

Science, Service, Stewardship



Climate Change and Arctic Fisheries

Mike Sigler
NOAA Alaska Fisheries Science Center

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Presentation at 3rd Symposium on the Impacts of an Ice-Diminishing Arctic on Naval & Maritime Operations, Annapolis, Maryland, 11 June 2009



Outline: Climate Change and Arctic Fisheries

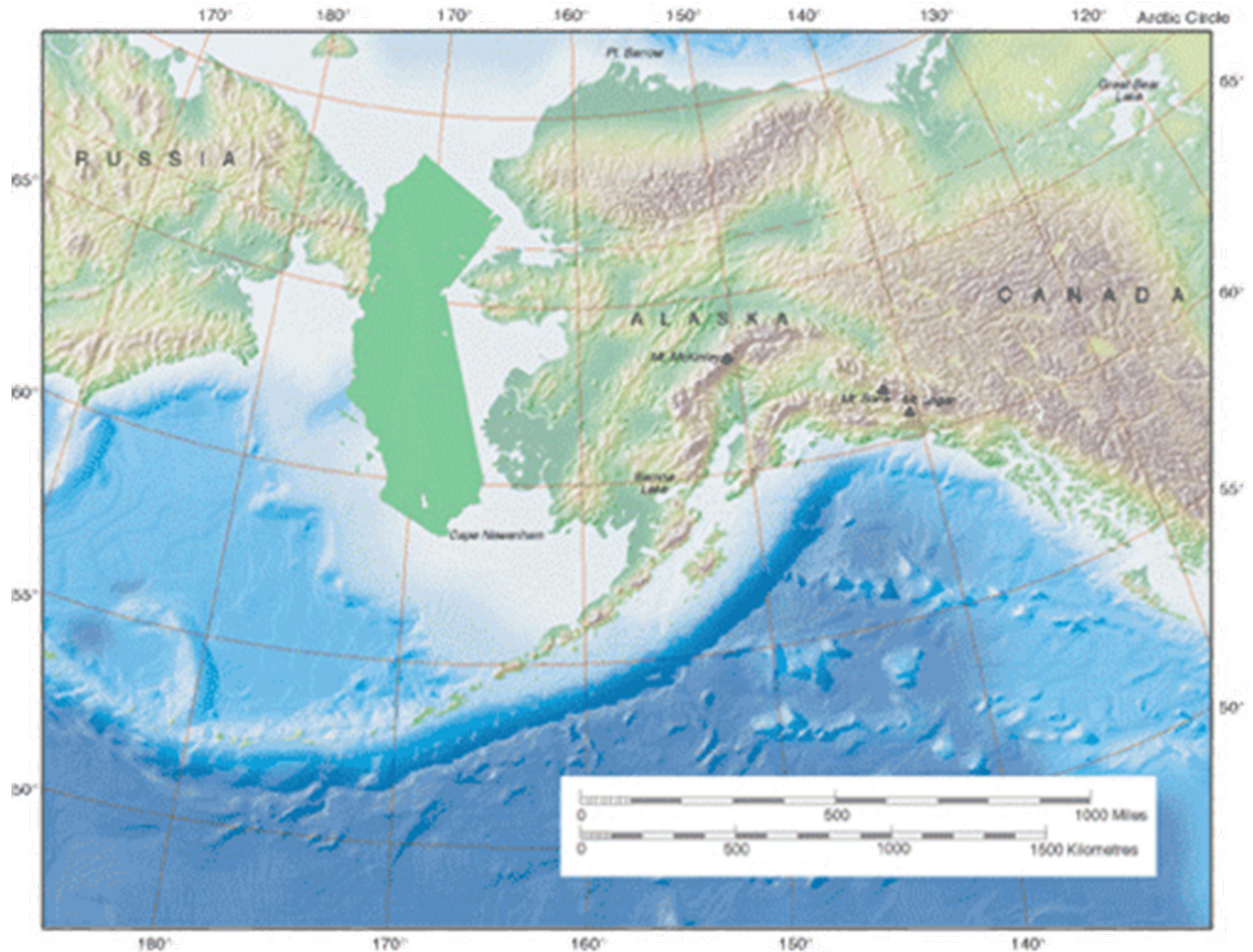
- Ecological and economic importance
- Ecosystem changes
- NOAA policies on Arctic fishing

