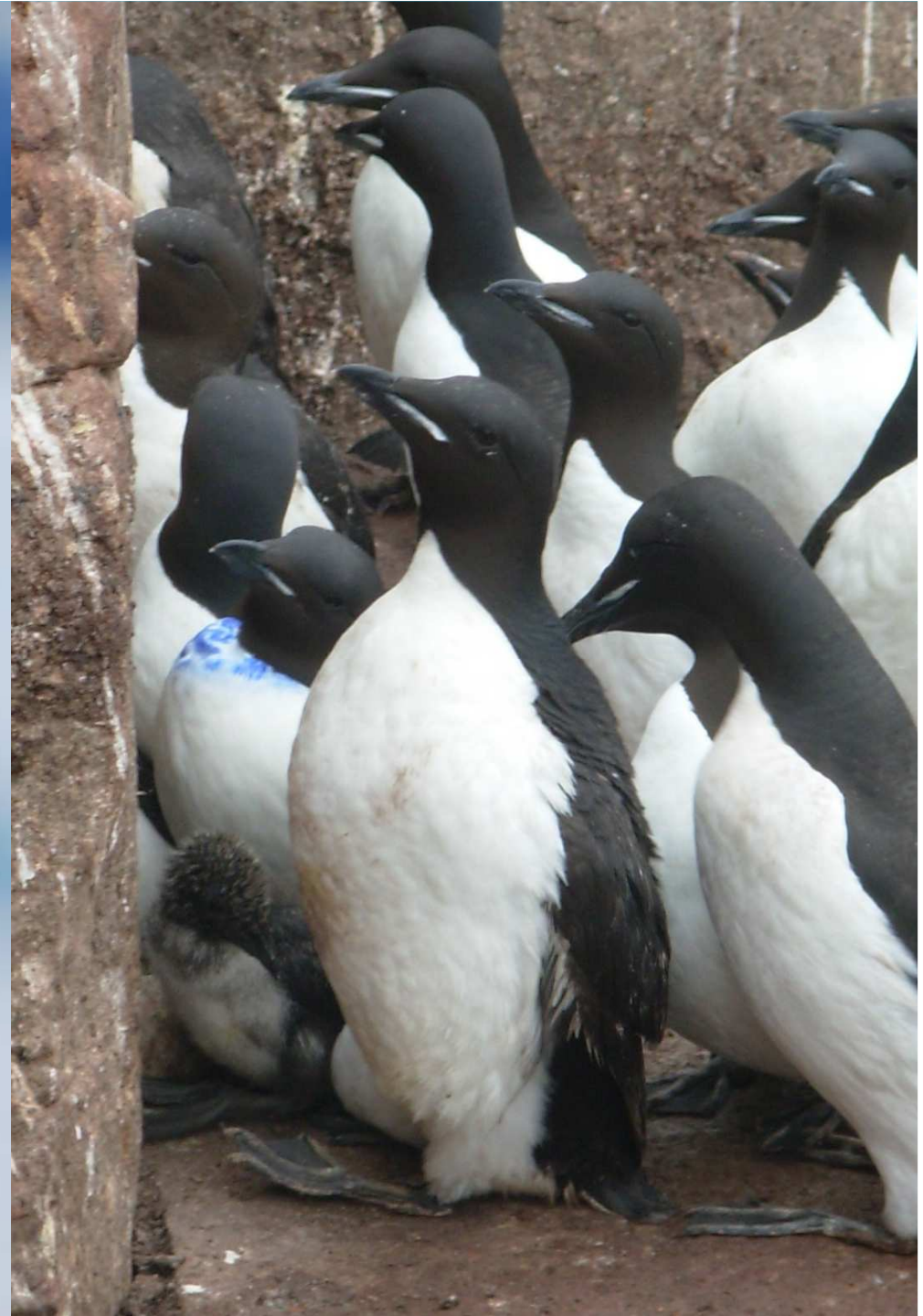


Arctic Institute of North America

Thick-billed Murre (Akpa)



Photo courtesy
S. Deschamp

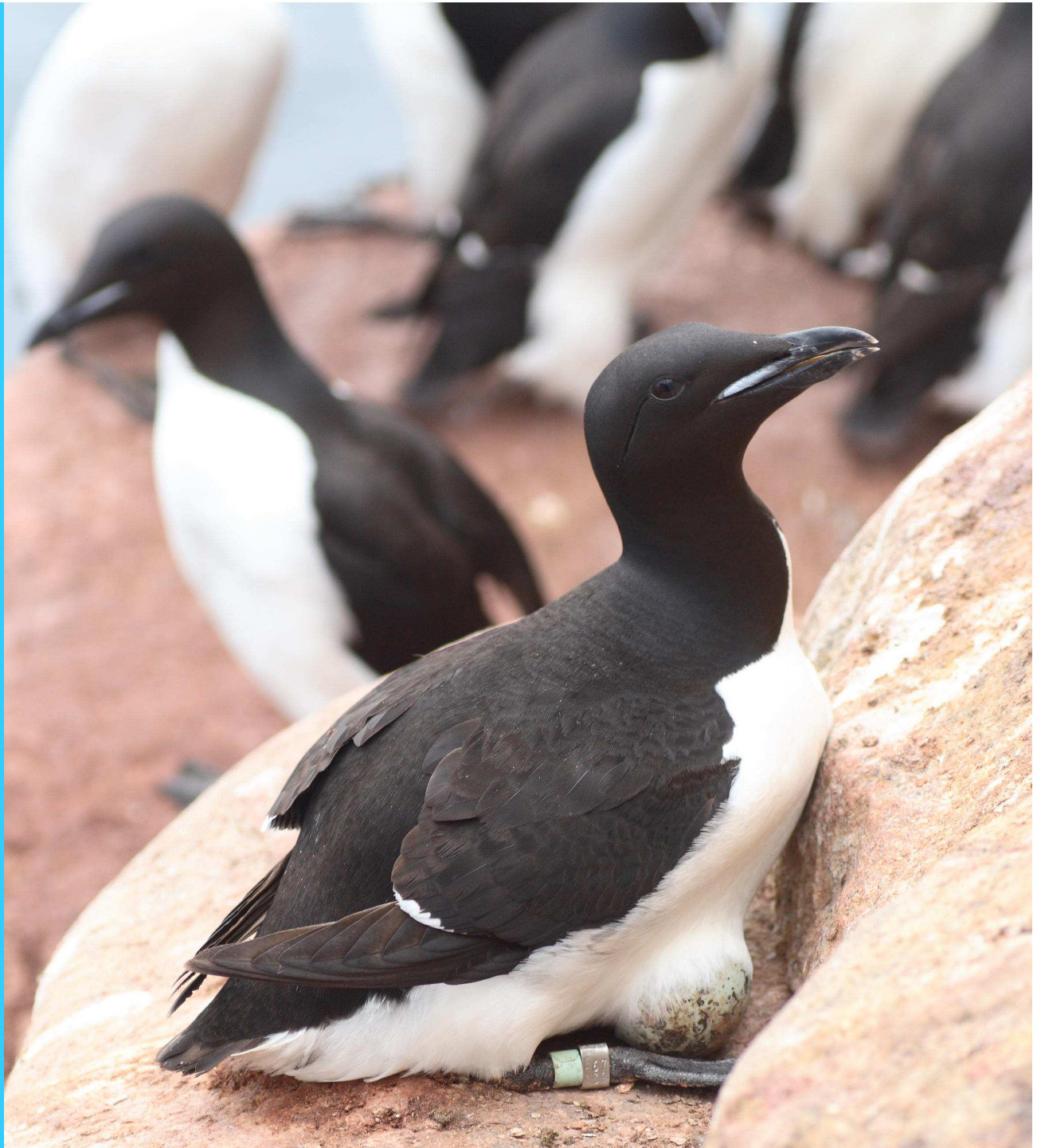


“The most populous bird in the world” --Darwin

- Over three million in the Canadian Arctic



Lays a
Single Egg

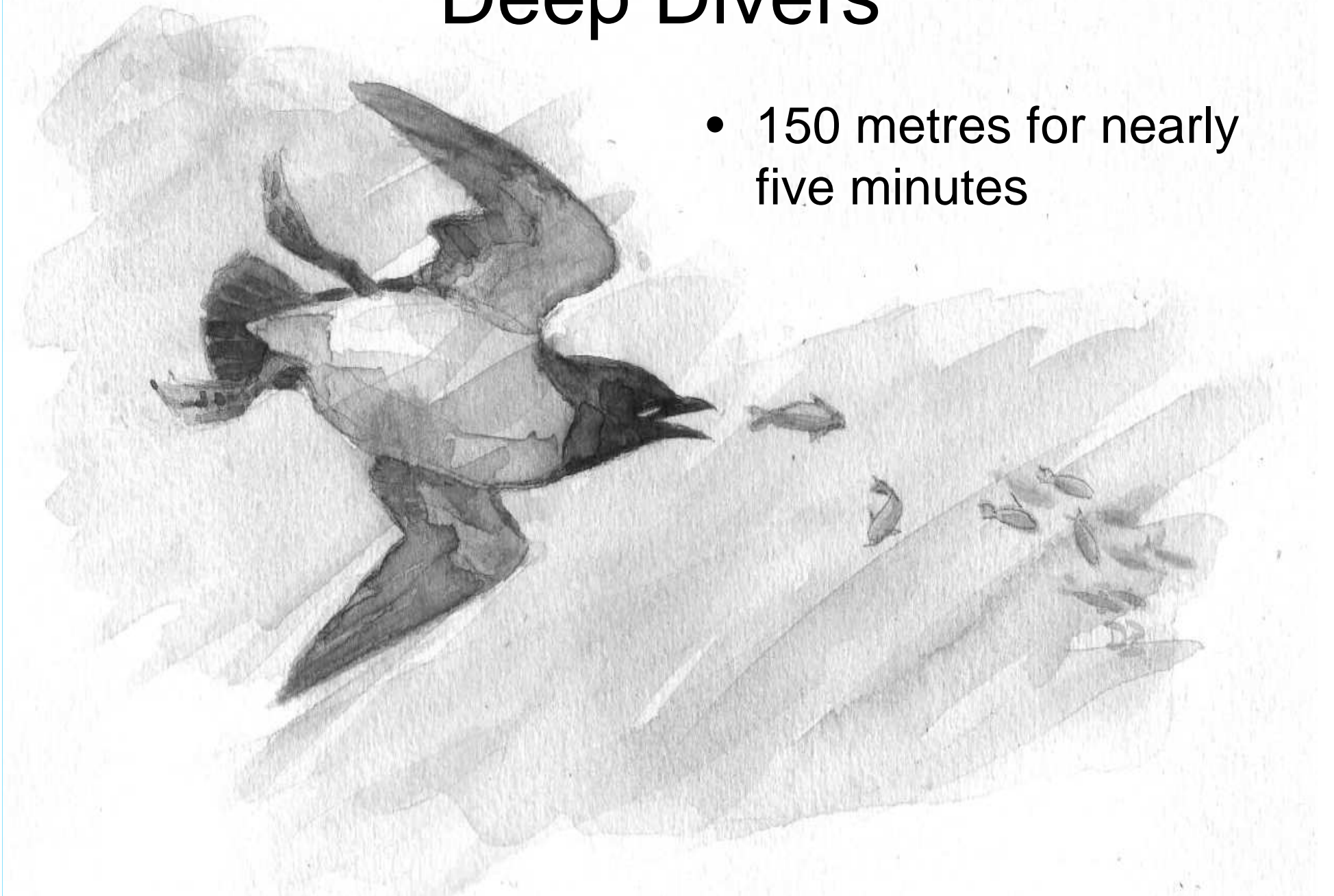


Chick Jumps Off the Cliff at One Quarter of Adult Weight



Deep Divers

- 150 metres for nearly five minutes



Highest wingloading of any bird

Small Wings



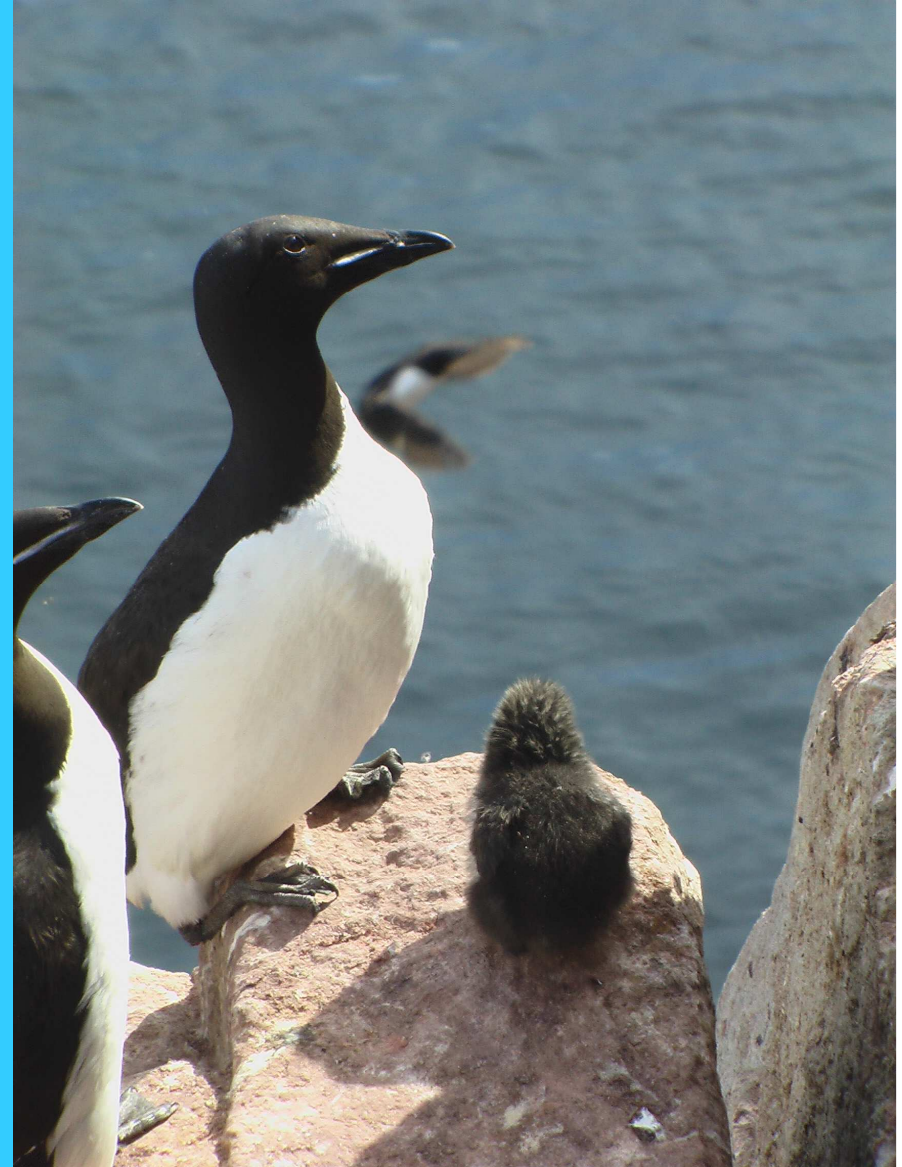
Big Body

Ice-associated



Photo courtesy S. Deschamp

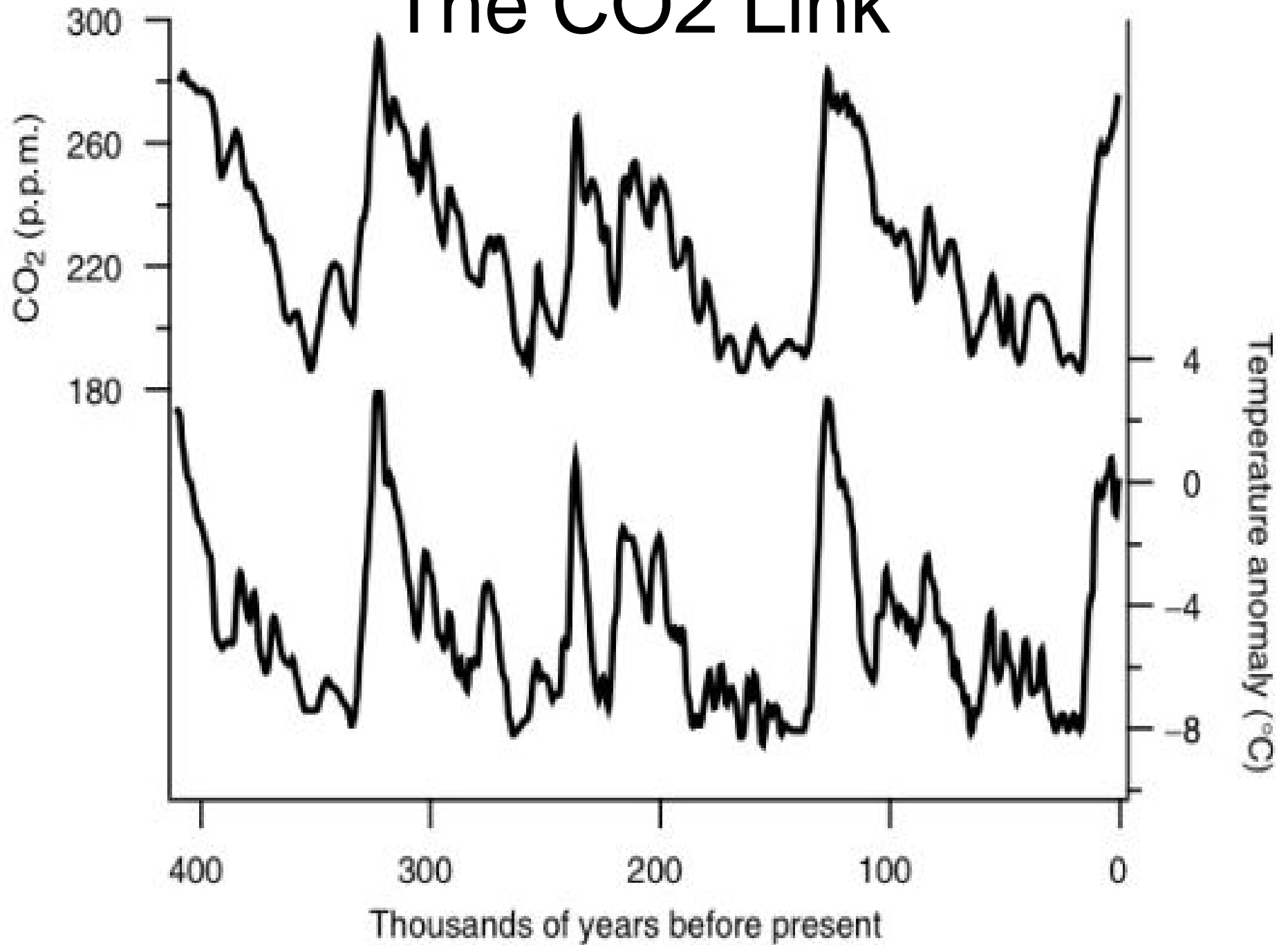
Winter in Newfoundland



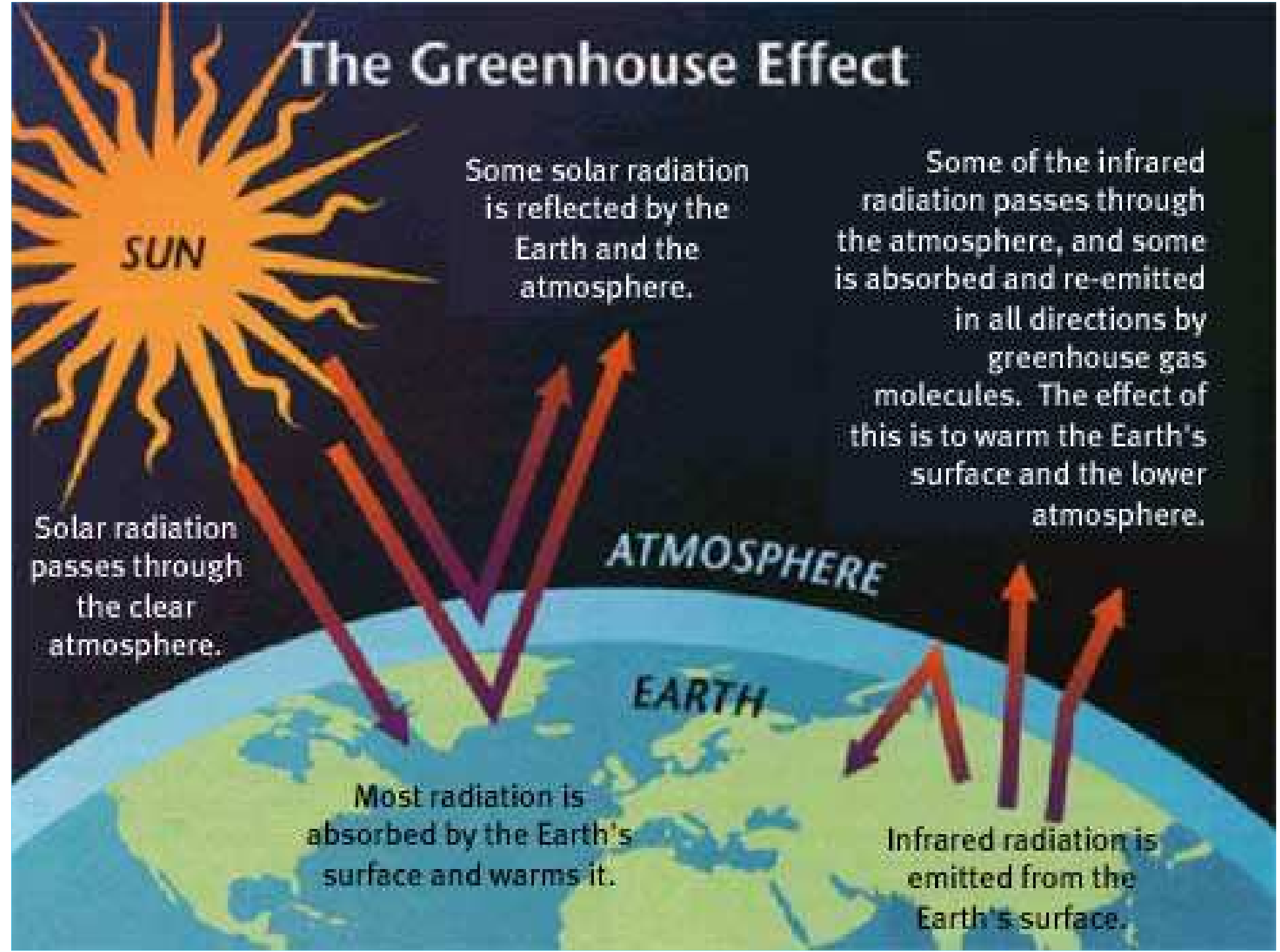


Climate Change:
A Now Familiar
Story

The CO2 Link



The Greenhouse Effect



Some solar radiation is reflected by the Earth and the atmosphere.