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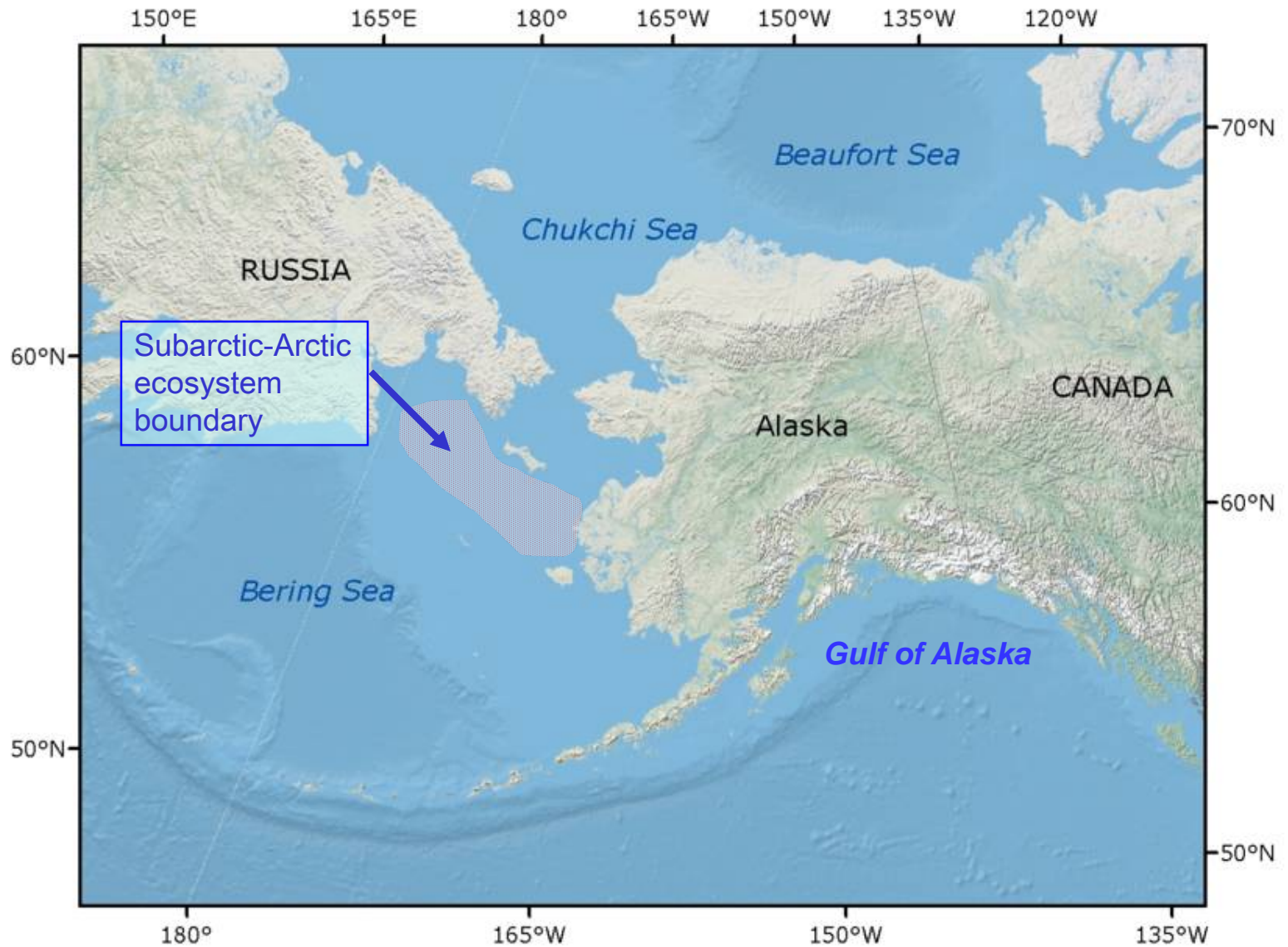


Ecological and Economic Importance

Scale Matters: California is Small



U.S. Arctic and Subarctic



Arctic Ecosystem (benthic dominant)



Walrus

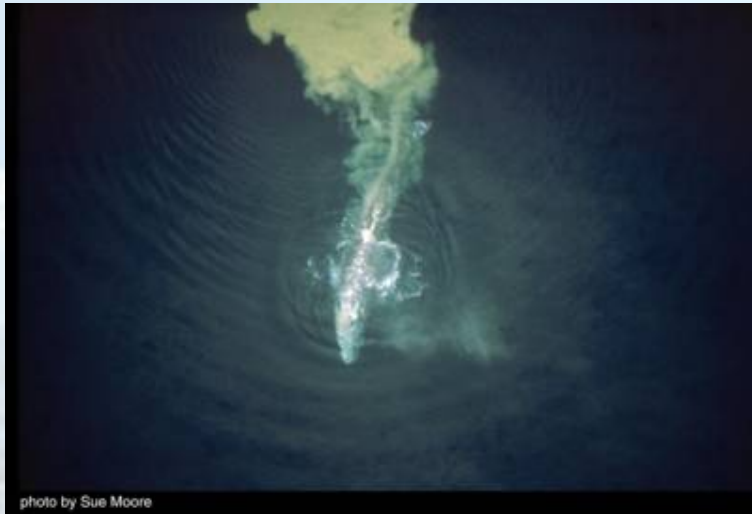


photo by Sue Moore

Gray whales



Bivalves and
amphipods

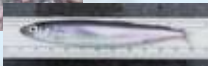


June 29, 2009

Subarctic Ecosystem (pelagic dominant)