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.

Solar radiation passes through the clear atmosphere.

ATMOSPHERE

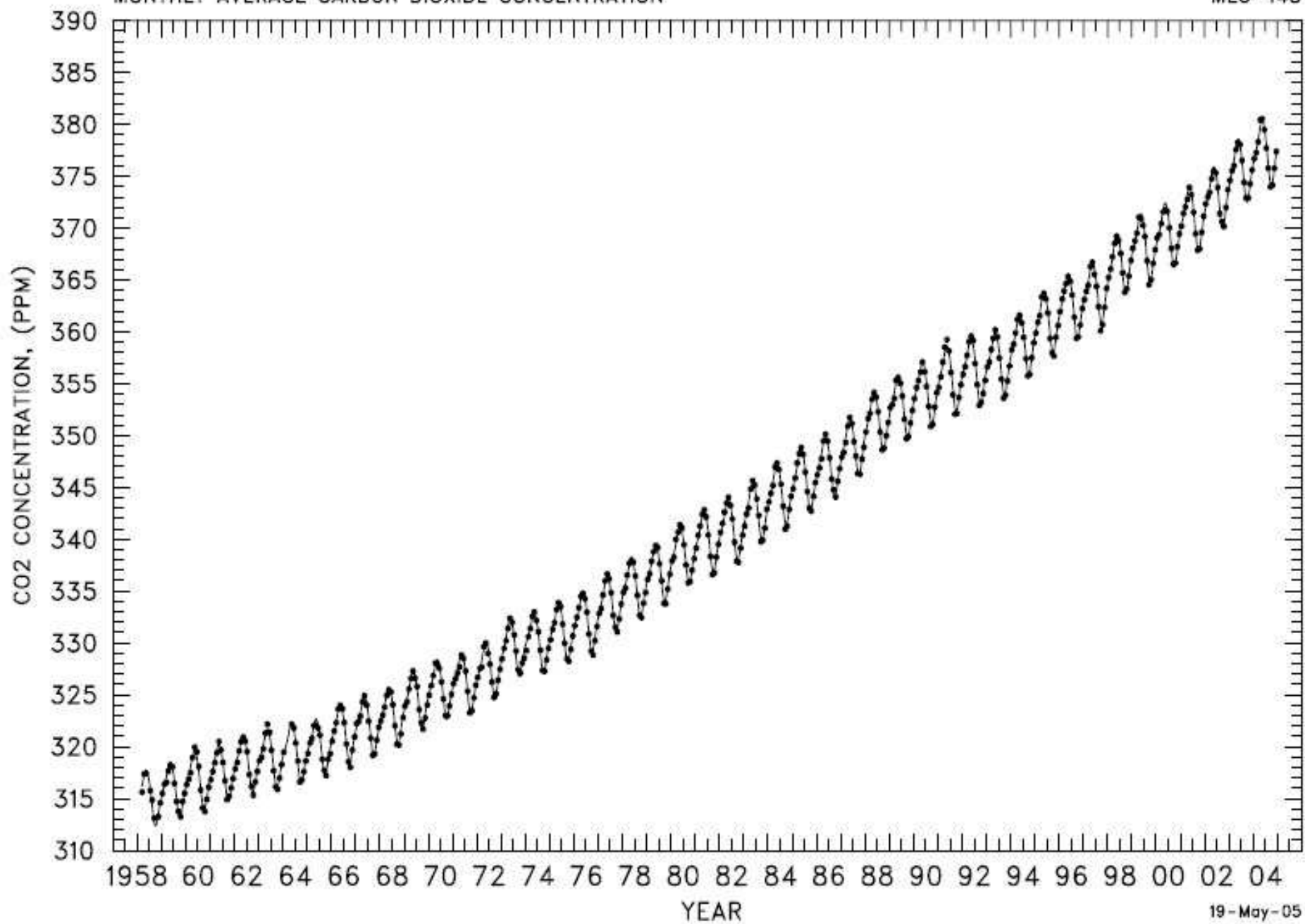
EARTH

Most radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.

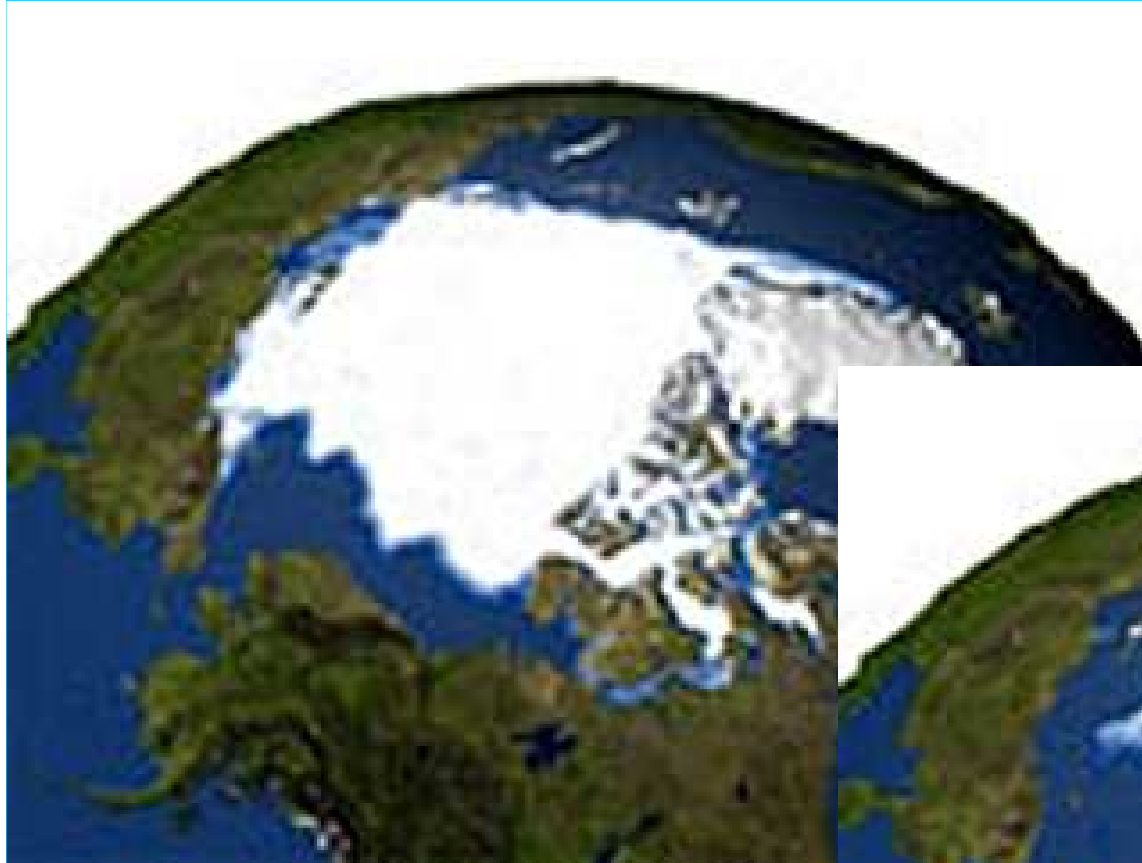
MAUNA LOA OBSERVATORY, HAWAII
MONTHLY AVERAGE CARBON DIOXIDE CONCENTRATION

MLO-145



19-May-05

What Does It Mean For The Arctic?



1979

2003



Seabirds & Climate Change

Four Stories

- Climate Change Will Impact Marine Ecosystems
 - Especially Arctic Marine Ecosystems



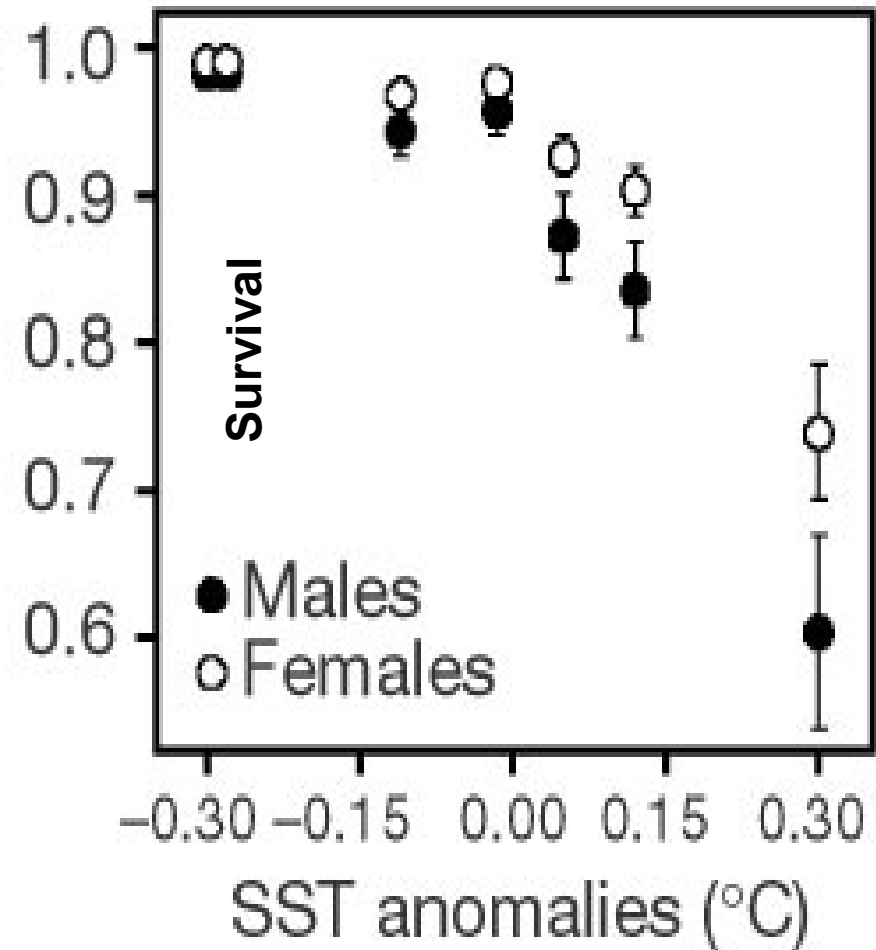
- Costly to monitor oceans
 - Seabirds do the work for us!
- Bellweathers for Climate Change

Adelie Penguins in the Antarctic: No Ice, No Penguins

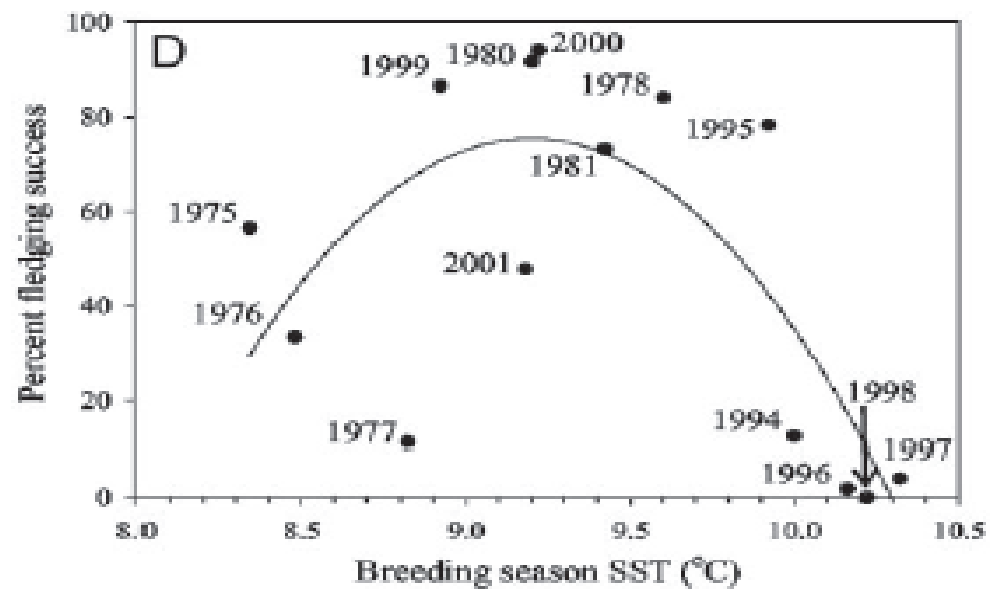
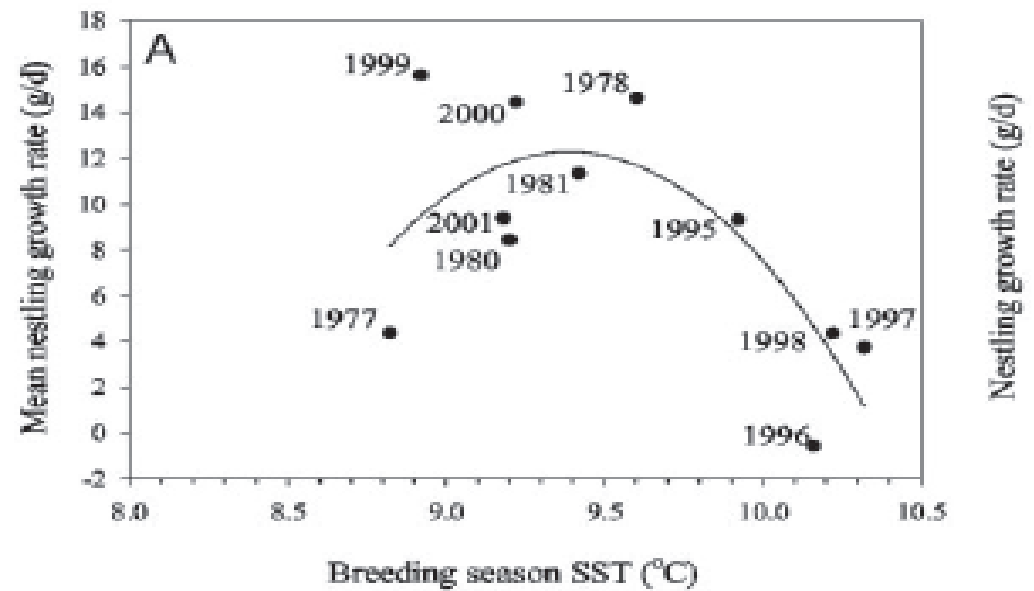


Emperor Penguins in Antarctica

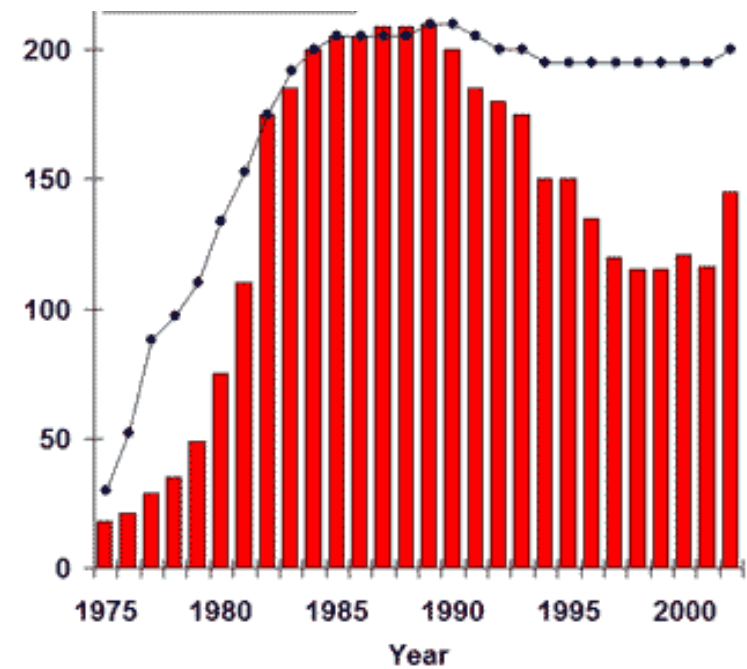
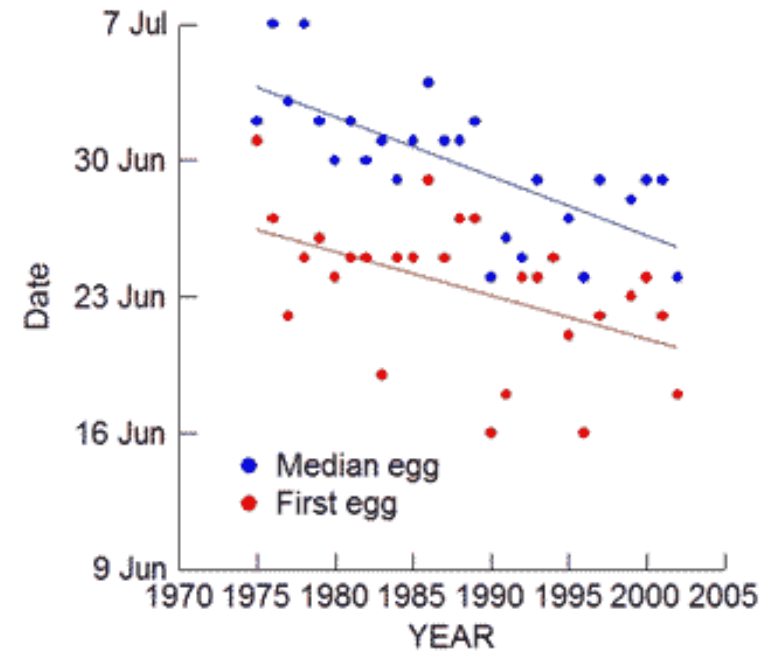
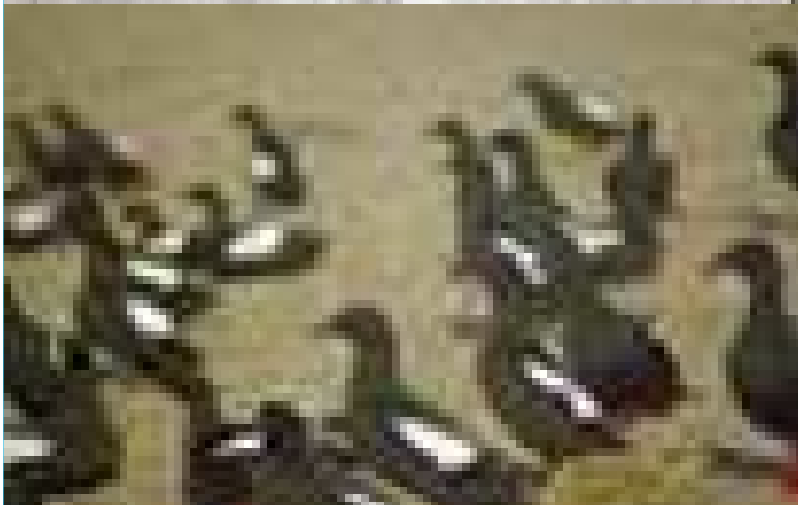
Chicks do better, Adults do
worse



Tufted Puffins in BC



Black Guillemots in Alaska



What About Nunavut?

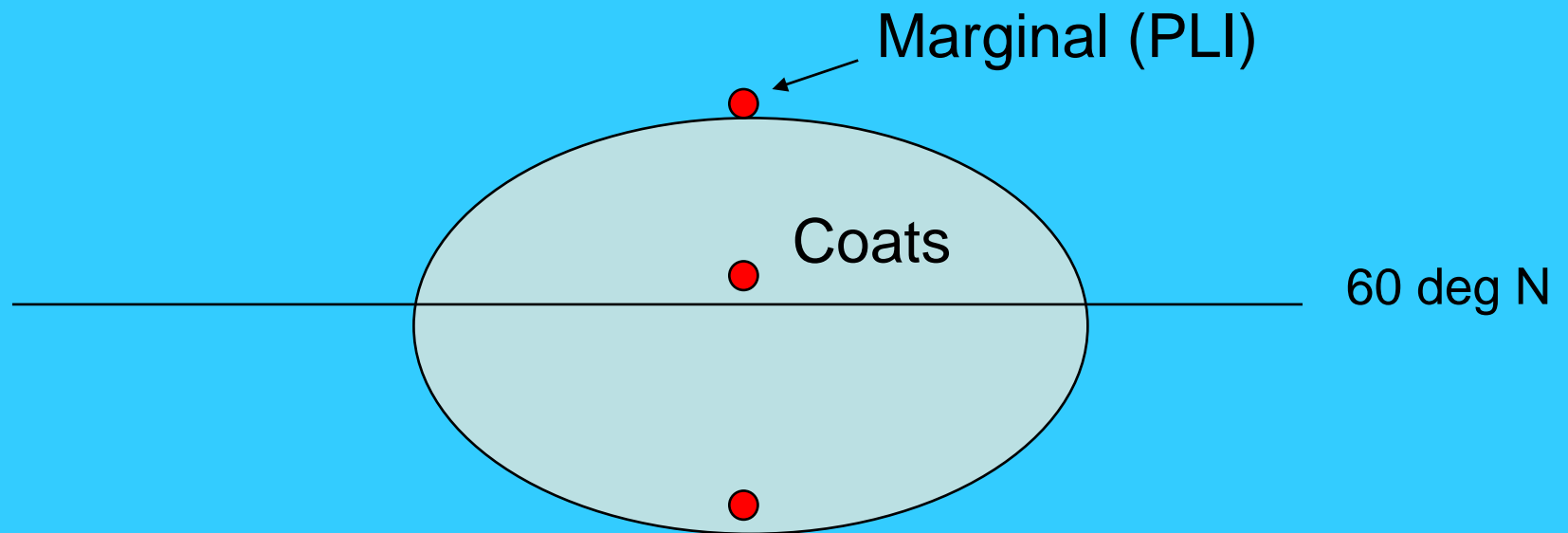


A tale of two colonies

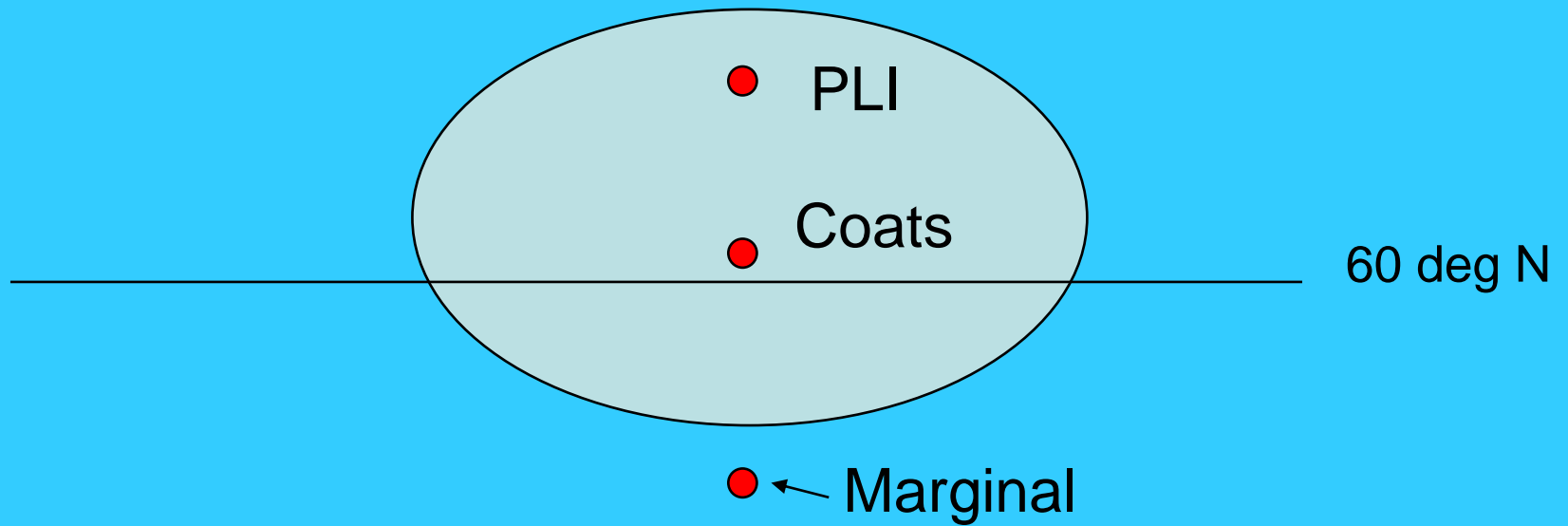


Thoughts on climate change impacts

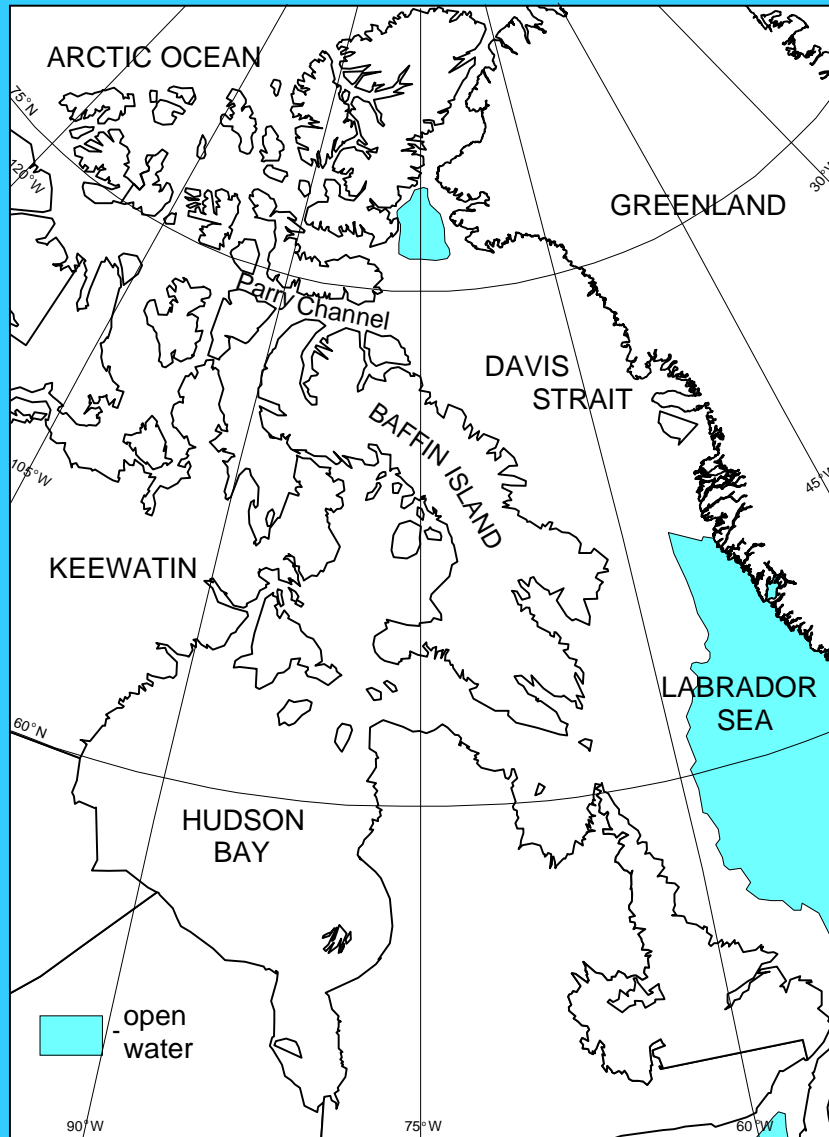
Situation at year 0



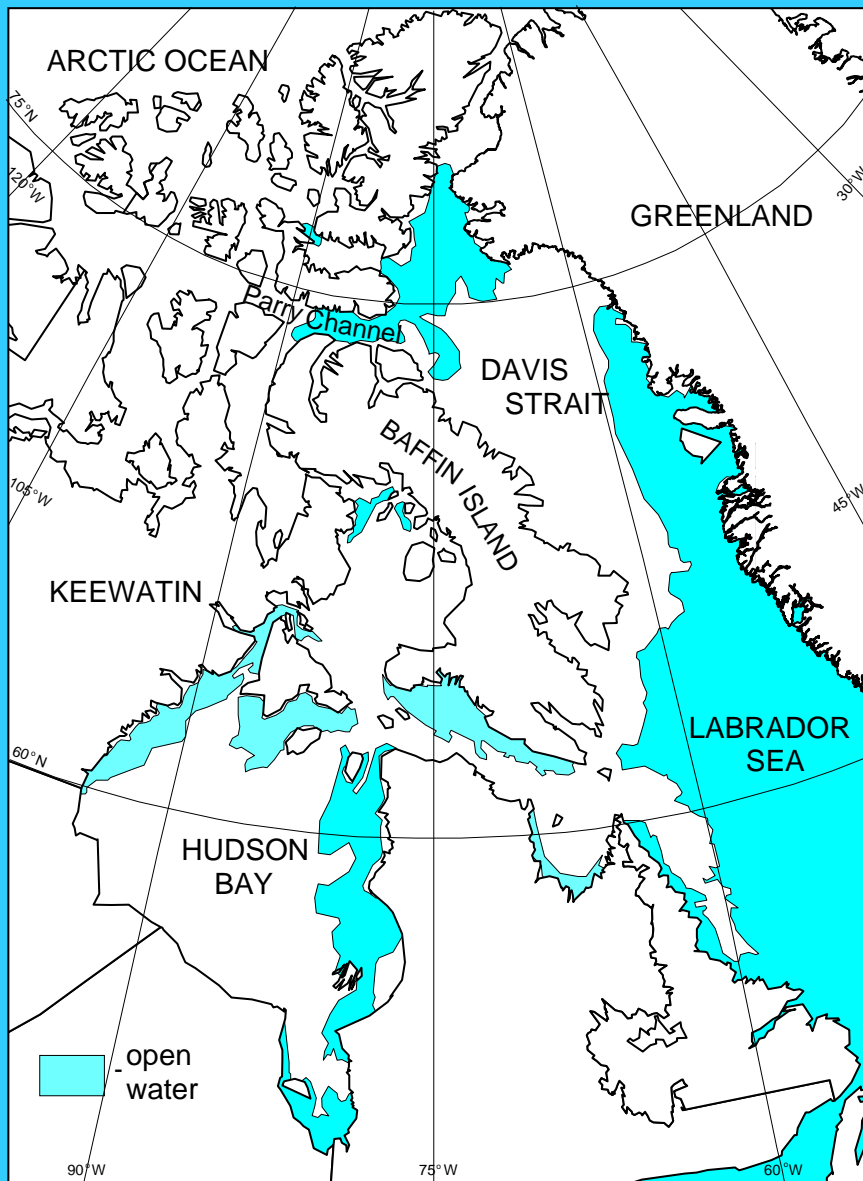
Situation at year +20



February (maximum) ice conditions



June ice conditions

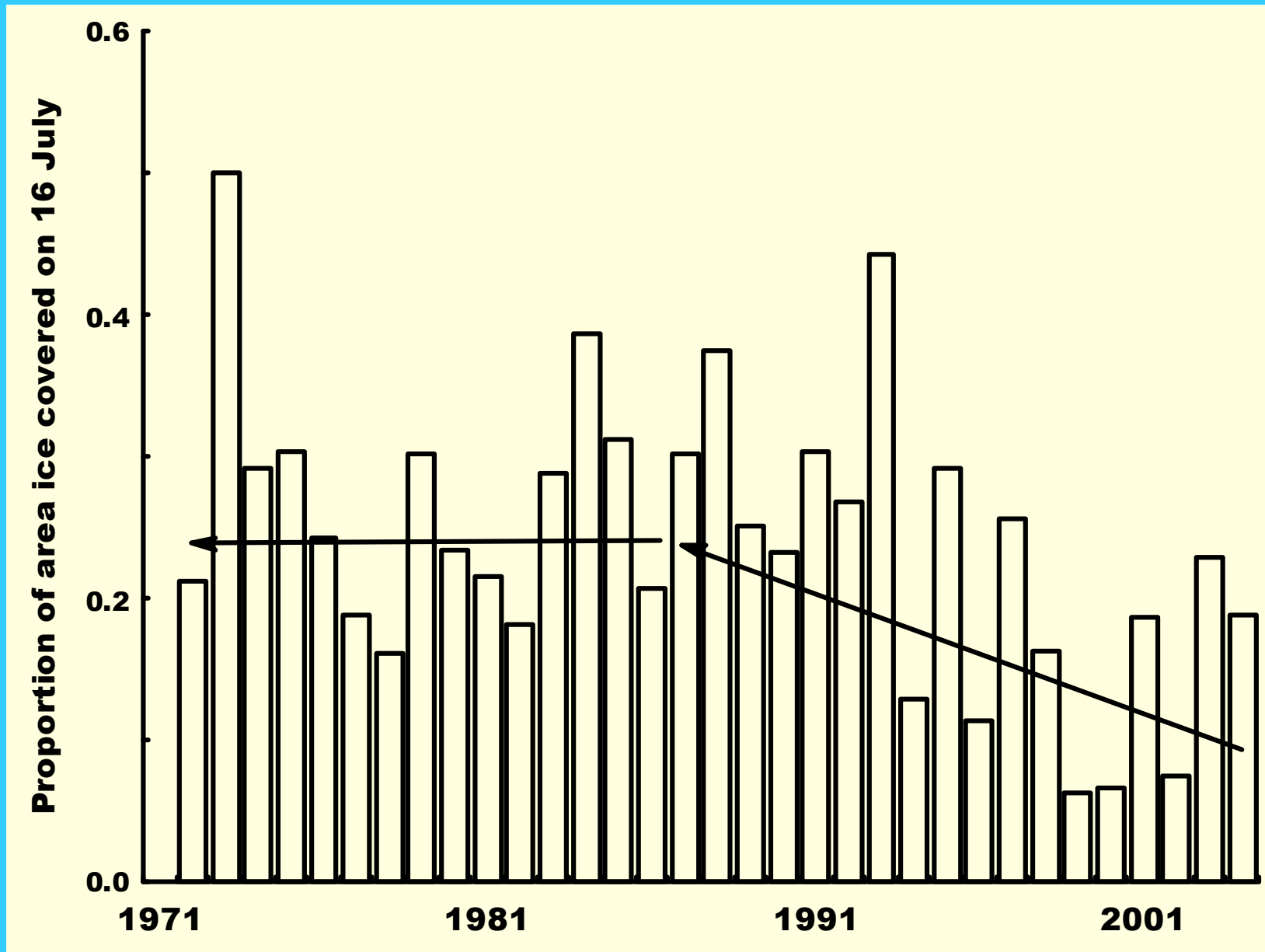


Hudson Bay ice



- Only small areas of land-fast ice
- No consolidated pack ice – remains mobile throughout the winter

Trends in summer ice cover, Hudson Bay



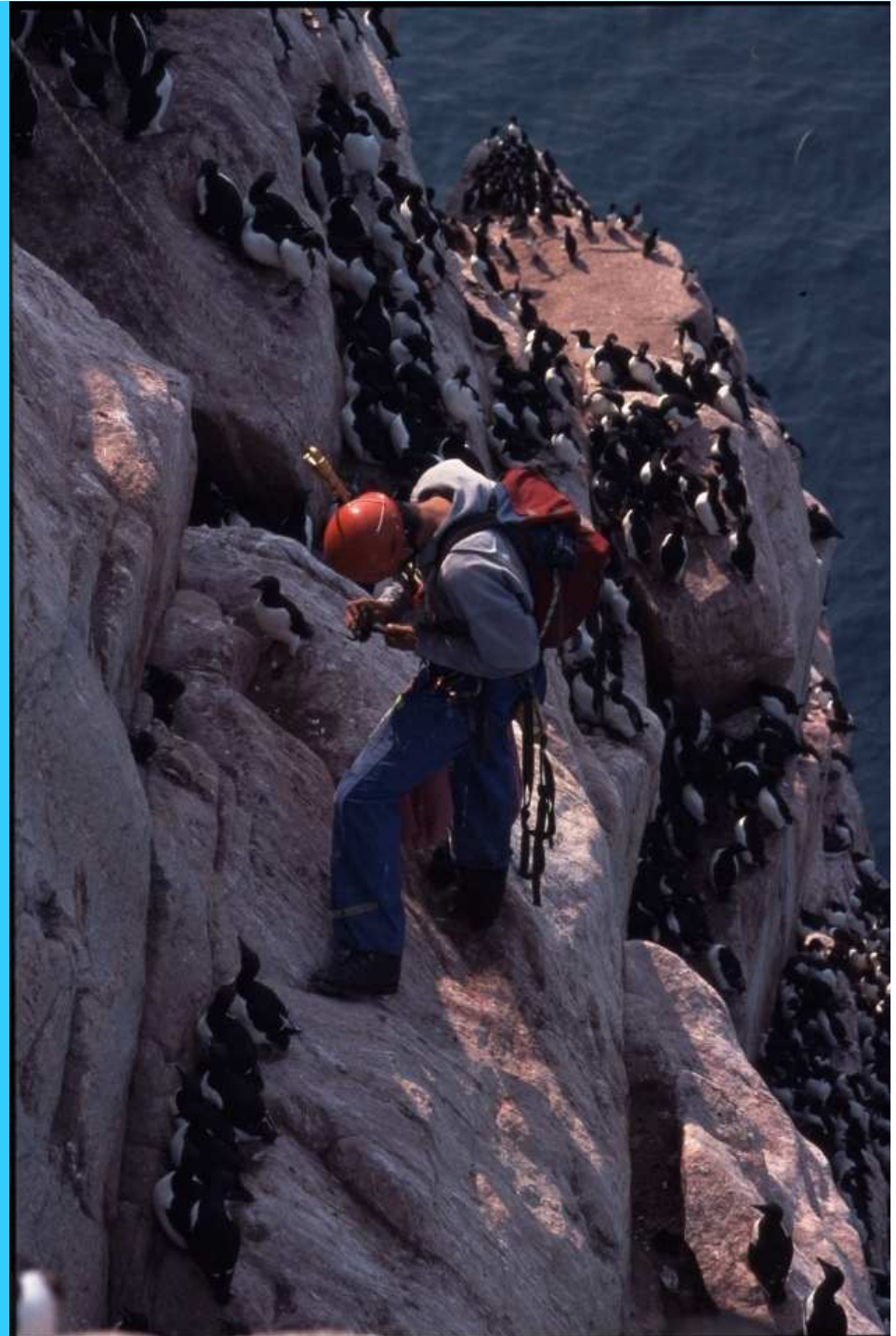
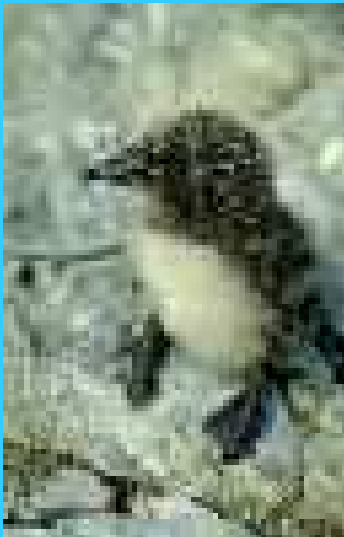
Coats Island

- 30 000+ Thick-billed Murres
- Globally important populations of marine mammals
- Possible NMCA/NWA designation



Research at Coats

- 1984-2007 Visited every year by CWS
 - Band 2000 nestlings
 - Feeding Watch
 - Reproductive success
- 30+ publications
- 5 articles in *Ecology*

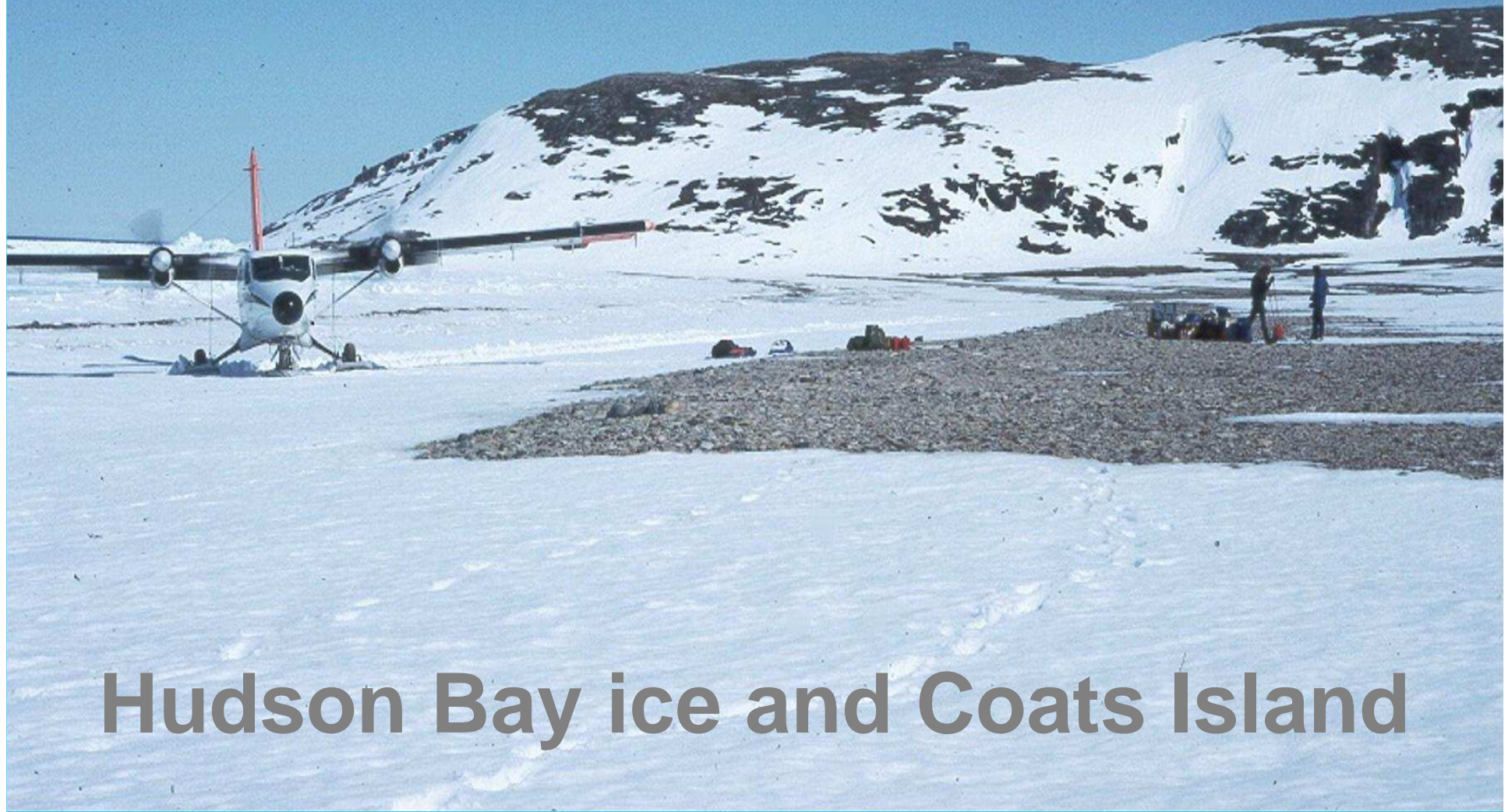


What are the effects of oil spills and the harvest?