Humpback
and fin whales



Forage species:
Juvenile pollock, capelin,
myctophids



Euphausiids and
copepods



Kittiwakes, murrets,
fur seals



Pollock, cod, arrowtooth
flounder



Bering Sea Fisheries

- 2 million metric tons annually



M. Sigler, NMFS



M. Jones, NMFS

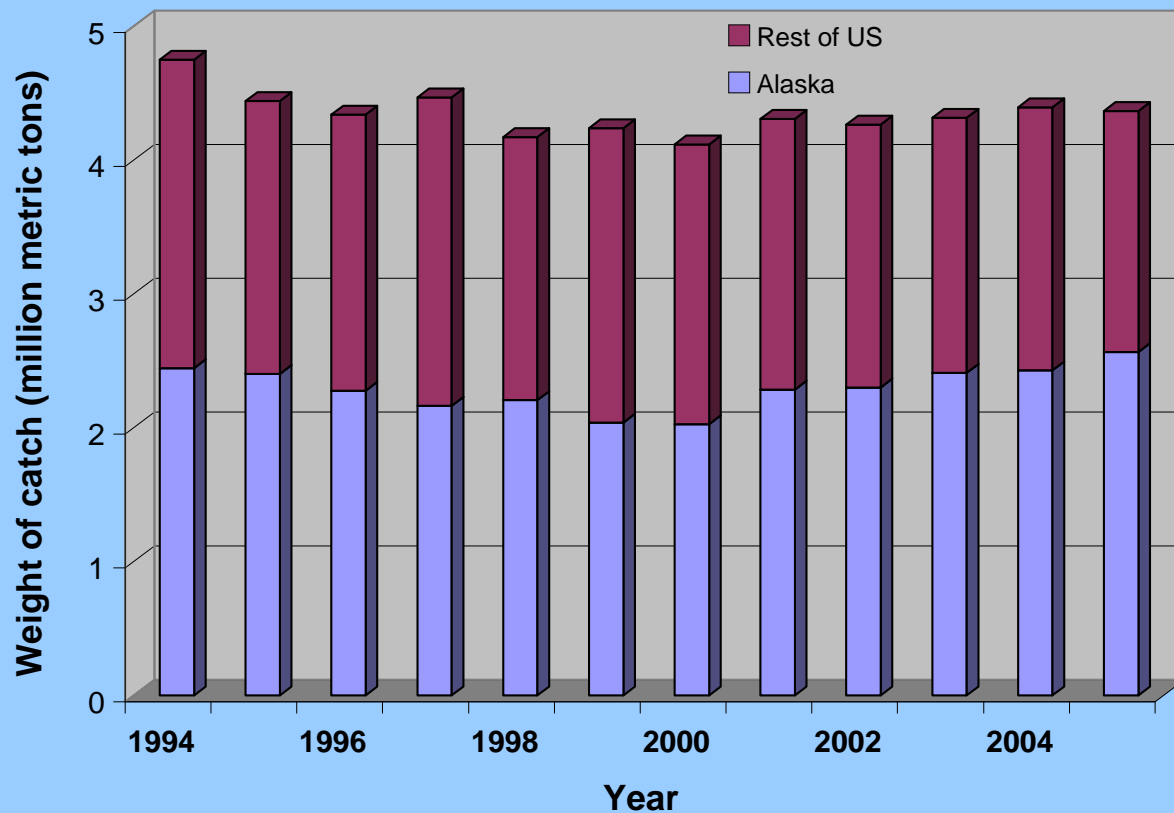
June 29, 2009



Alaska Feeds the Nation

Largest private sector employer in Alaska

US Domestic Commercial Fisheries



U.S. Arctic Fisheries

- Commercial
 - None in EEZ waters
 - Possibly some personal use fishery sales in nearshore waters: red king crab, chum salmon, whitefishes
- Subsistence
 - Dolly Varden
 - Whitefishes
 - Arctic cod
 - Saffron cod
 - Sculpins

Several hundred tons annually
(Arctic Ocean totals 12,800 t)

Subsistence Harvests Critical for Many Coastal Communities



© RurAL CAP

©1987 ADF&G / Hyde



07B17, 856 cm, male; 9 October 2007
Barrow, Captain: Jonathan Aiken

Inuit whaling boat

Protected, Endangered & Threatened Species



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Ecosystem Changes



Weather.gov Forecast

 City, ST [» GO](#)

» Active Weather Alerts

» NOAA Organizations

» Working With NOAA

» Media & Constituents

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» [Jana Goldman](#)
301-734-1123

Ice-Free Arctic Summers Likely Sooner Than Expected

April 2, 2009

Summers in the Arctic may be ice-free in as few as 30 years, not at the end of the century as previously expected. The updated forecast is the result of a new analysis of computer models coupled with the most recent summer ice measurements.

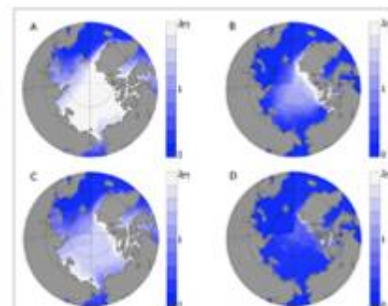
"The Arctic is changing faster than anticipated," said James Overland, an oceanographer at [NOAA's Pacific Marine Environmental Laboratory](#) and co-author of the study, which will appear April 3 in *Geophysical Research Letters*. "It's a combination of natural variability, along with warmer air and sea conditions caused by increased greenhouse gases."

Overland and his co-author, Muyin Wang, a University of Washington research scientist with the Joint Institute for the Study of the Atmosphere and Ocean in Seattle, analyzed projections from six computer models, including three with sophisticated sea ice physics capabilities. That data was then combined with observations of summer sea ice loss in 2007 and 2008.



Data visualization: Arctic sea ice.

[Visualization](#) (Credit: NOAA)



Mean sea ice thickness in meters for March (left) and September (right) based on six models. Top panels: September ice extent reached the current level by these models. Bottom panels: Arctic reached nearly "ice-free summer" conditions.

[High resolution](#) (Credit: University of Washington / NOAA)

The area covered by summer sea ice is expected to decline from its current 4.6 million square kilometers (about 1.8 million square miles) to about 1 million square kilometers (about 390,000 square miles) – a loss approximately two-fifths the size of the continental U.S. Much of the sea ice would remain in the area north of Canada and Greenland and decrease between Alaska and Russia in the Pacific Arctic.

"The Arctic is often called the 'Earth's refrigerator' because the sea ice helps cool the planet by reflecting the sun's radiation back into space," said Wang. "With less ice, the sun's warmth is instead absorbed by the open water, contributing to warmer temperatures

in the water and the air."

NOAA understands and predicts changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and conserves and manages our coastal and marine resources.