-200 Thousand to One Million Killed Every Year

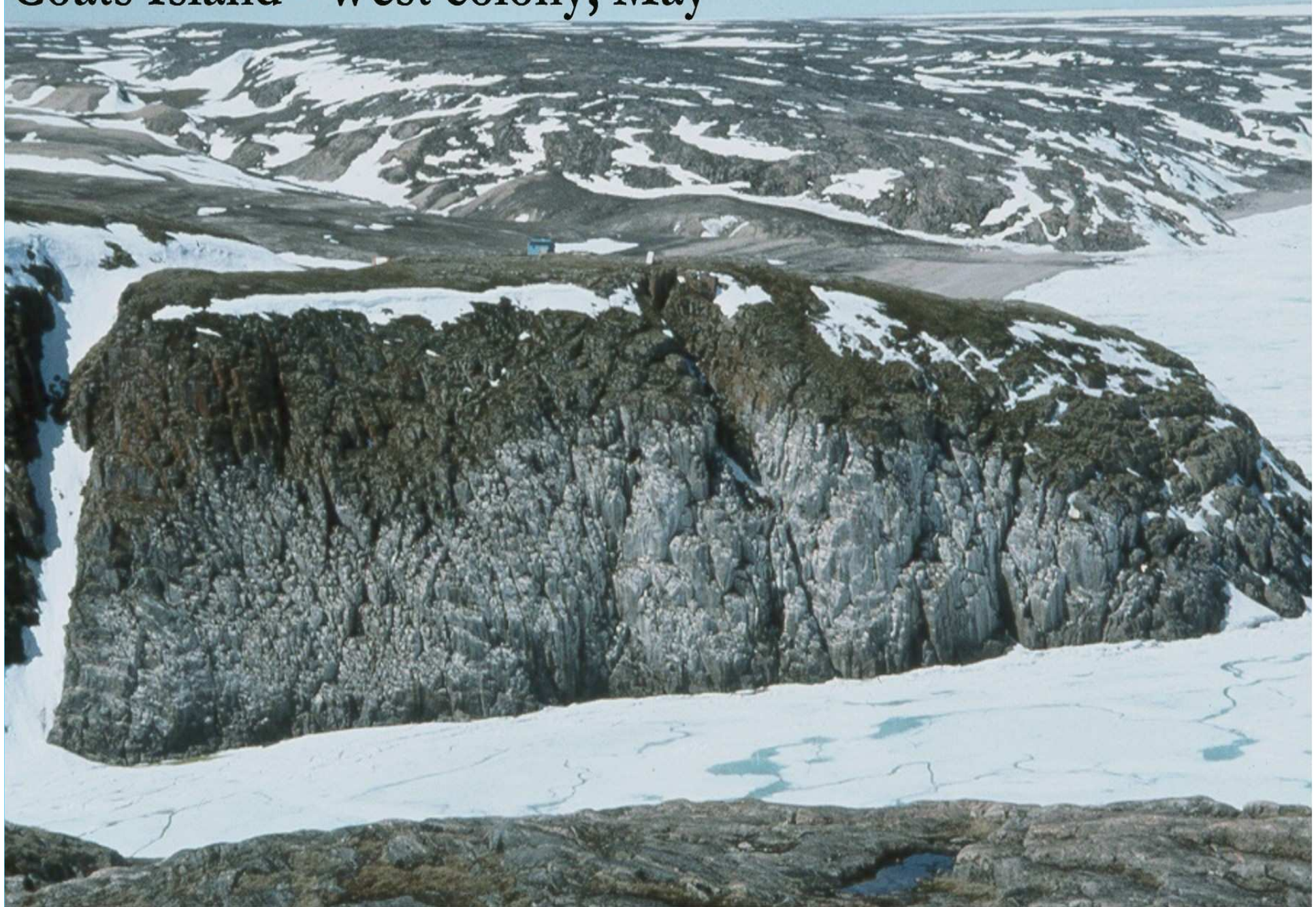


Coats Island, May 1990



Hudson Bay ice and Coats Island

Coats Island - West colony, May











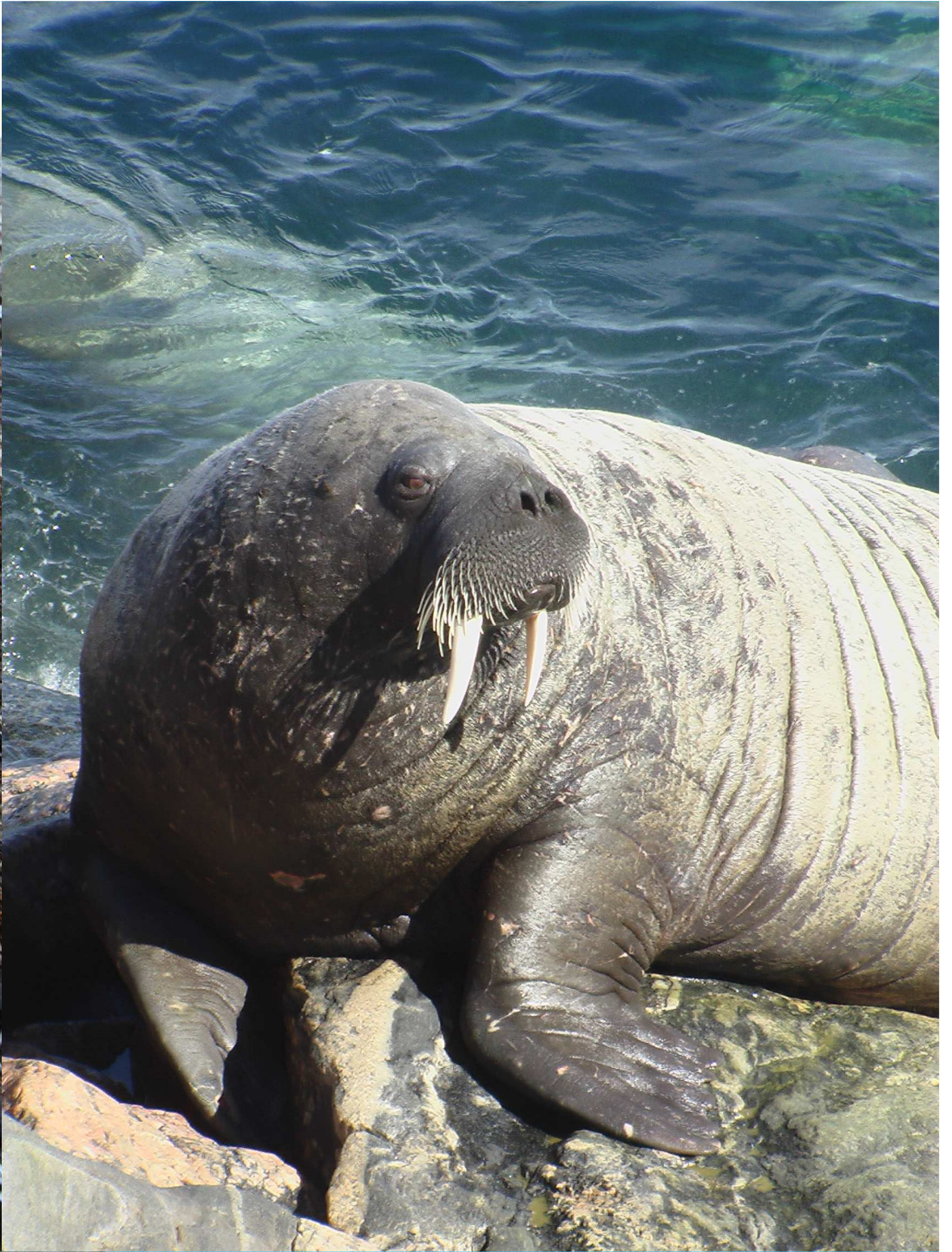






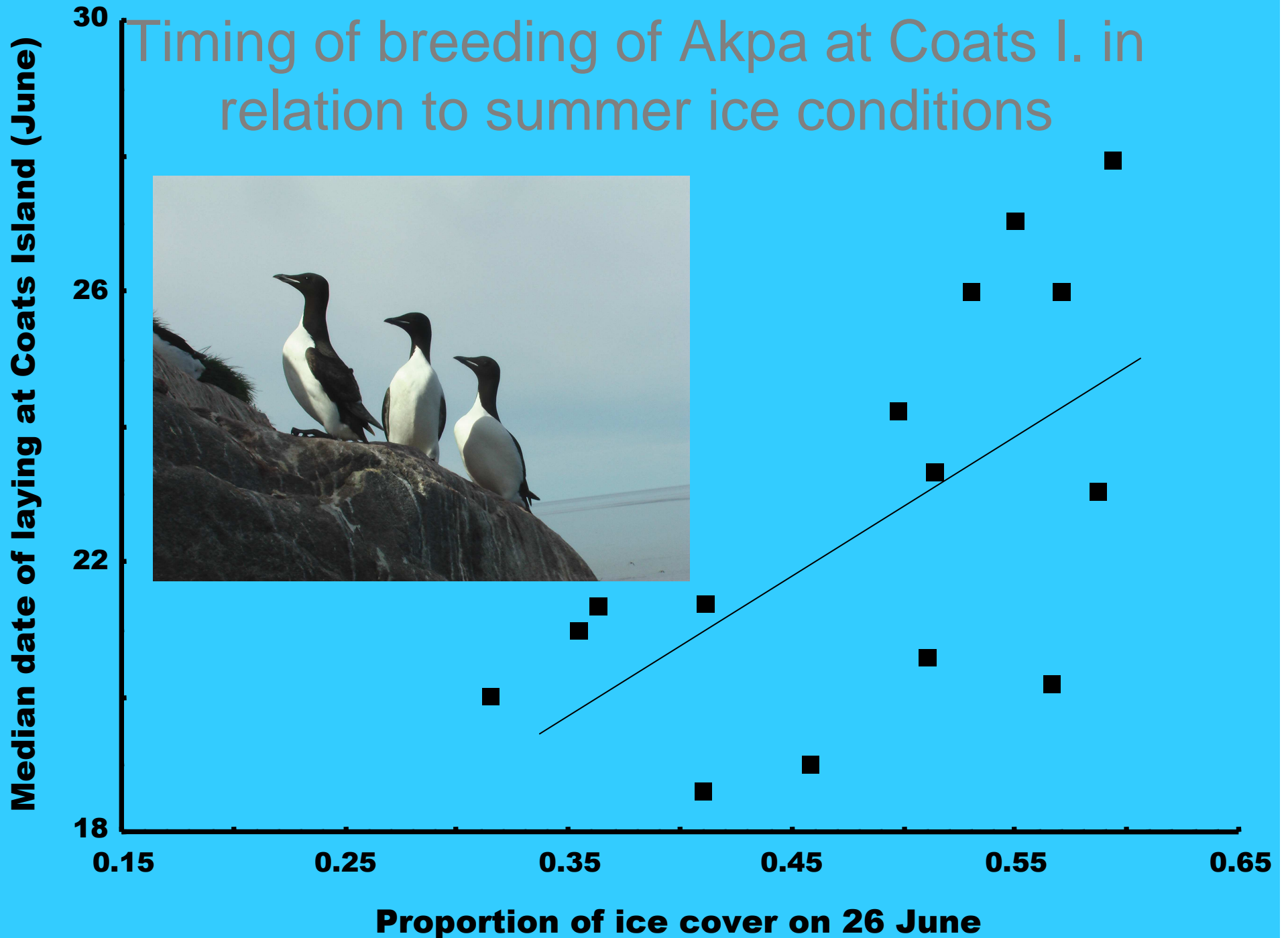






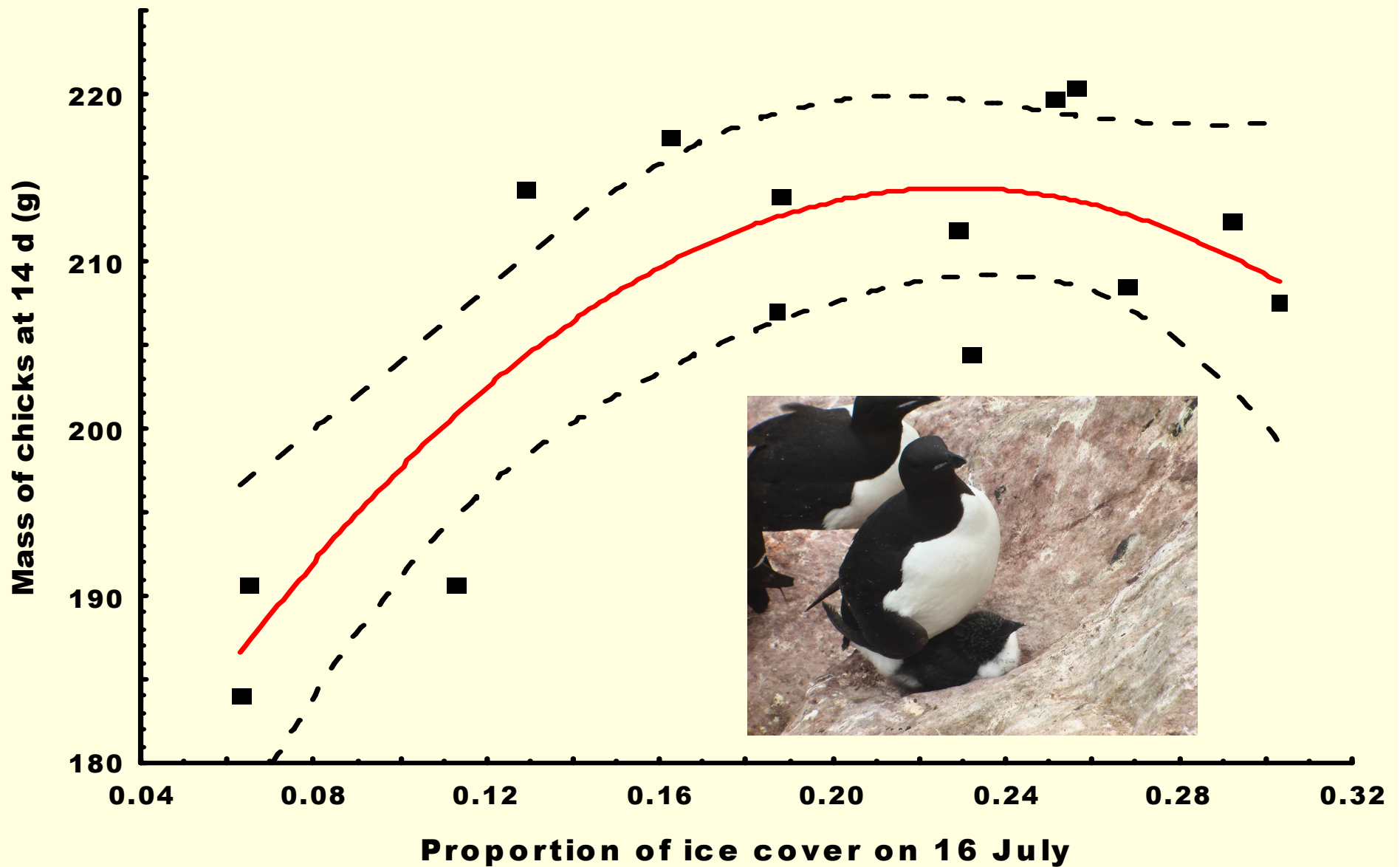


Timing of breeding of Akpa at Coats I. in relation to summer ice conditions

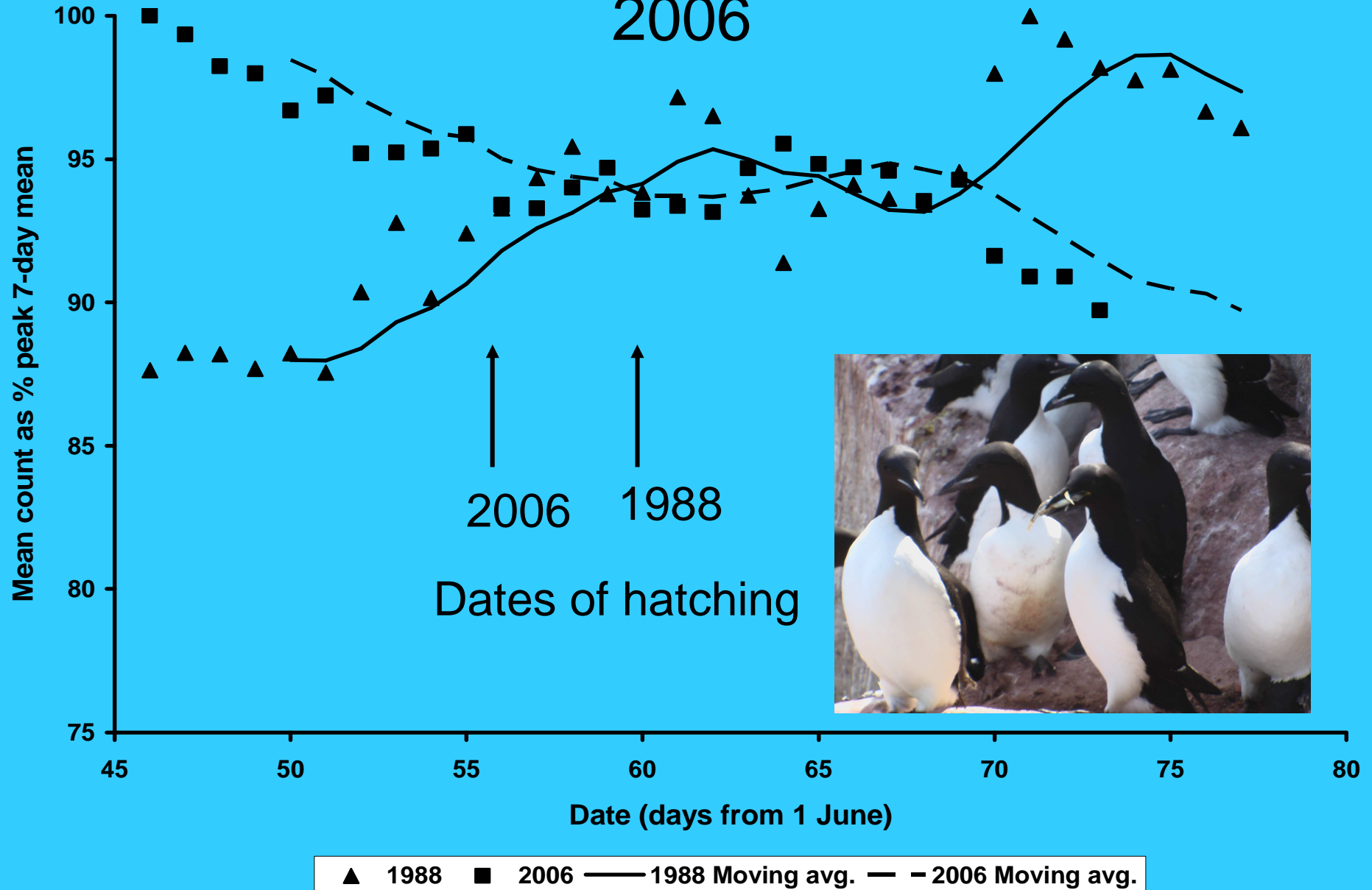


Effect of ice extent on chick growth, Coats

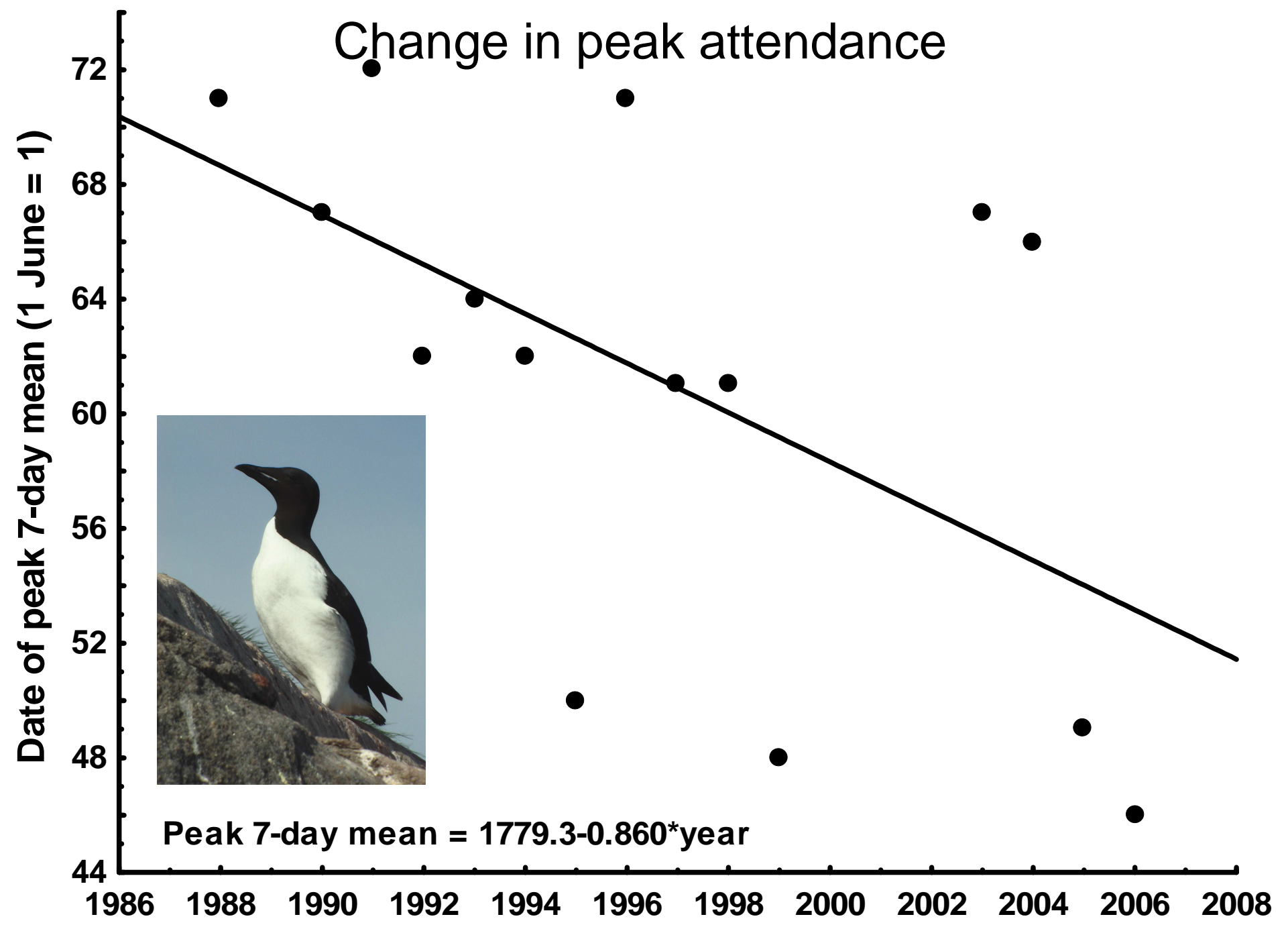
Effect of ice extent on chick growth, Coats



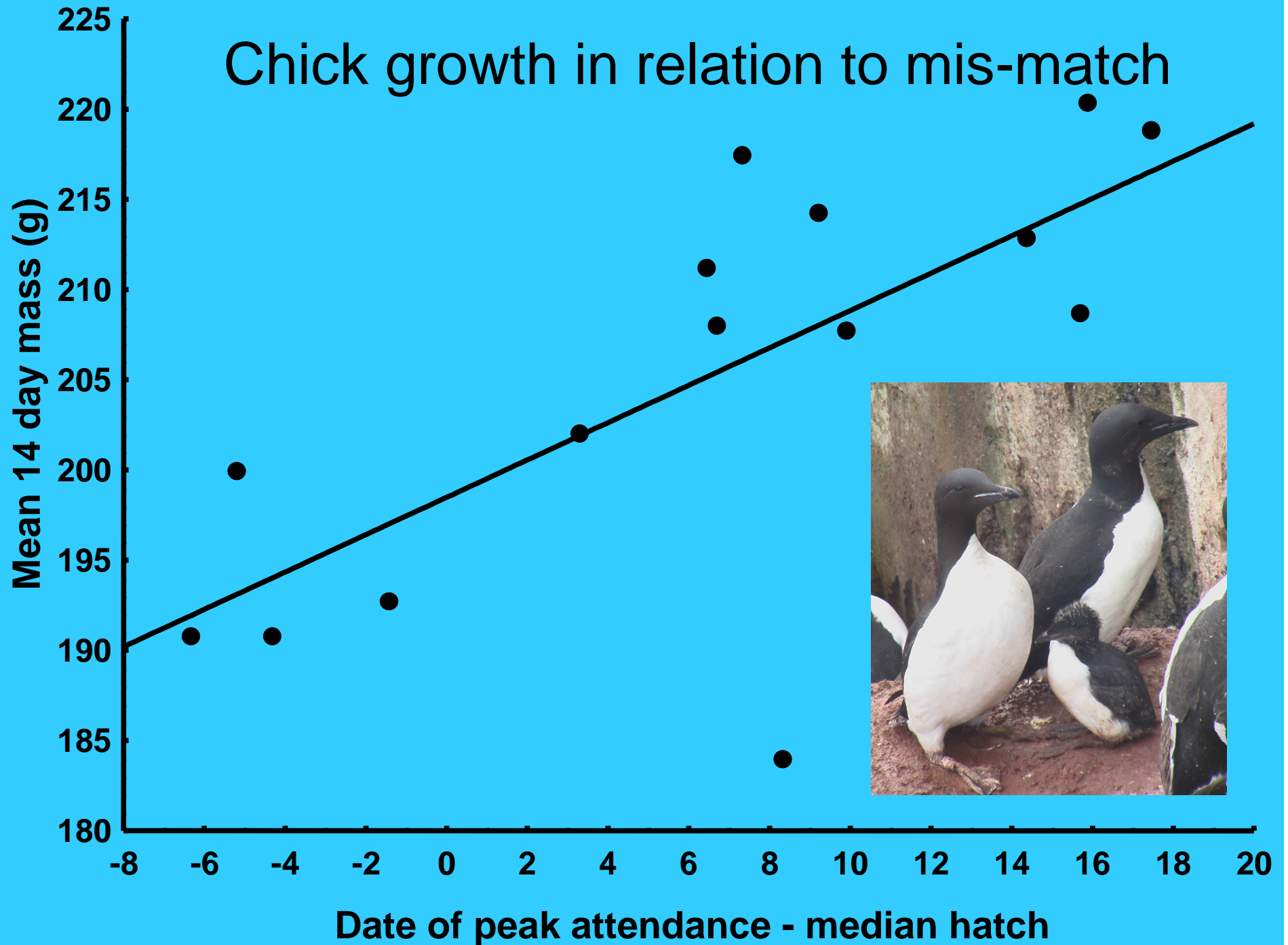
Trends in attendance at Coats Island, 1988, 2006



Change in peak attendance



Chick growth in relation to mis-match



Summary of ice effects at Coats



- Early ice break-up means
 - earlier breeding
 - lower adult mass during chick rearing
 - slower chick growth
 - mismatch between arrival time and breeding time

Prince Leopold Island and ice conditions in Parry Channel









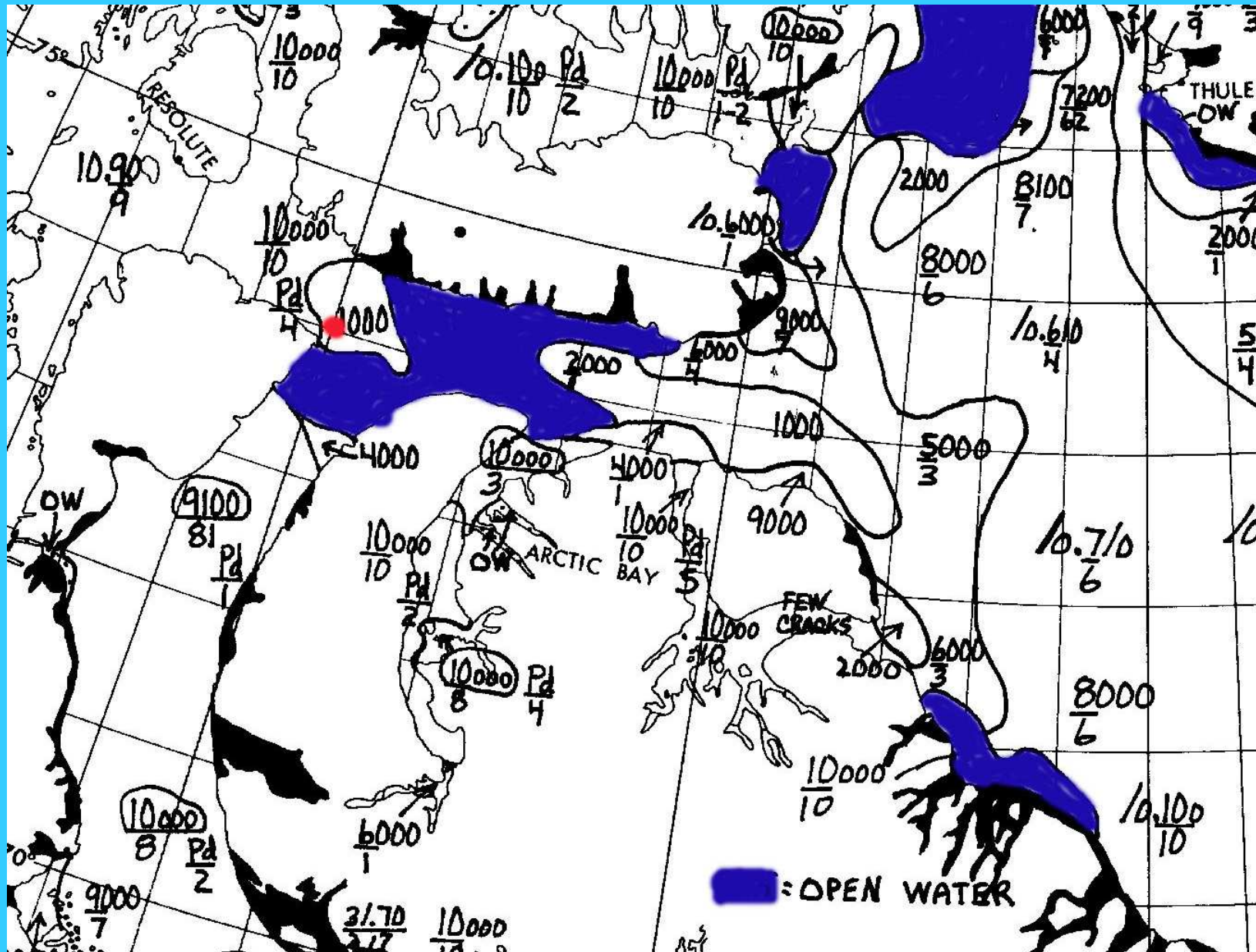
Sometimes it's nice..



Sometimes not so nice ...

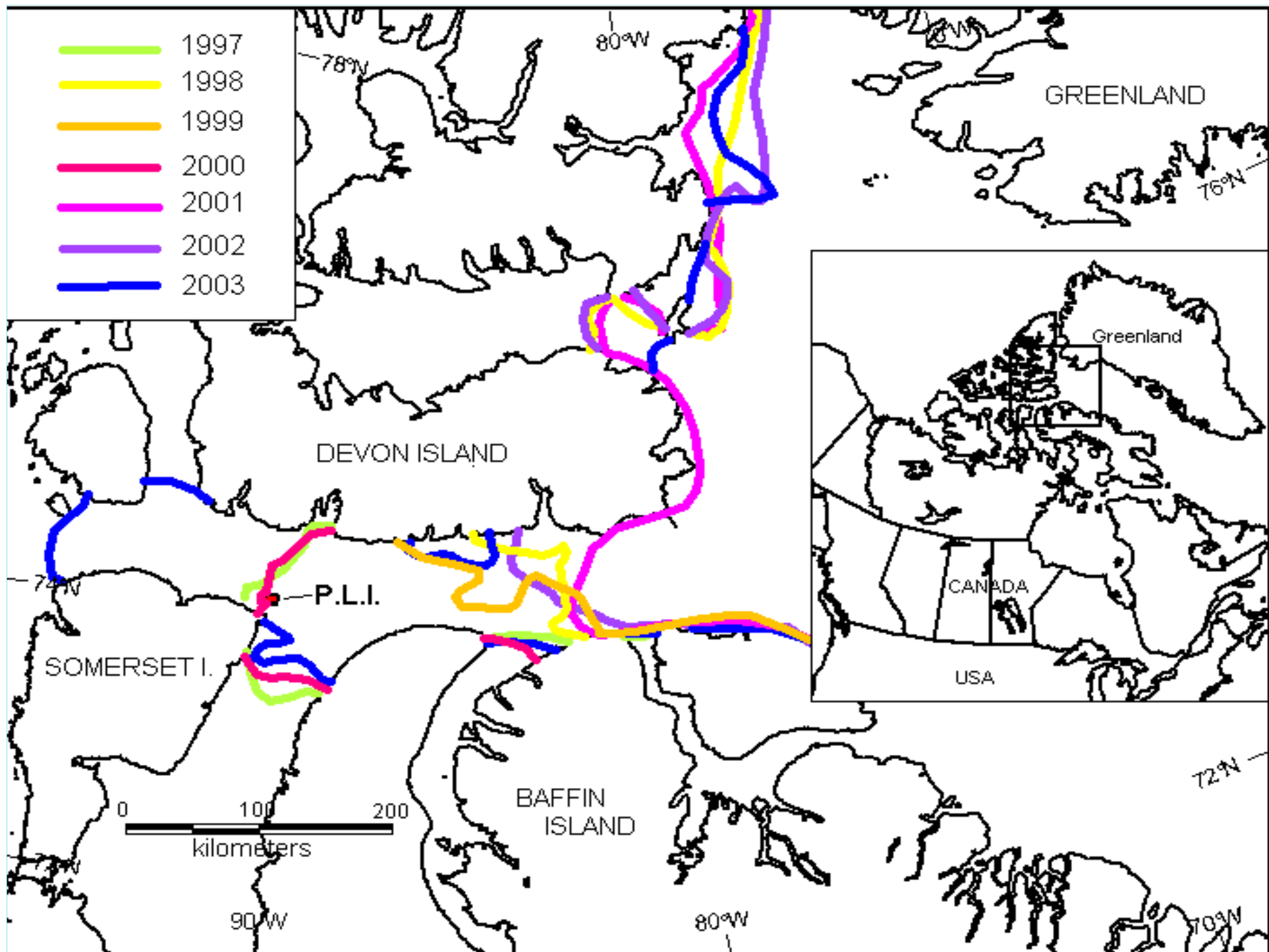
1984

Ice conditions in Lancaster Sound, June 1975

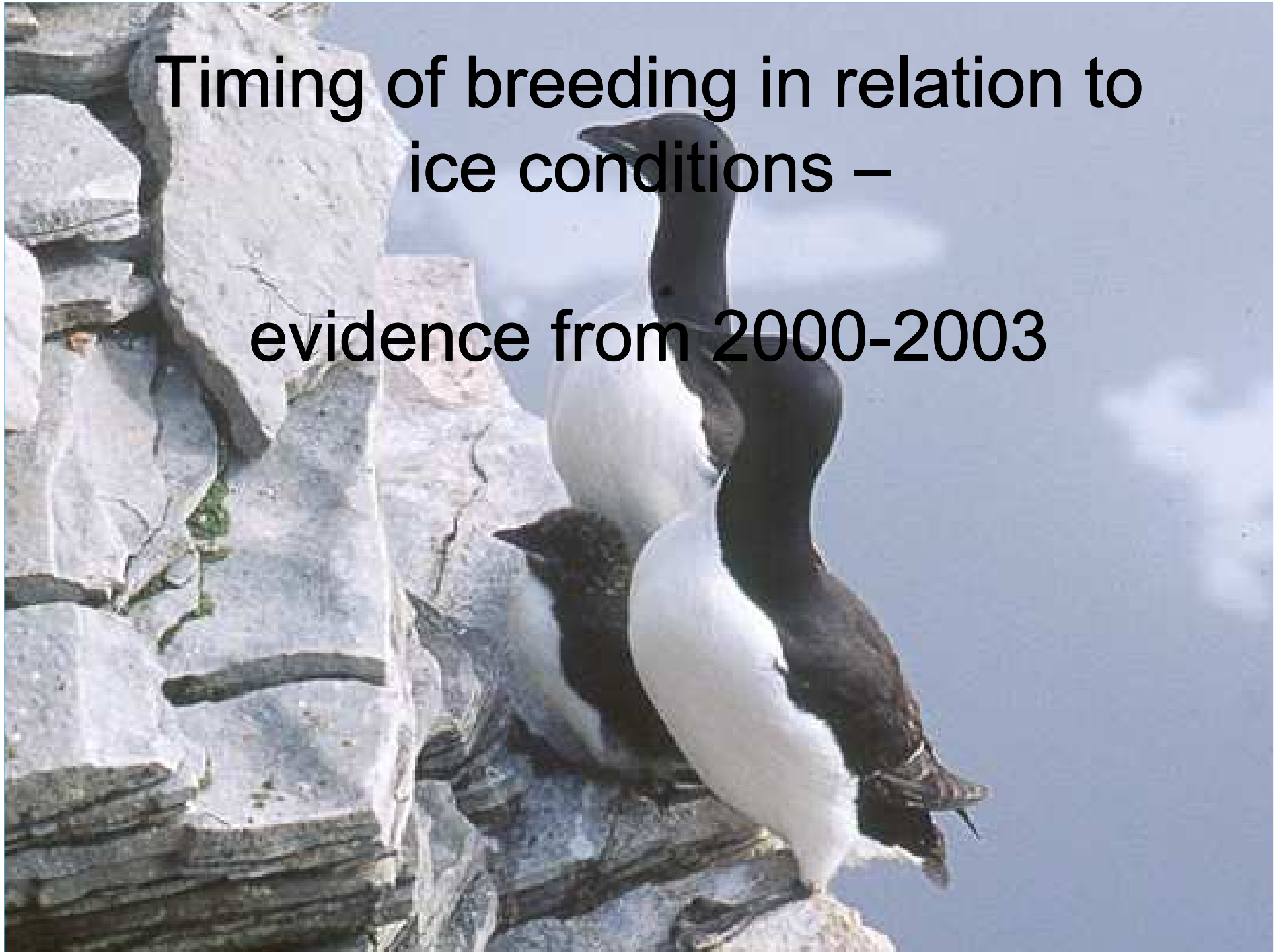


Small wings, long journey

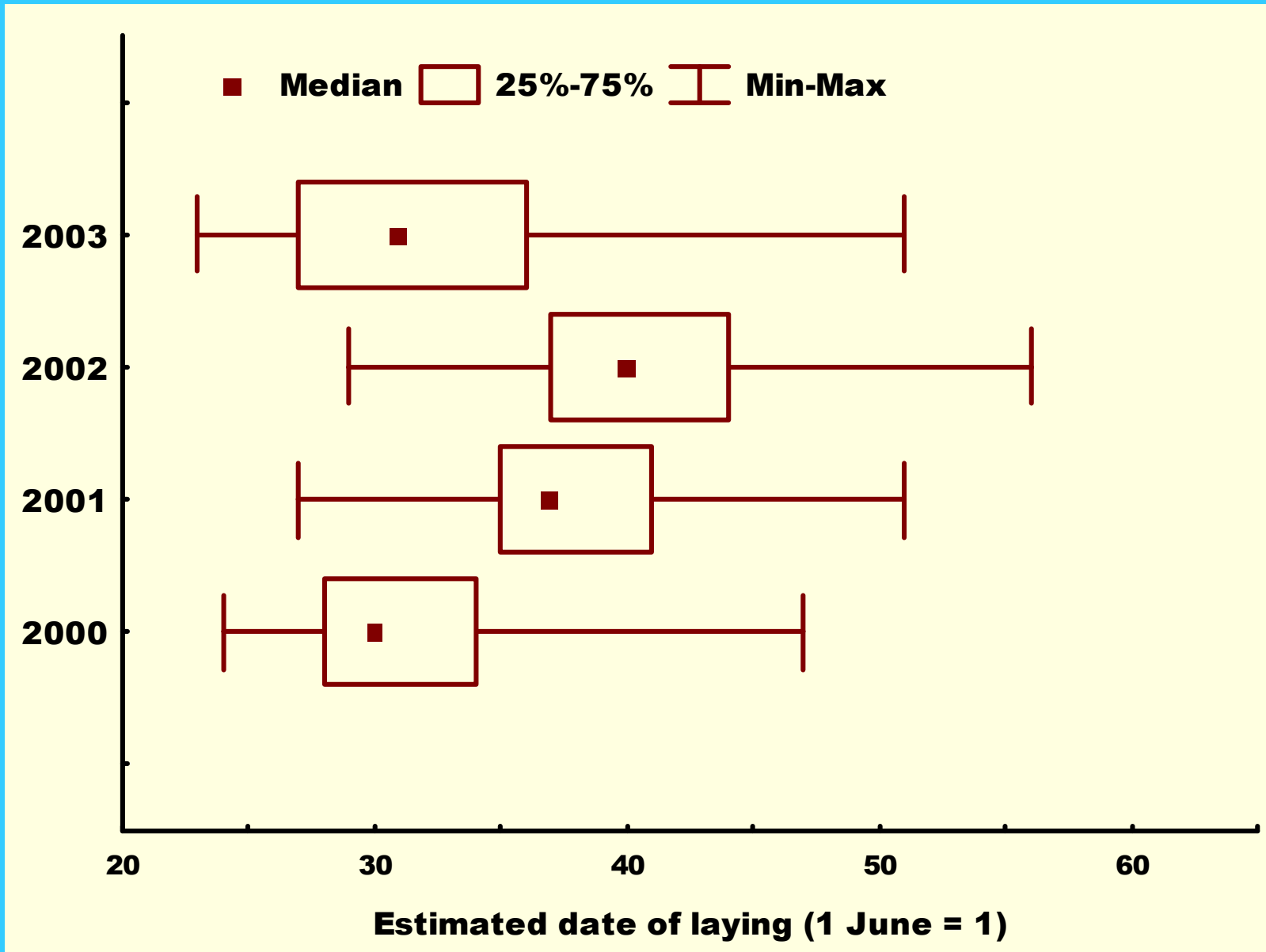




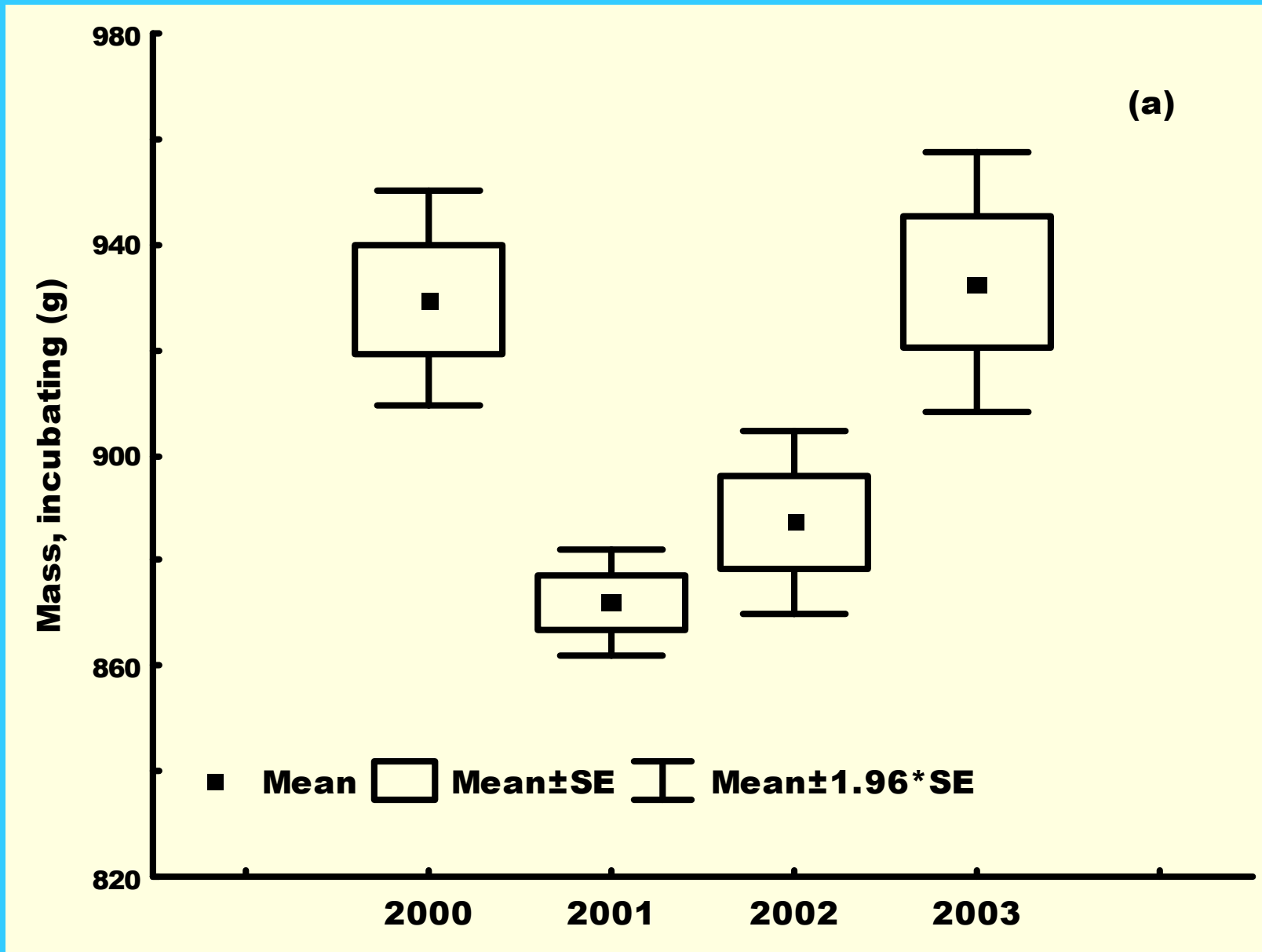
**Timing of breeding in relation to
ice conditions –
evidence from 2000-2003**