Significant Northward Displacement in the Bering Sea



Greenland halibut 98 km



Snow crab 89 km



Bering flounder 76 km



Arrowtooth flounder 46 km



Eulachon 34 km



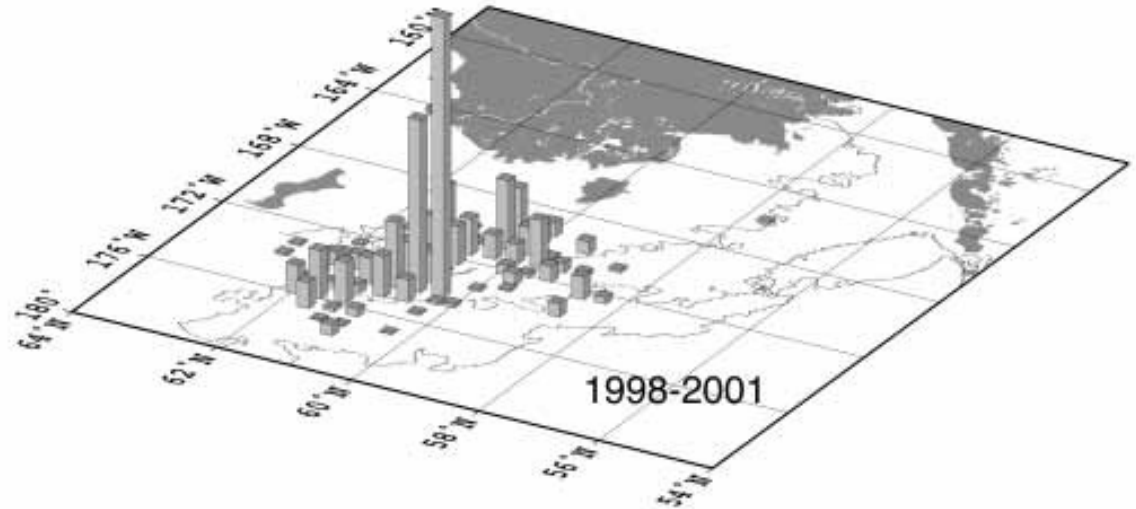
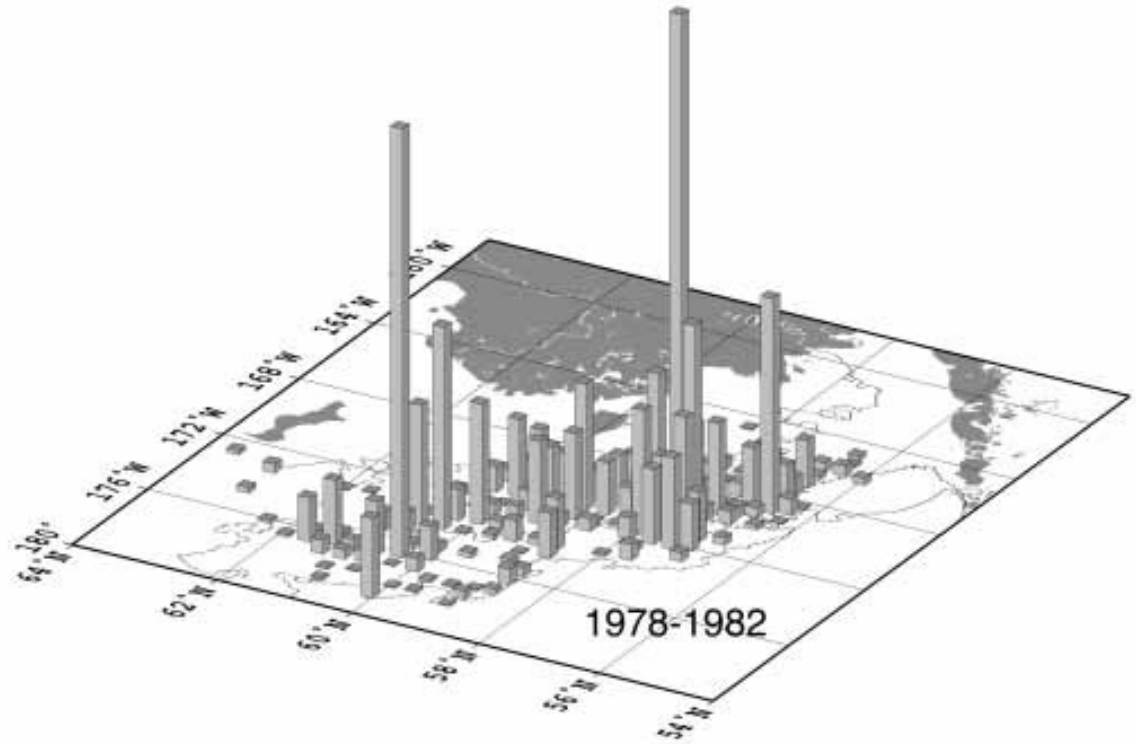
Flathead sole 57 km



Pacific halibut 55 km

Plus 8
other
species

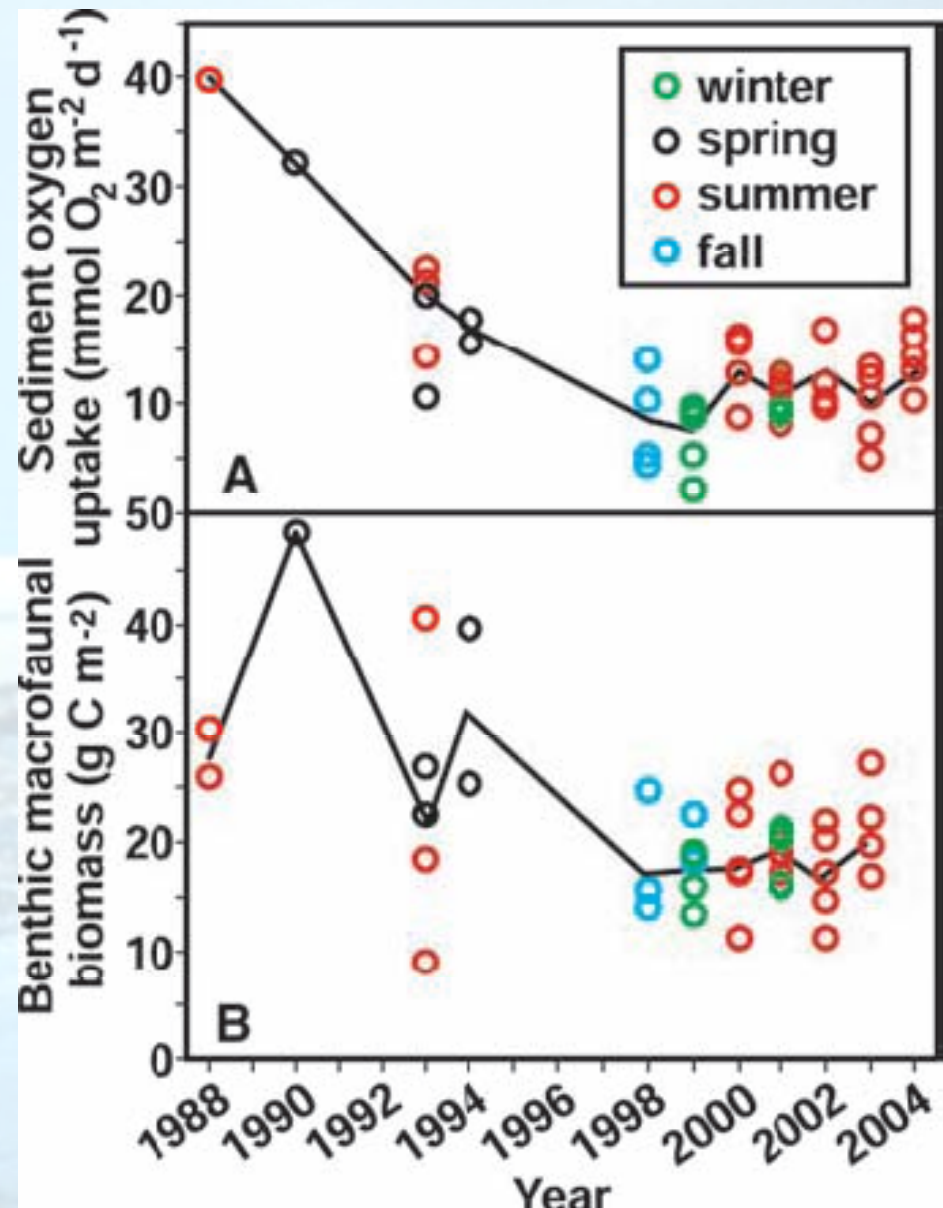
Snow Crab Population Has Diminished and Contracted North



Orensanz, J. L., B. Ernst, D. Armstrong, P. Stabeno, and P. Livingston. 2004. Contraction of the geographic range of distribution of snow crab (*Chionoecetes opilio*) in the eastern Bering Sea: An environmental ratchet? *CalCOFI Rep.* 45: 65-79.