PLI date of laying



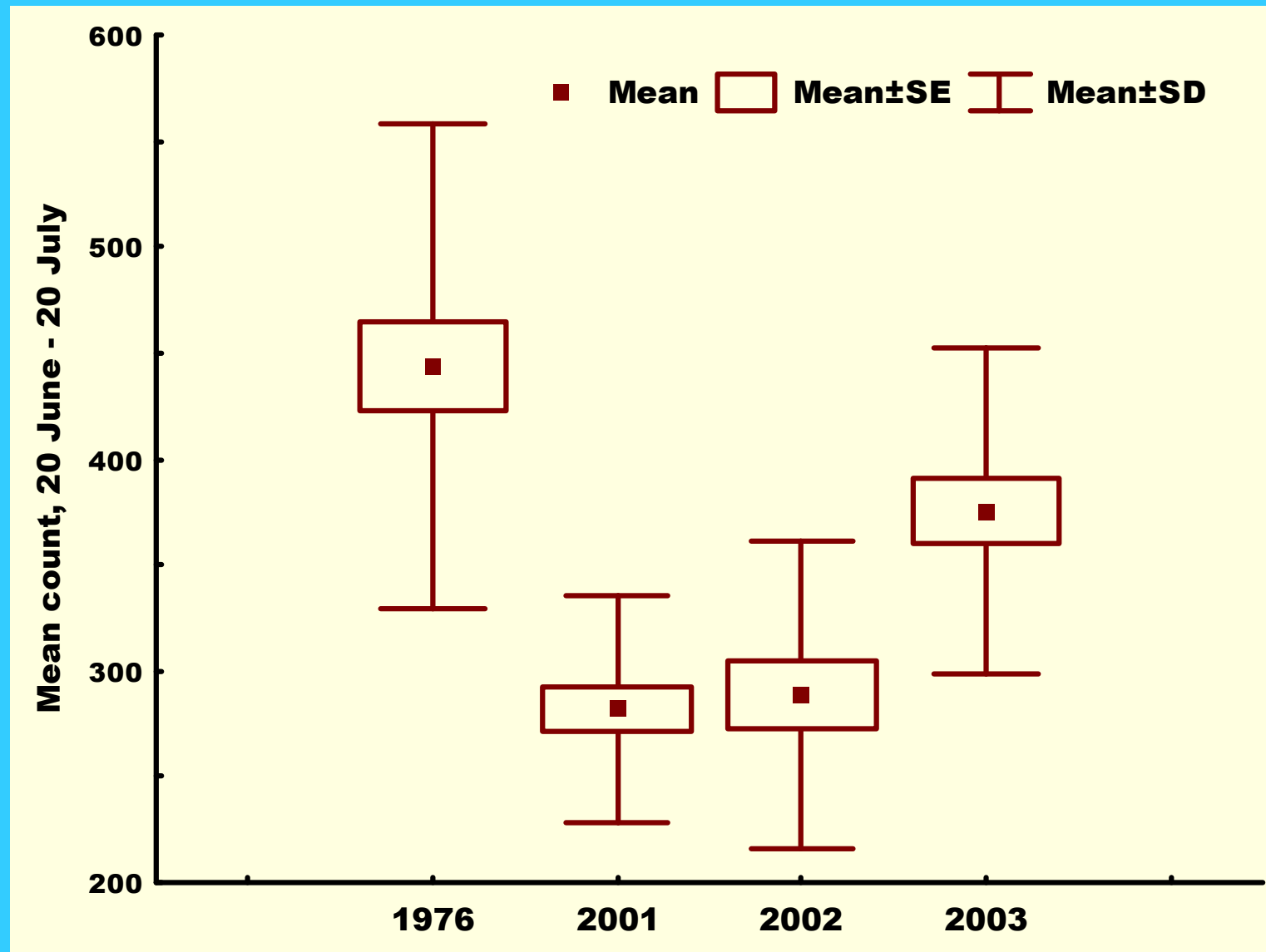
PLI mass of incubating akpas



Northern Fulmars



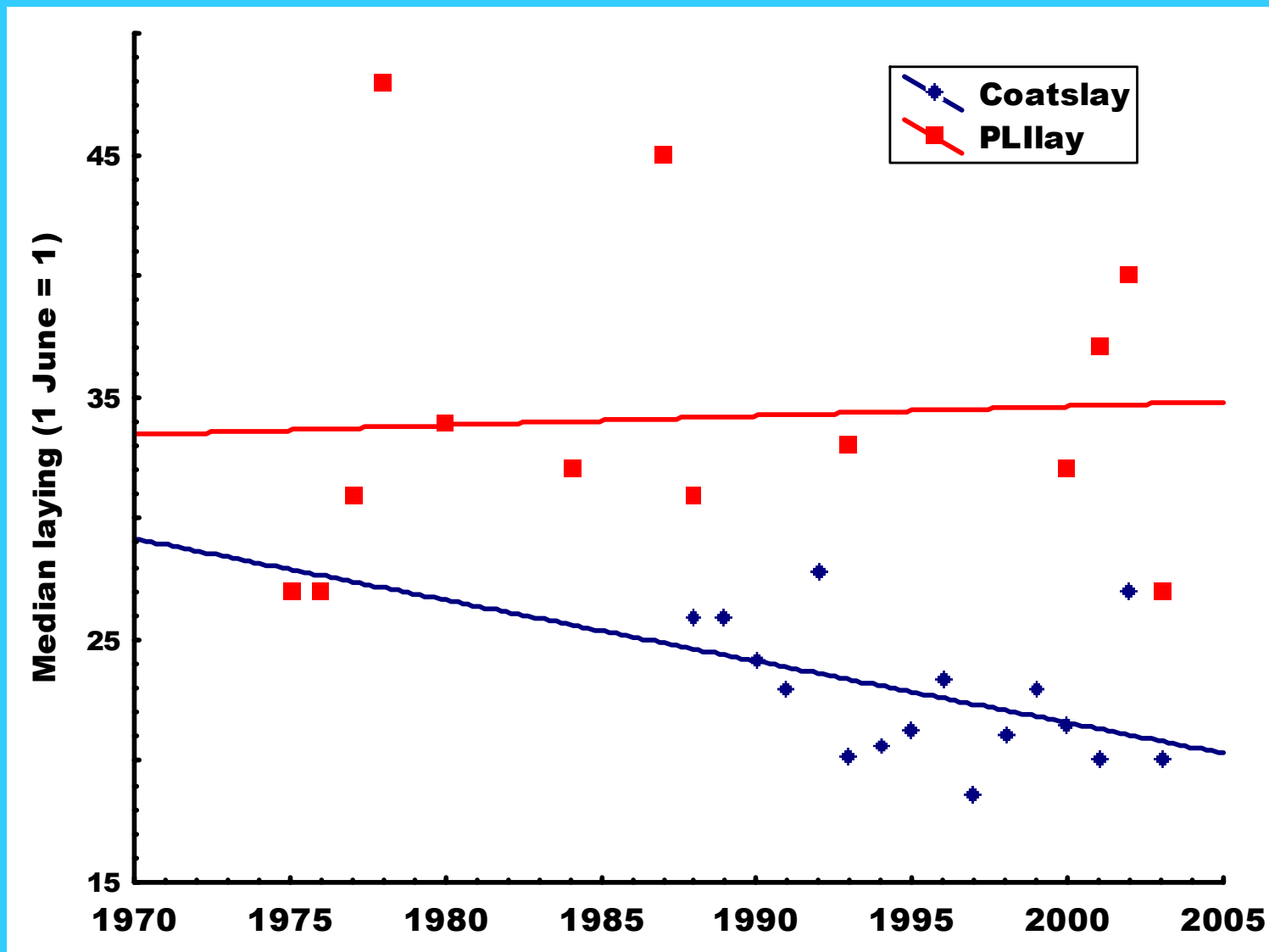
Fulmar mean attendance, incubation



Black-legged Kittiwake



Trends in laying dates for Akpa



So...

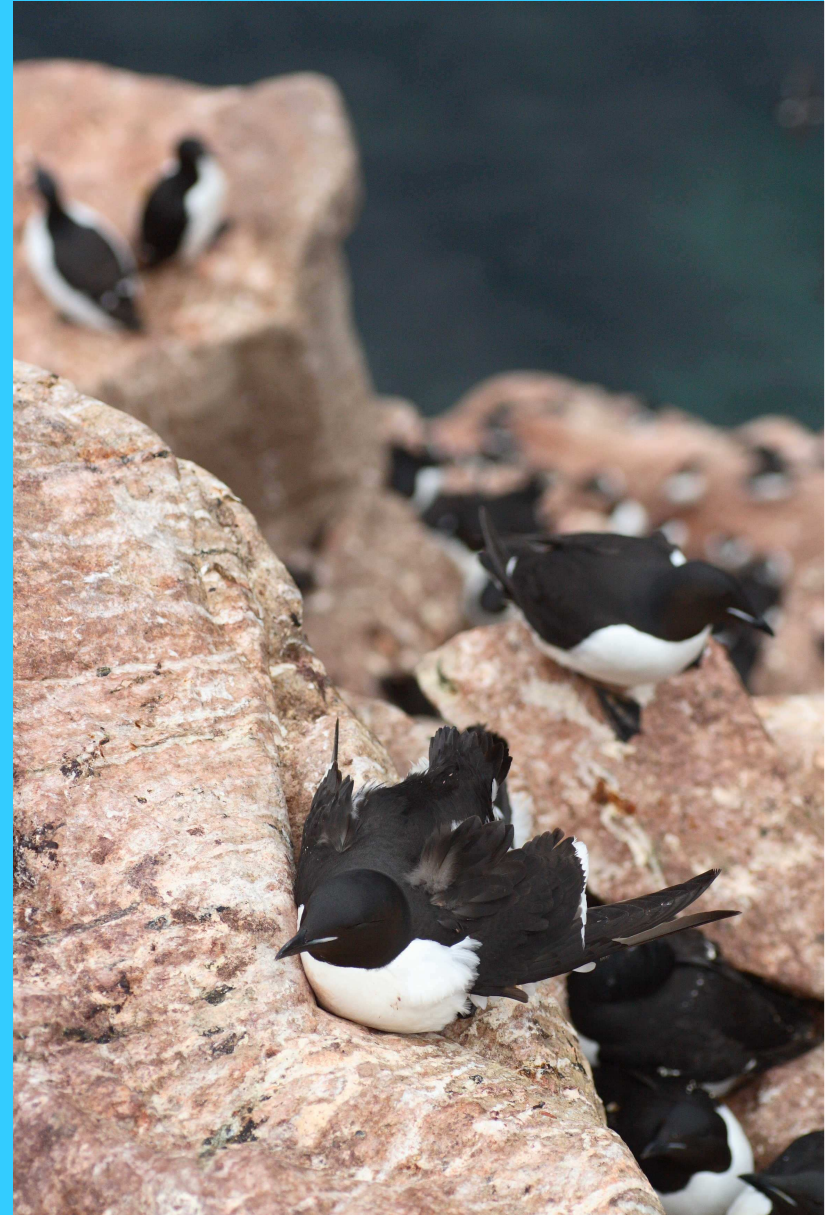
- In the South (Coats), trends in ice break-up means worse conditions for akpa (lower adult mass, slower chick growth)



- In the North (PLI) earlier ice break-up means better conditions for akpa (more, heavier chicks, higher adult mass)

A Closer Look At Coats

- Why the mismatch? Why lower growth rates? Why lower adult mass? Why are they just “hanging on”?



DIVERSE DIET

PELAGIC, SCHOOLING FISH

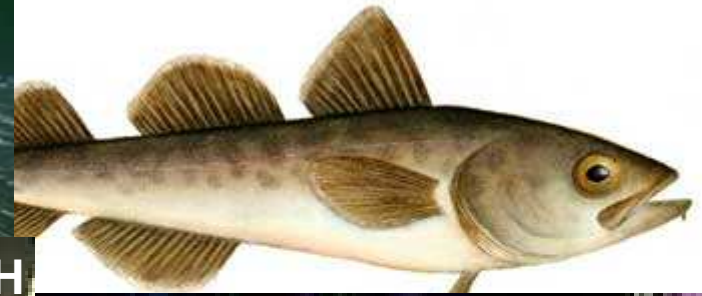
INVERTEBRATE--SLOW



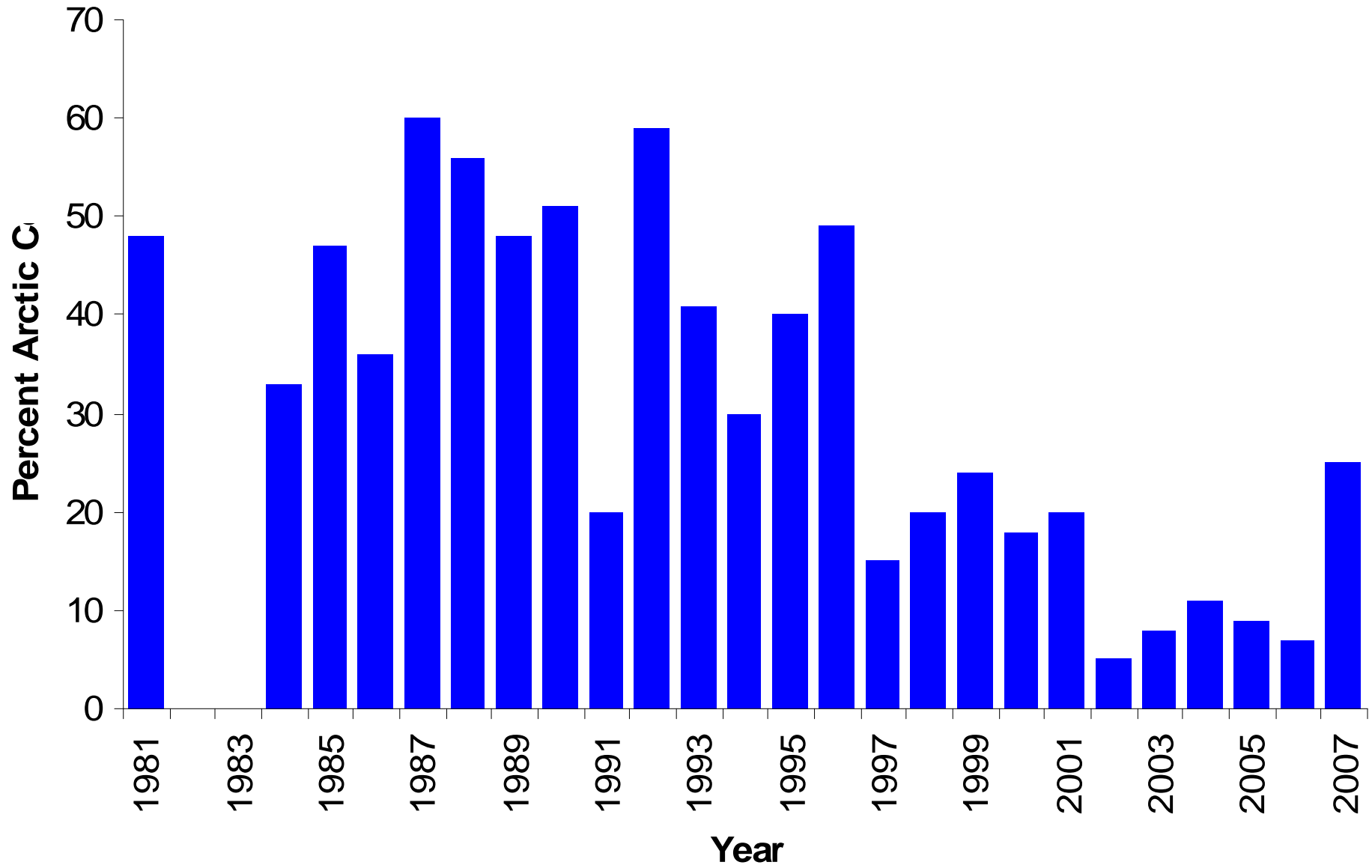
INVERTEBRATE--FAST



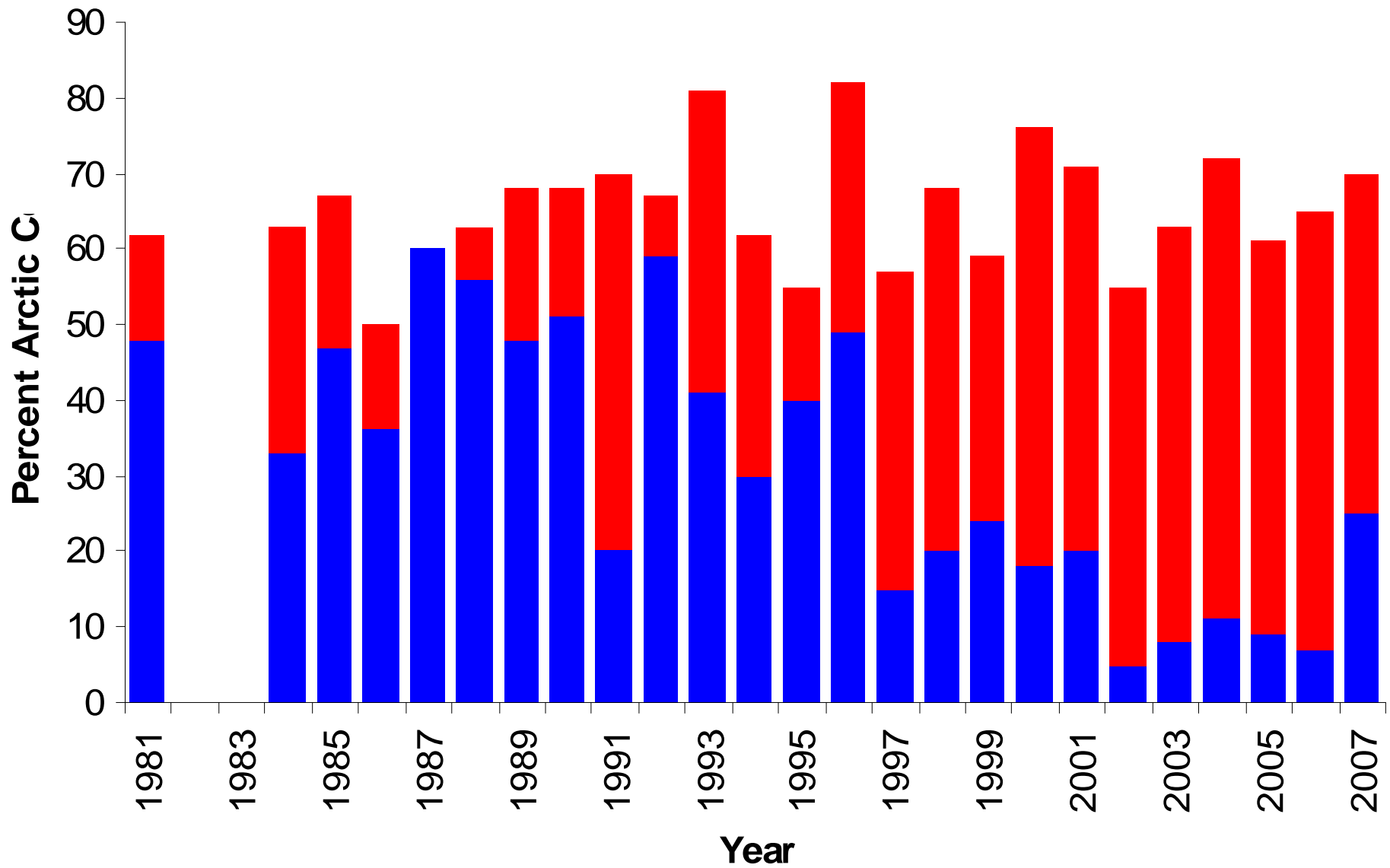
BENTHIC, STATIONARY FISH



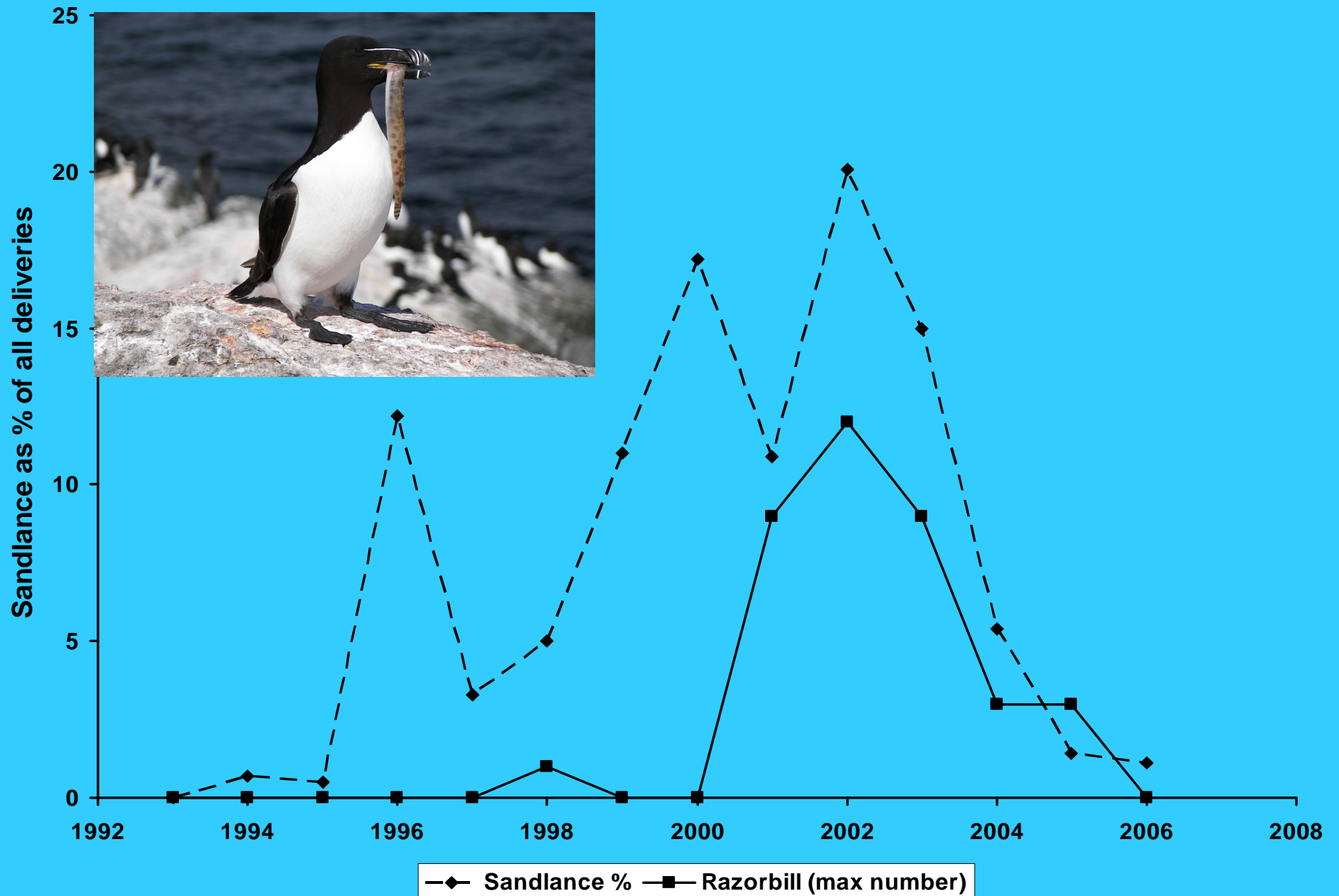
Coats Island Thick-billed Murre Nestling Diet 1981-2007