June 29, 2009

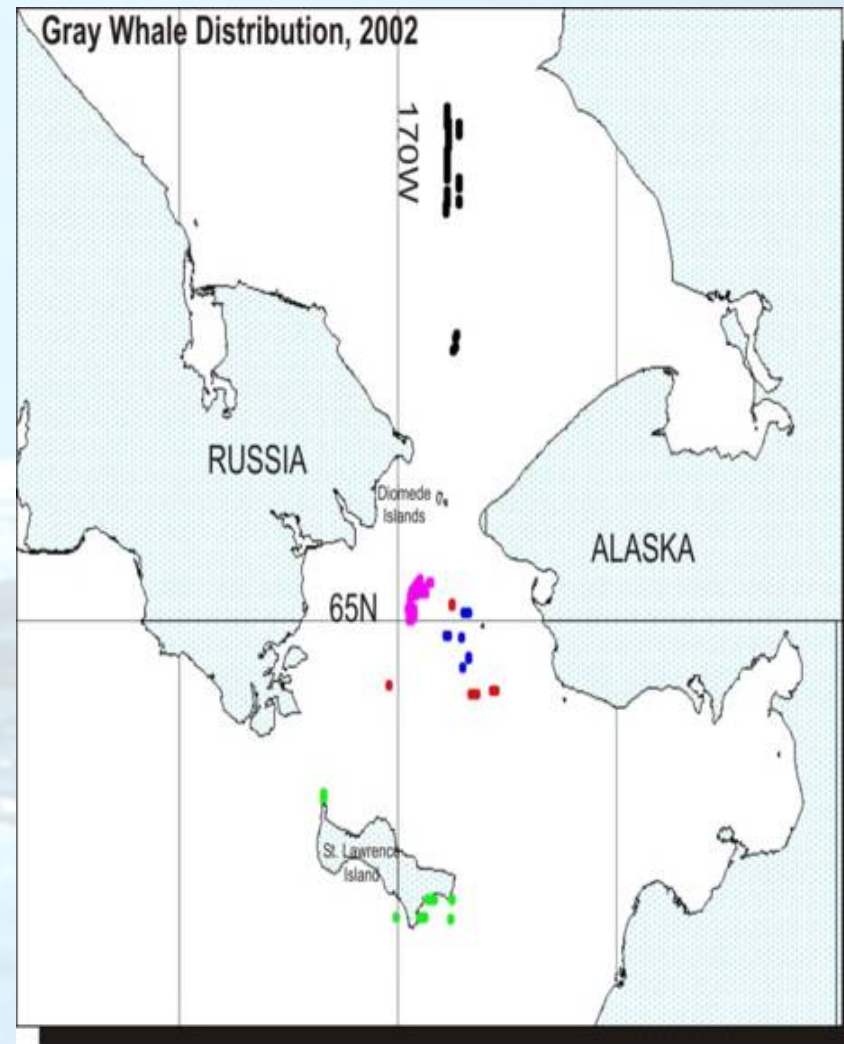
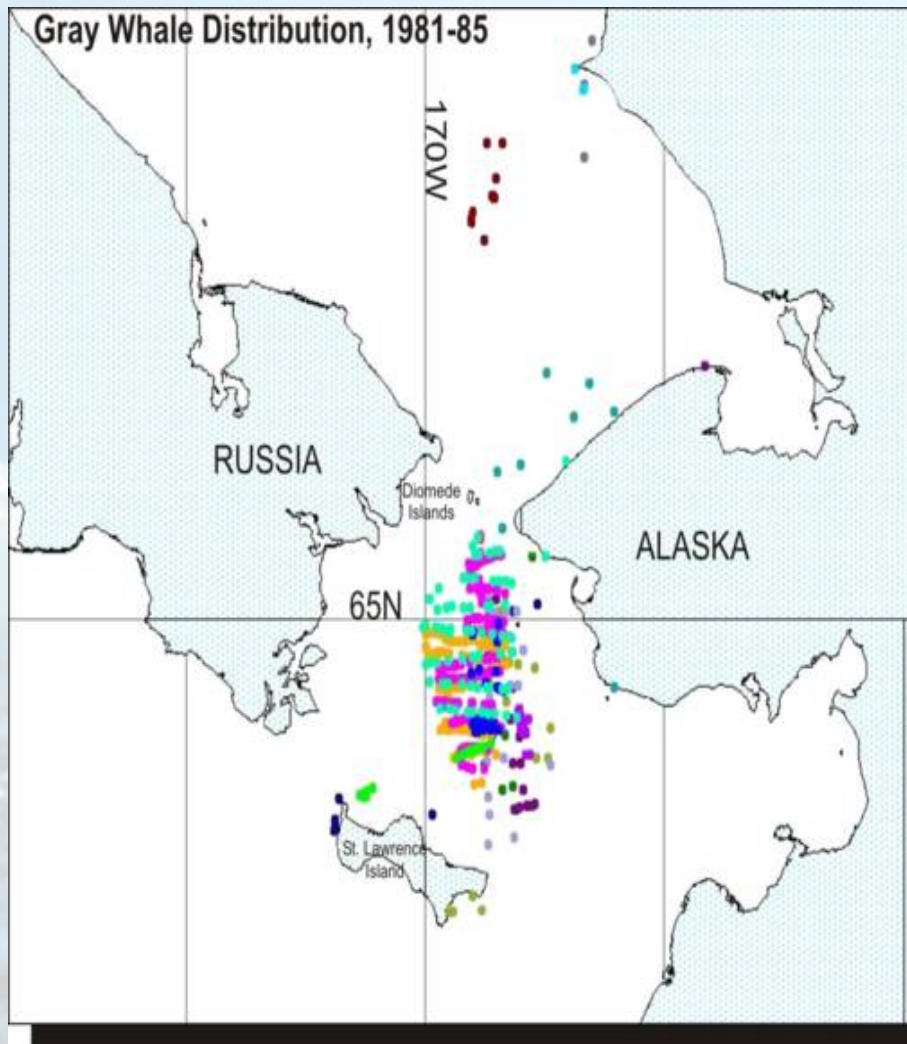
Reduction of Benthic Prey Populations



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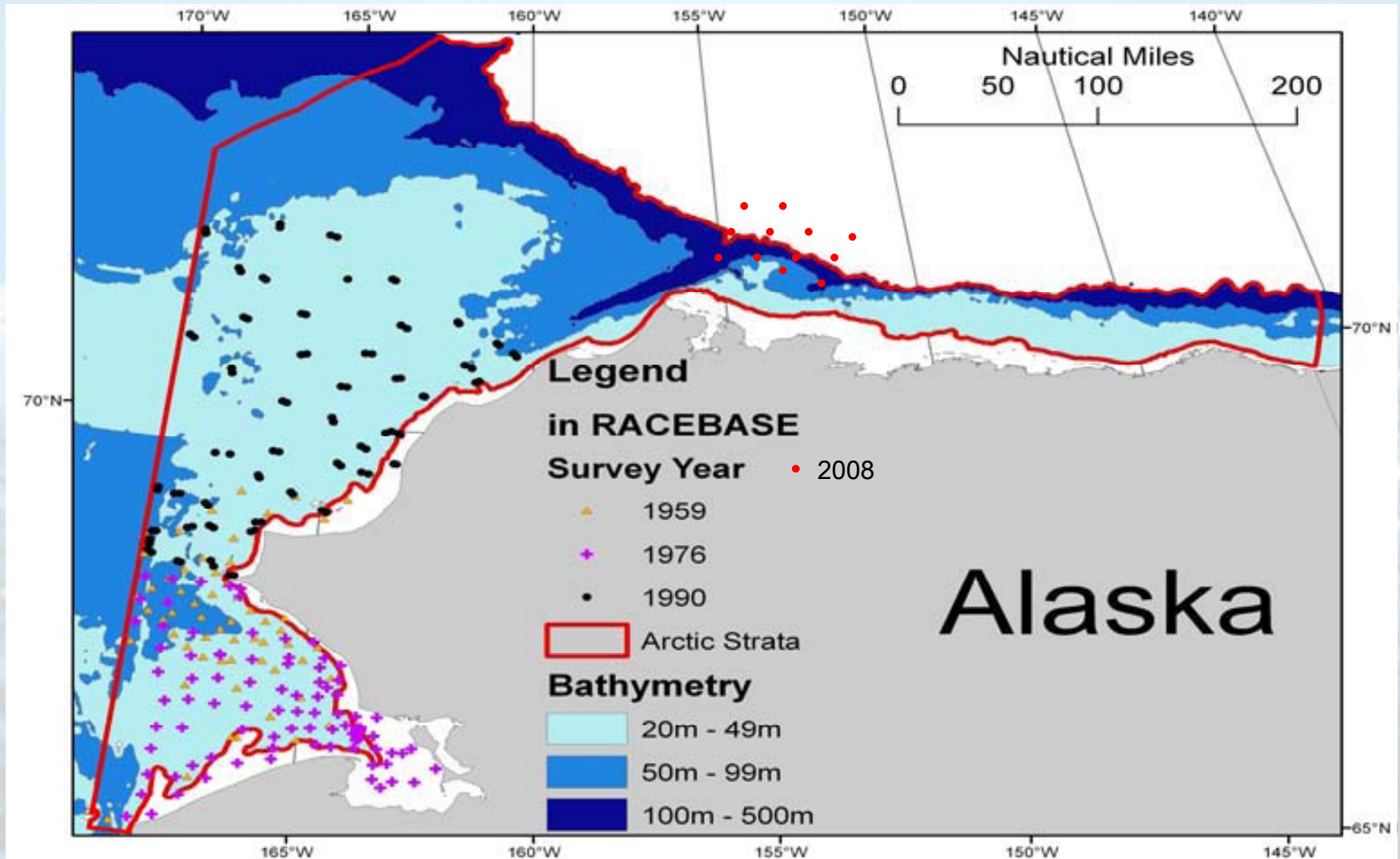
Grebmeier, J.M., et al. 2006. A major ecosystem shift in the northern Bering Sea. *Science* 311: 1461-1464.

Gray Whale Feeding Grounds Have Changed



Gray whale feeding grounds have changed. Moore, S.E., Grebmeier, J.M., and Davies, J.R. 2006. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. *Can. J. Zool.* 81: 734-742.

Insufficient information to make adequate assessments

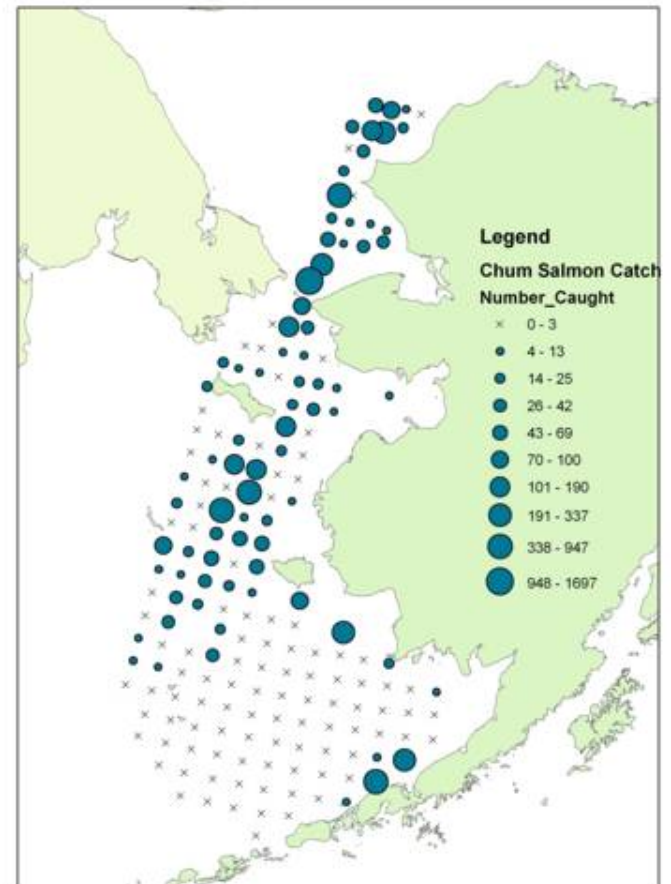




Chukchi Sea Surface Trawl Survey

- Northward migration into the Arctic was observed for all five species of salmon during 2007.
- Growth rate potential models indicated that the Chukchi Sea provided excellent rearing habitats for juvenile salmon.