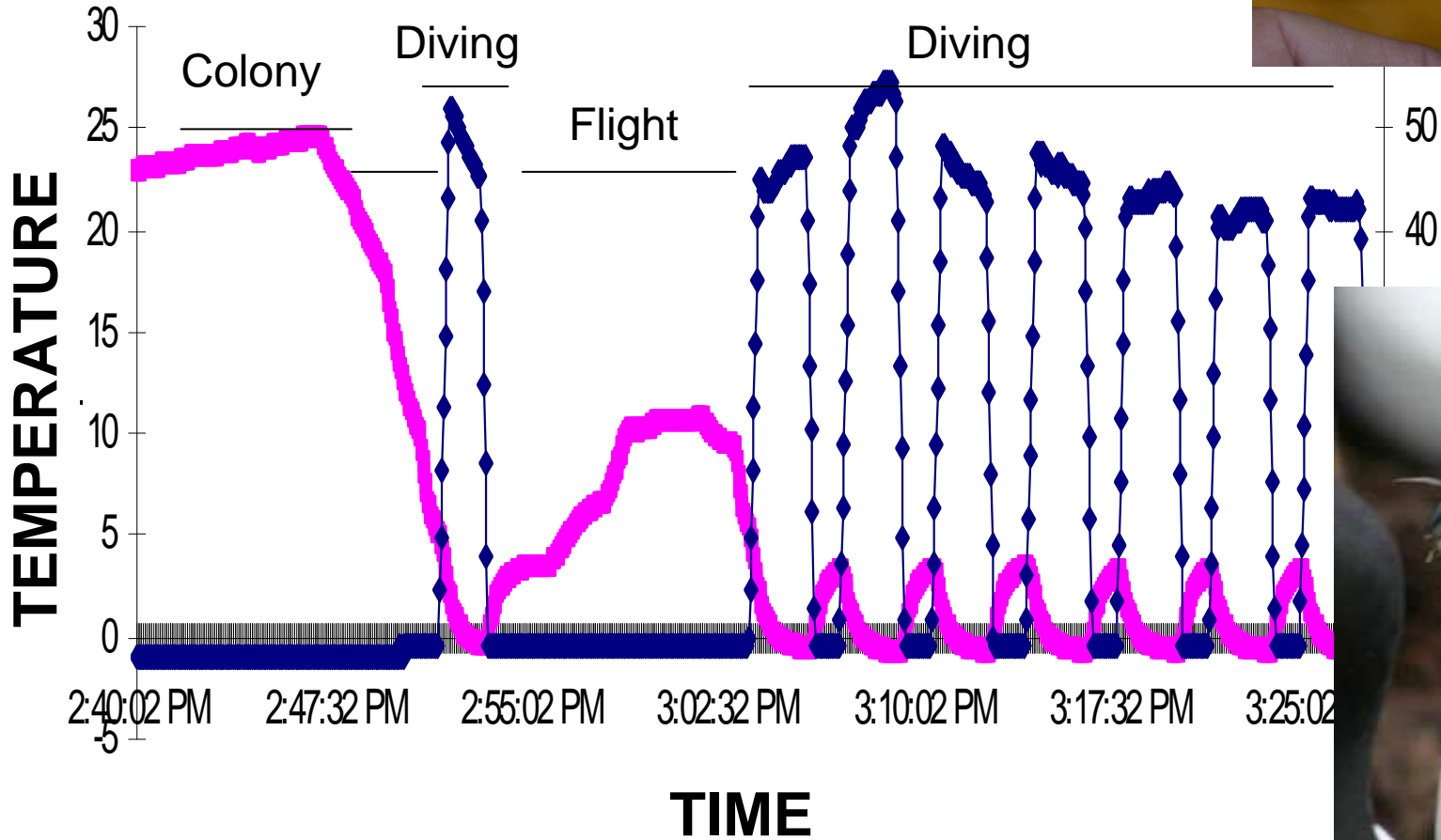
Coats Island Thick-billed Murre Nestling Diet 1981-2007



Sandlance and Razorbills

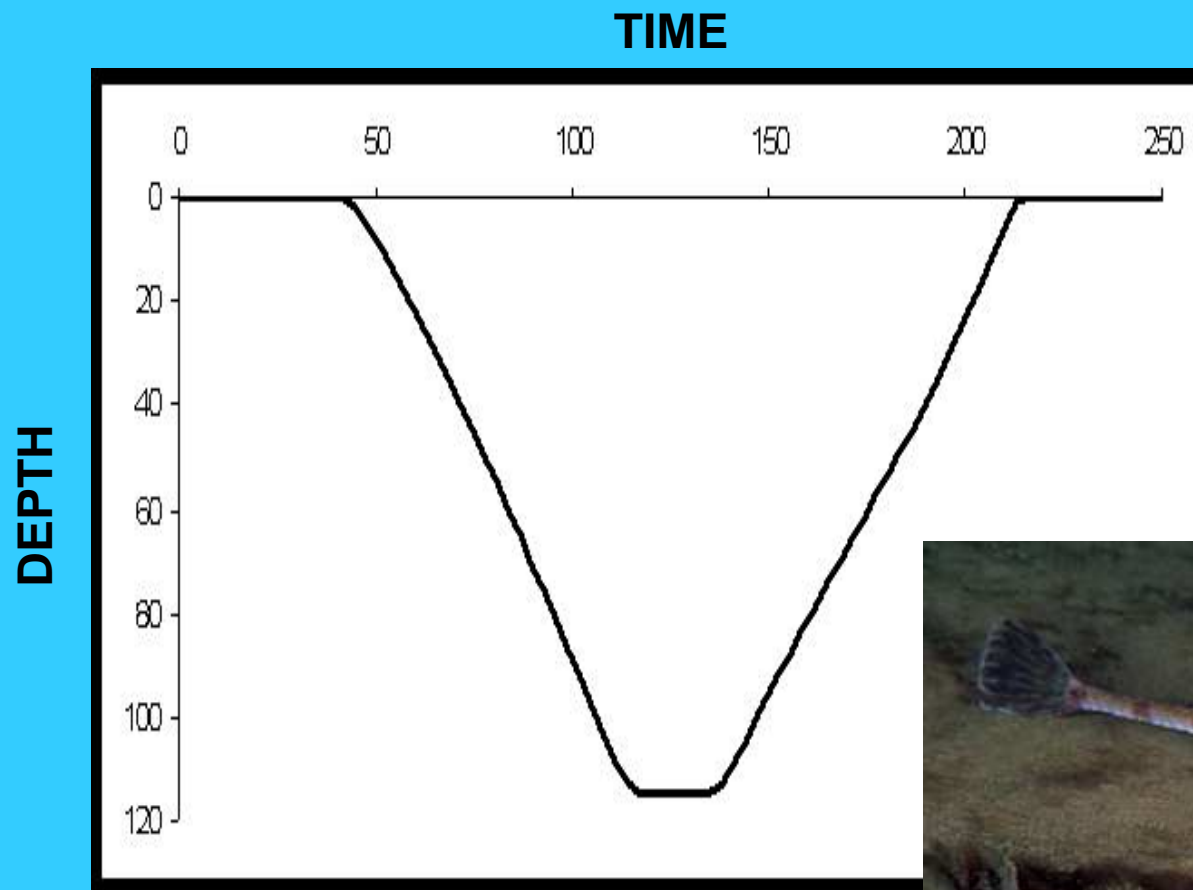


Depth-temperature Recorders



Benthic Fish

Atlantic Poacher: Another Newcomer



Slow, Pelagic Invertebrate Amphipods

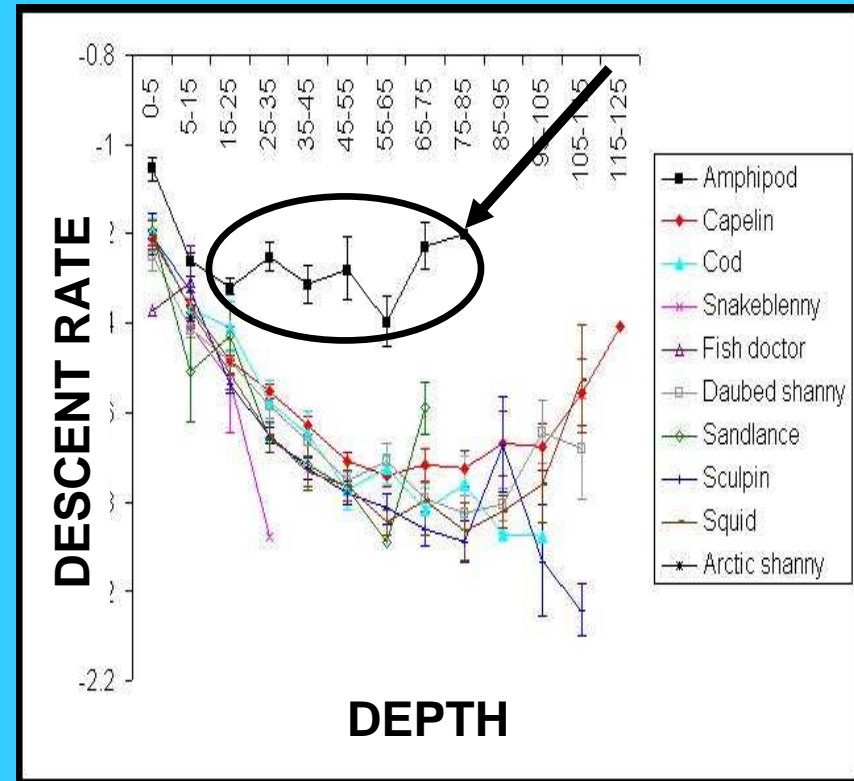
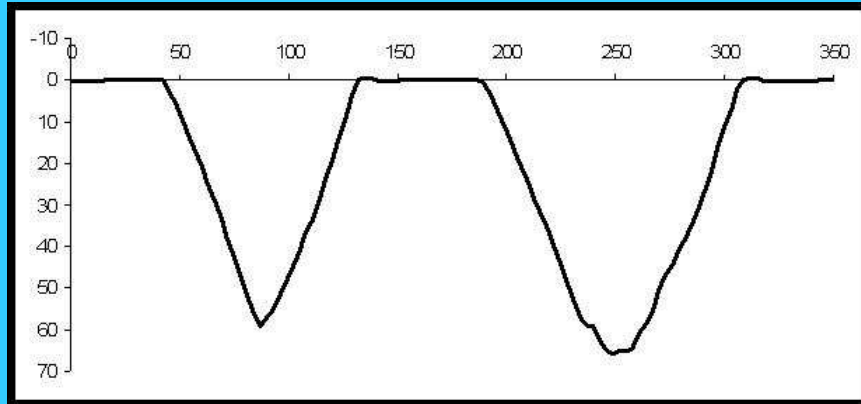
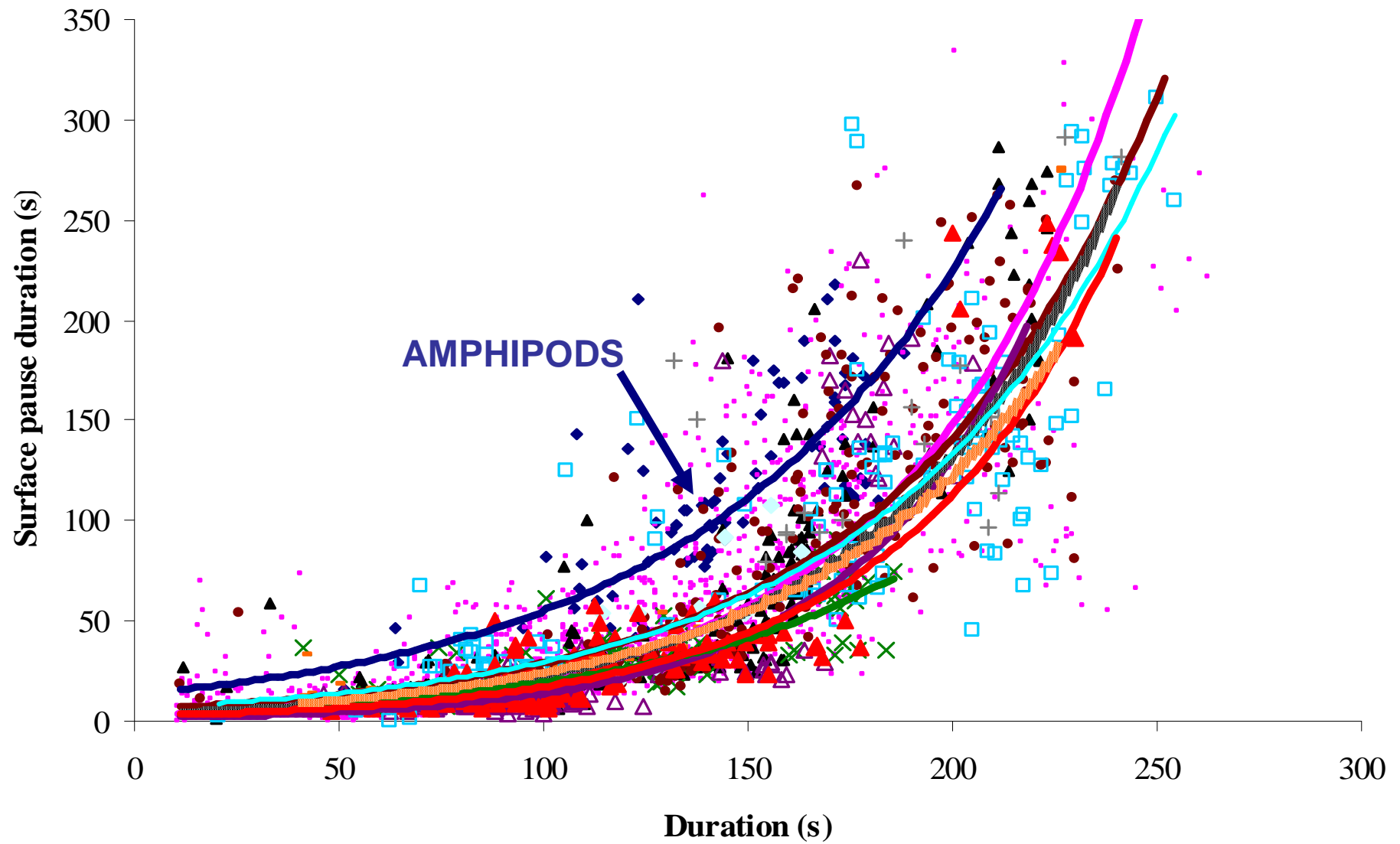
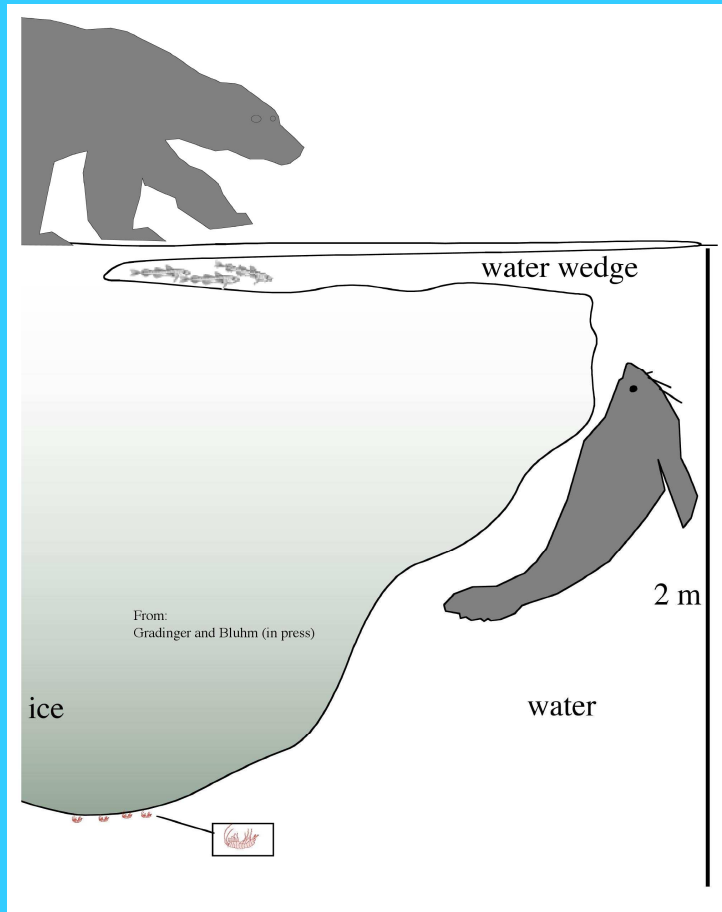


Photo courtesy of FishBase.Org

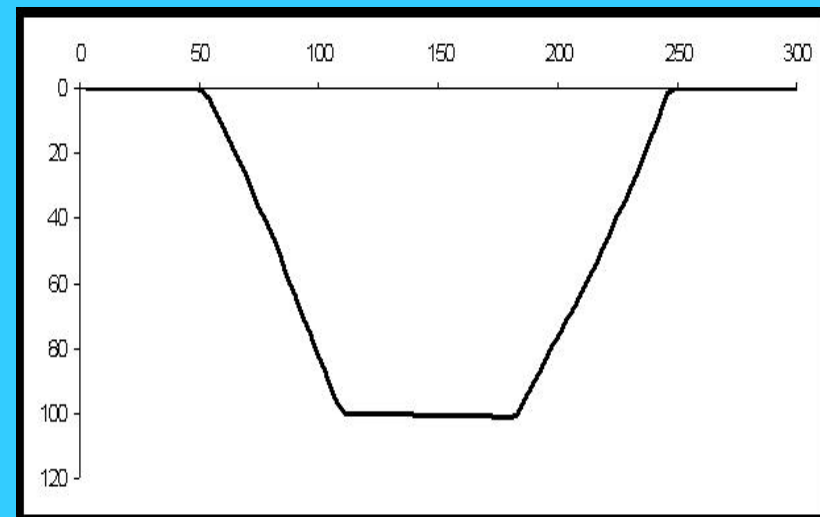
Amphipods

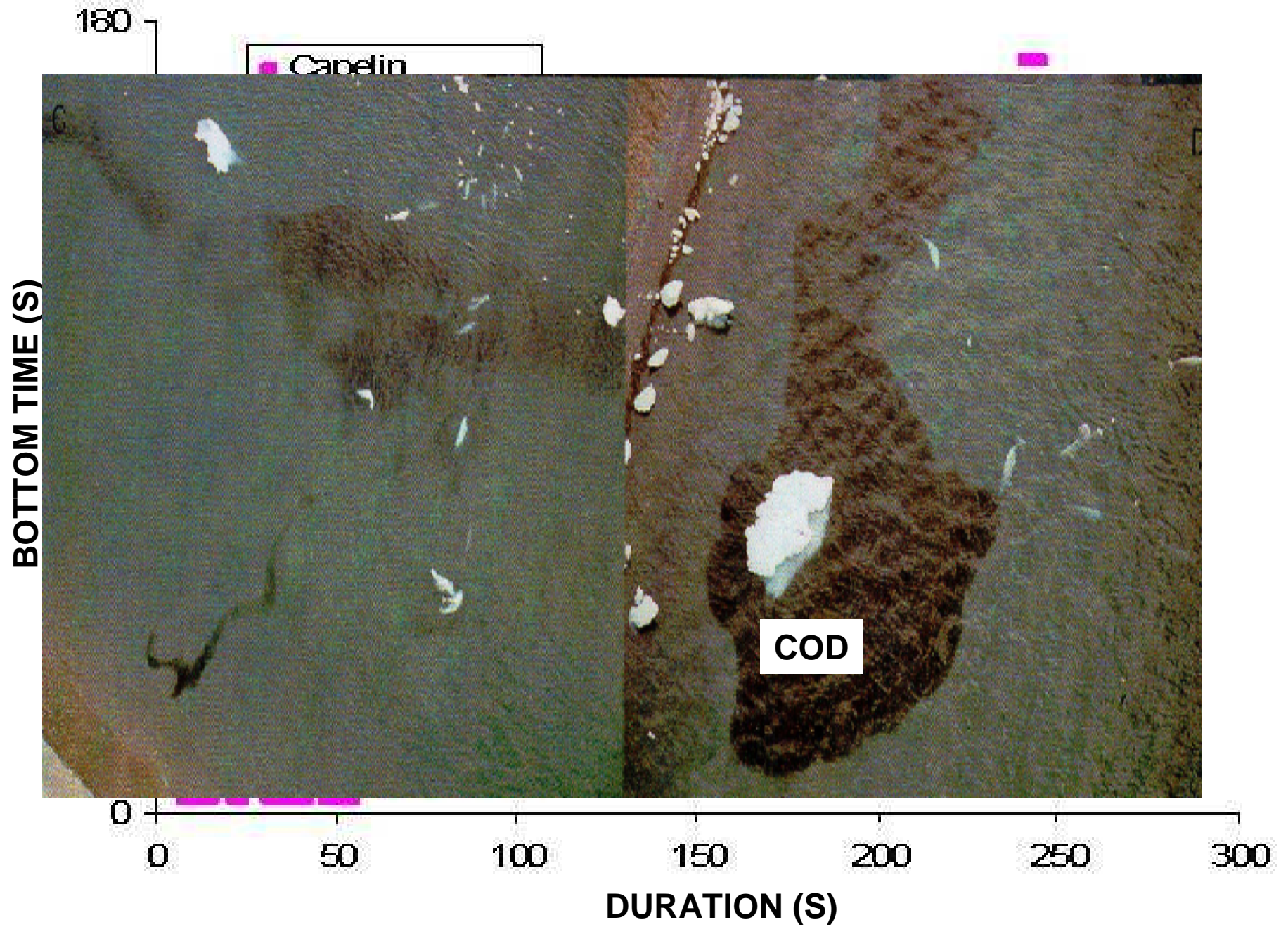


Ice-linked Pelagic, Schooling Fish Arctic Cod



Benthic during ice-free period?

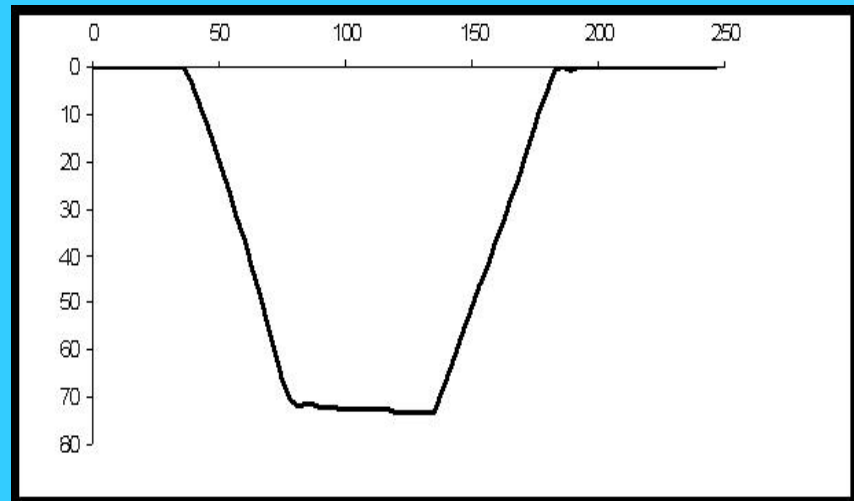
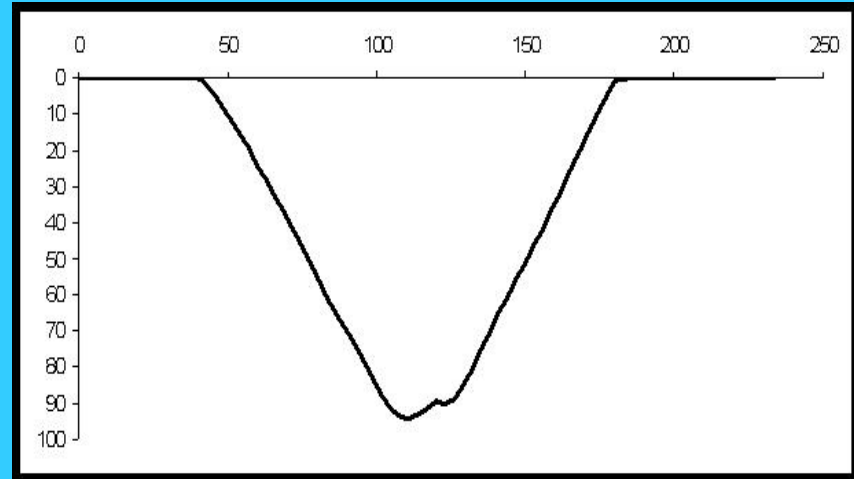




“Generalist” Prey Item Capelin



First spawning records in 2006 & 2007



Nighttime Pelagic Fish Sand lance

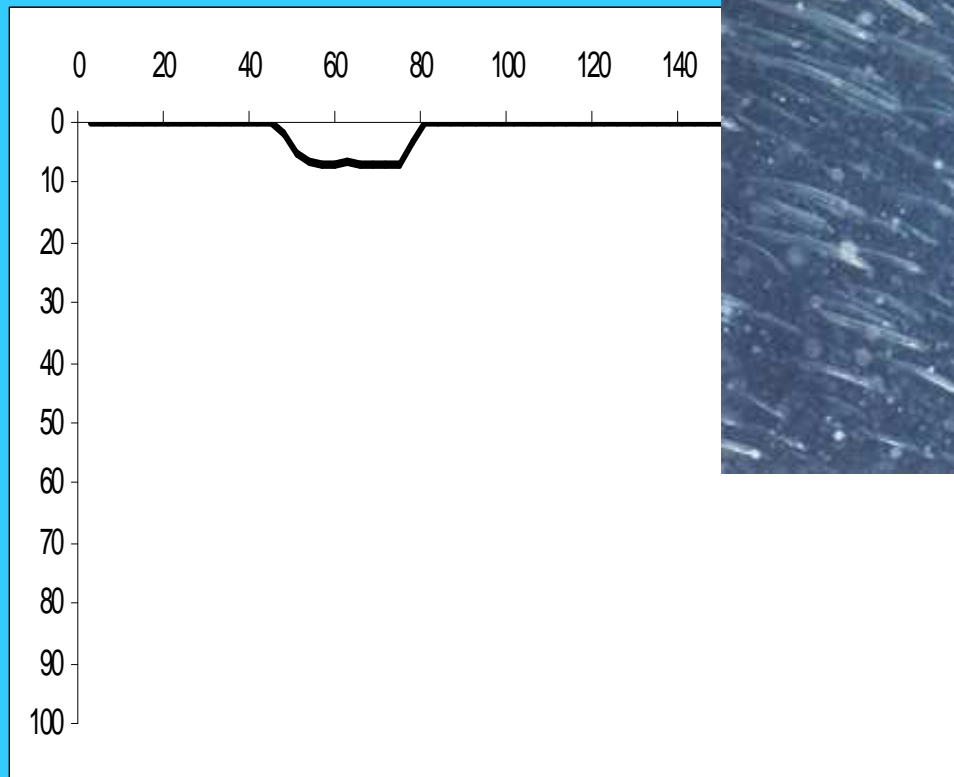
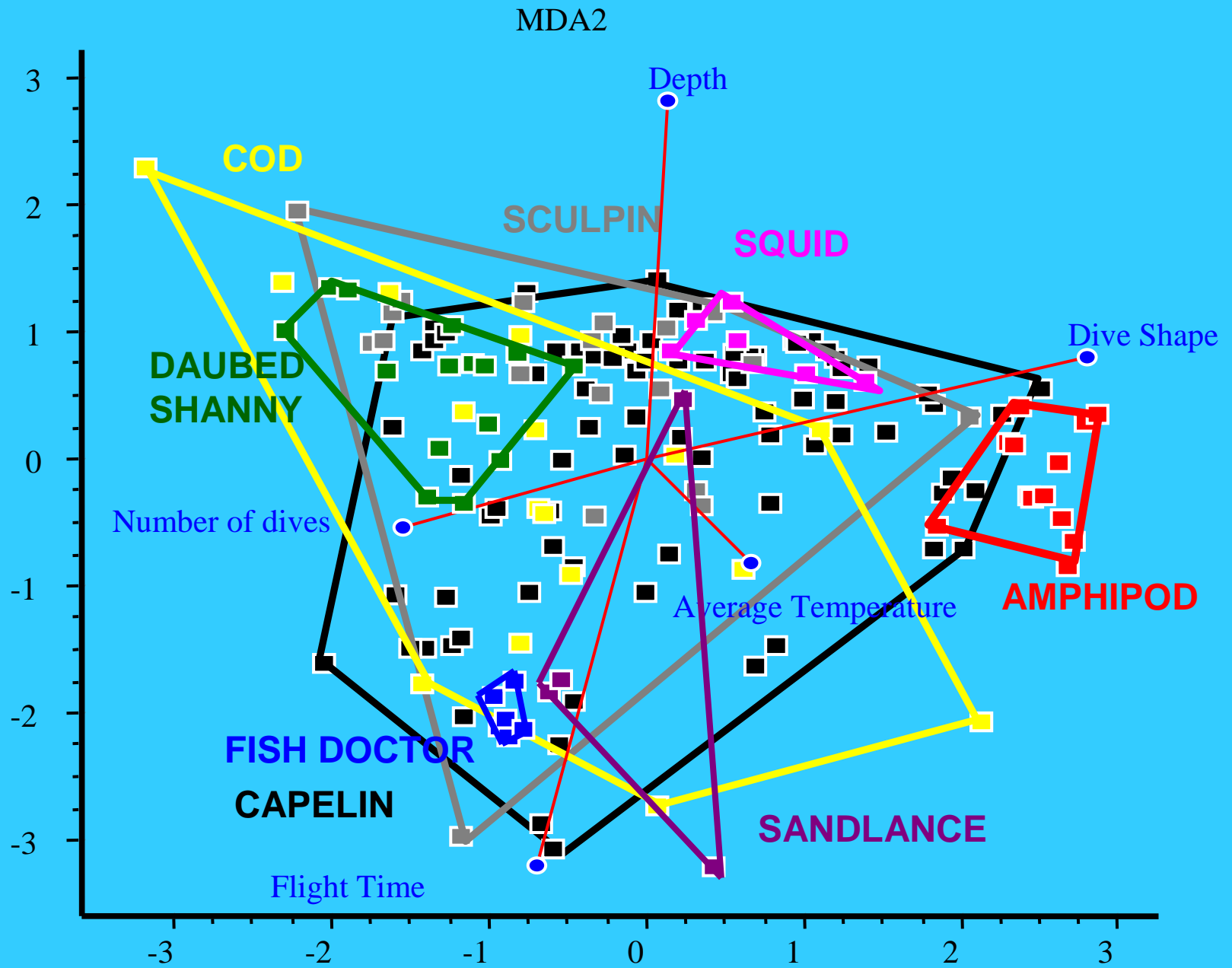
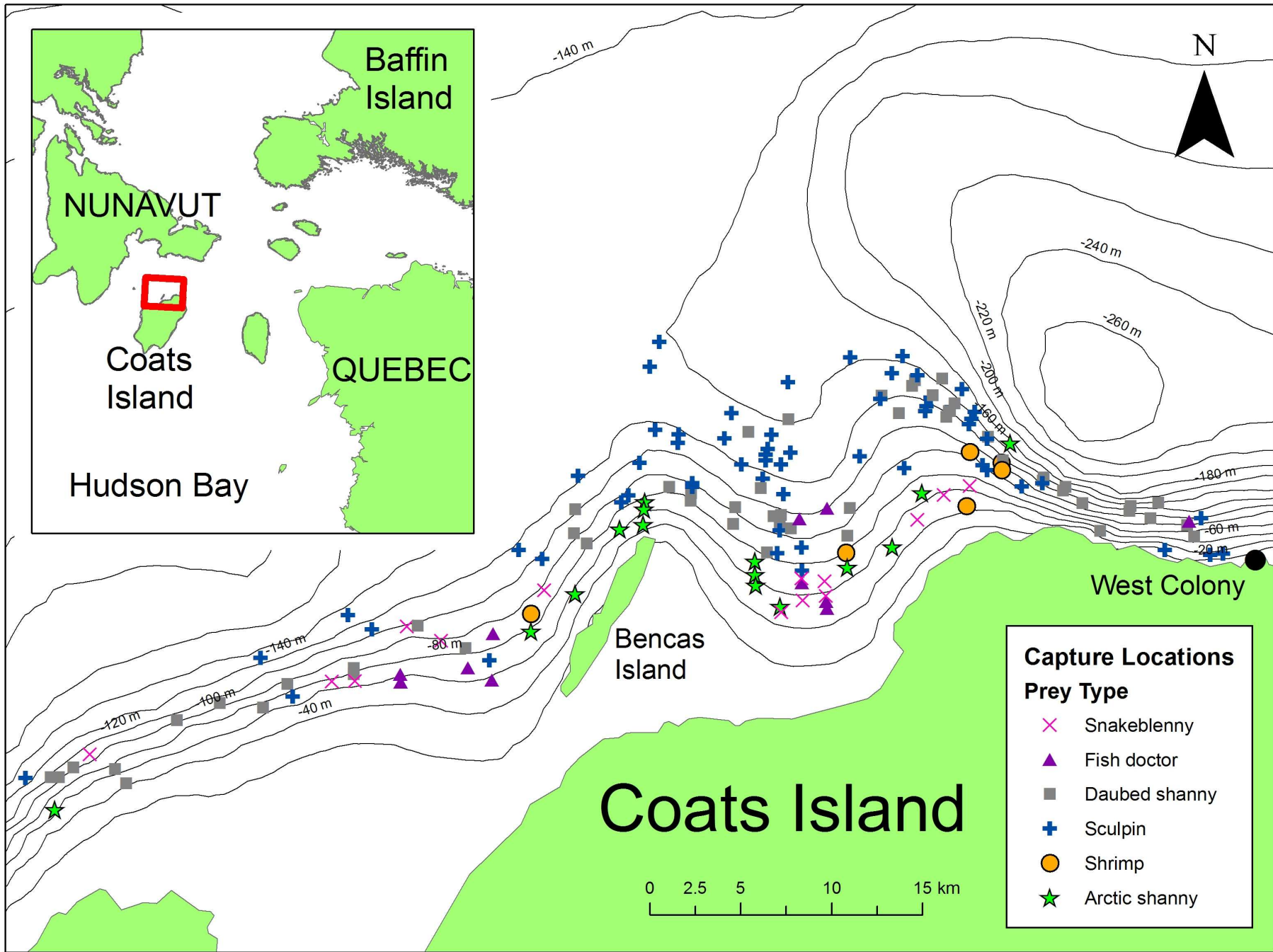
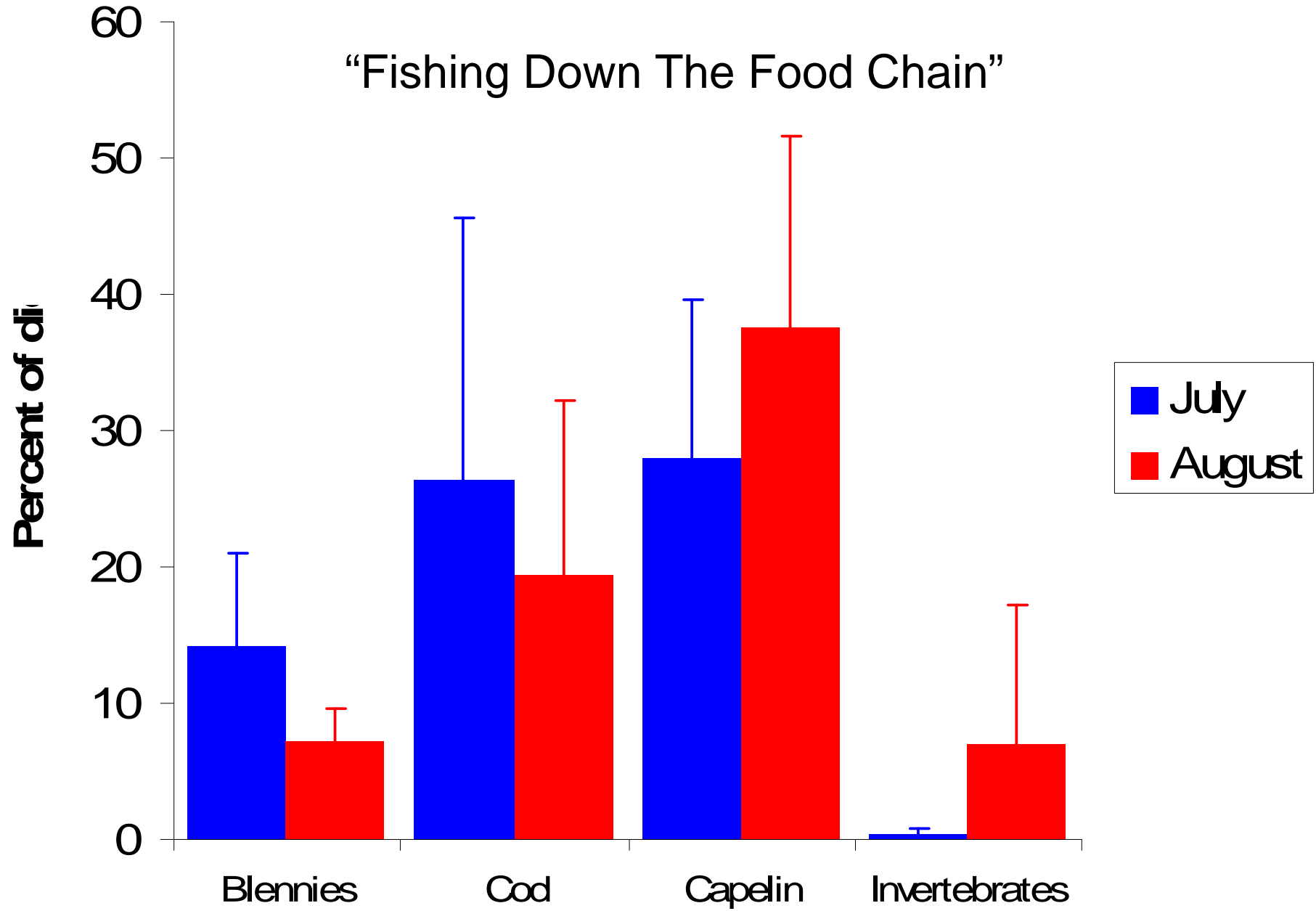


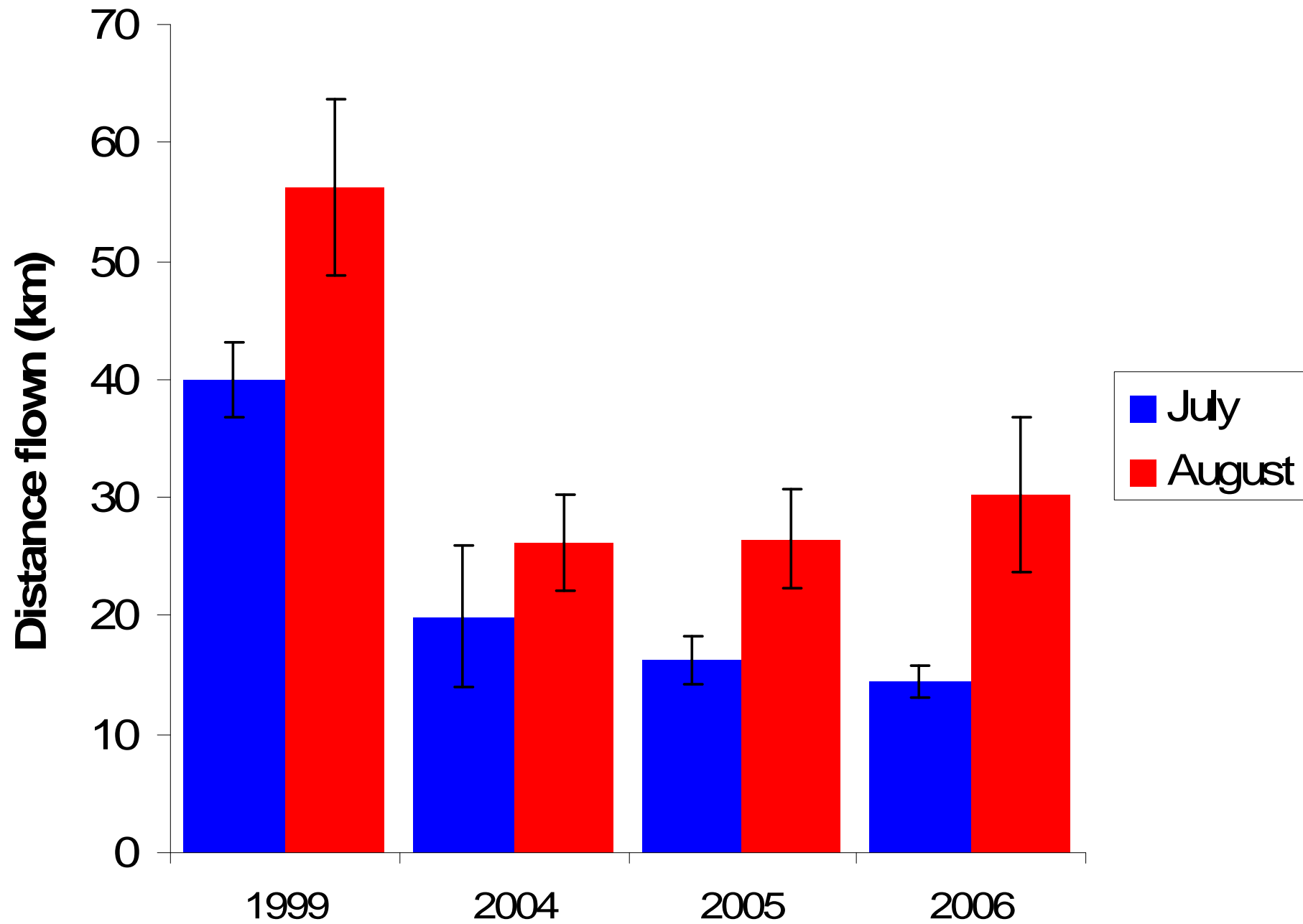
Photo courtesy of FishBase.Org



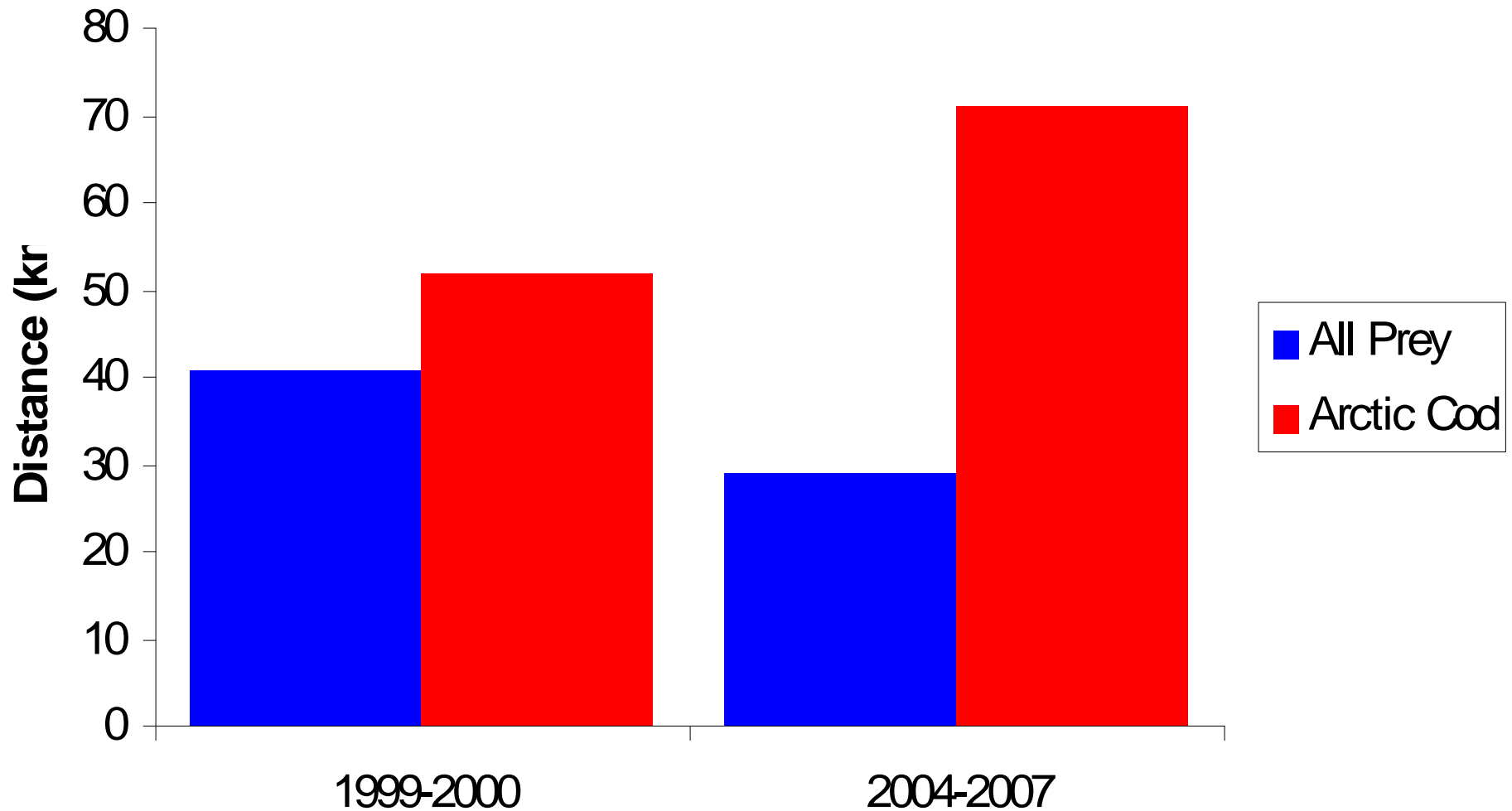


"Fishing Down The Food Chain"

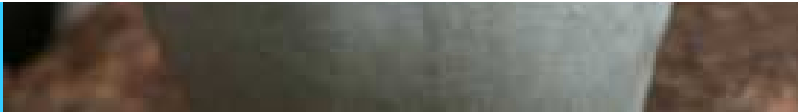
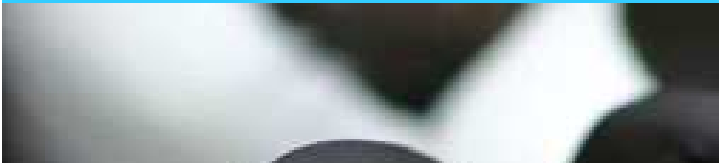




Flying Farther For Less



Capelin vs. Cod



Capelin

20 kJ/g

8 g

Energy

Mass

Cod

25 kJ/g

20 g

Conclusions:



- Diet is changing
- Fishing down the food chain: Conditions deteriorating towards the end of the season
- Large, lipid-rich fish being replaced by smaller, lipid-poor fish
- Likely causes the “mismatch”

Ecosystem Effect?

- Arctic cod are “keystone” species



For the Future

2007 & IPY

Looking down the
food chain:

Stable Isotopes
Stomach contents