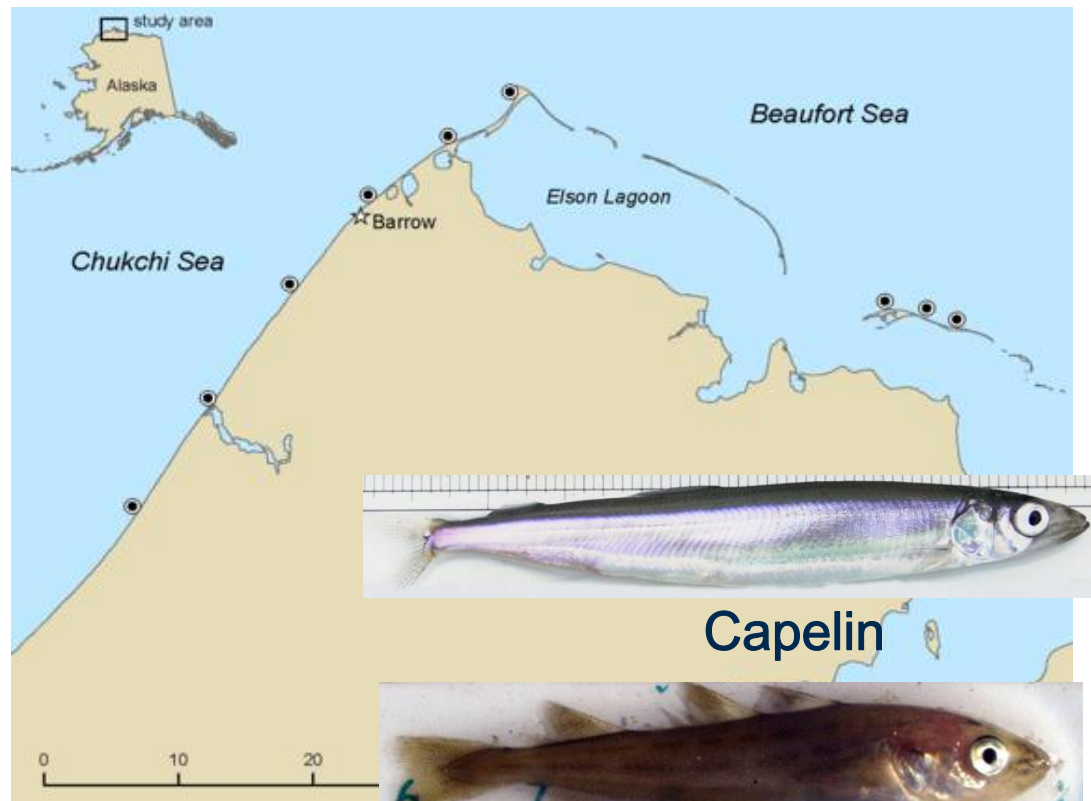
2007 BASIS Juvenile Chum Salmon Catch





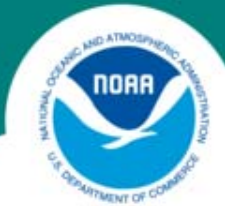
Nearshore Arctic Fish Surveys

- Established baseline in 2007-2009.
- Capelin and Arctic cod accounted for 80% of beach seine and bottom trawl catches.



http://www.afsc.noaa.gov/ABL/Habitat/ablhab_nearshore_atlas.htm

Arctic cod



Beaufort Sea Survey



Six Species Have Extended Range from the Bering or Chukchi Seas to the Beaufort Sea



Marbled eelpout



Bering flounder



Pacific cod



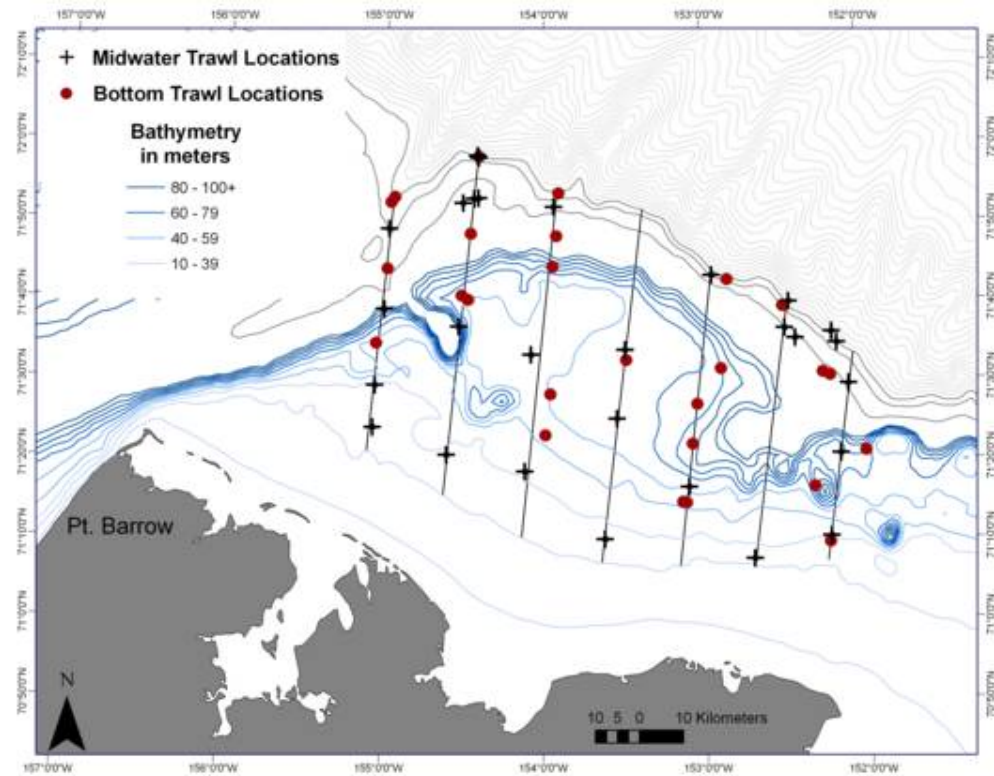
Walleye pollock



Bigeye sculpin



Salmon snailfish



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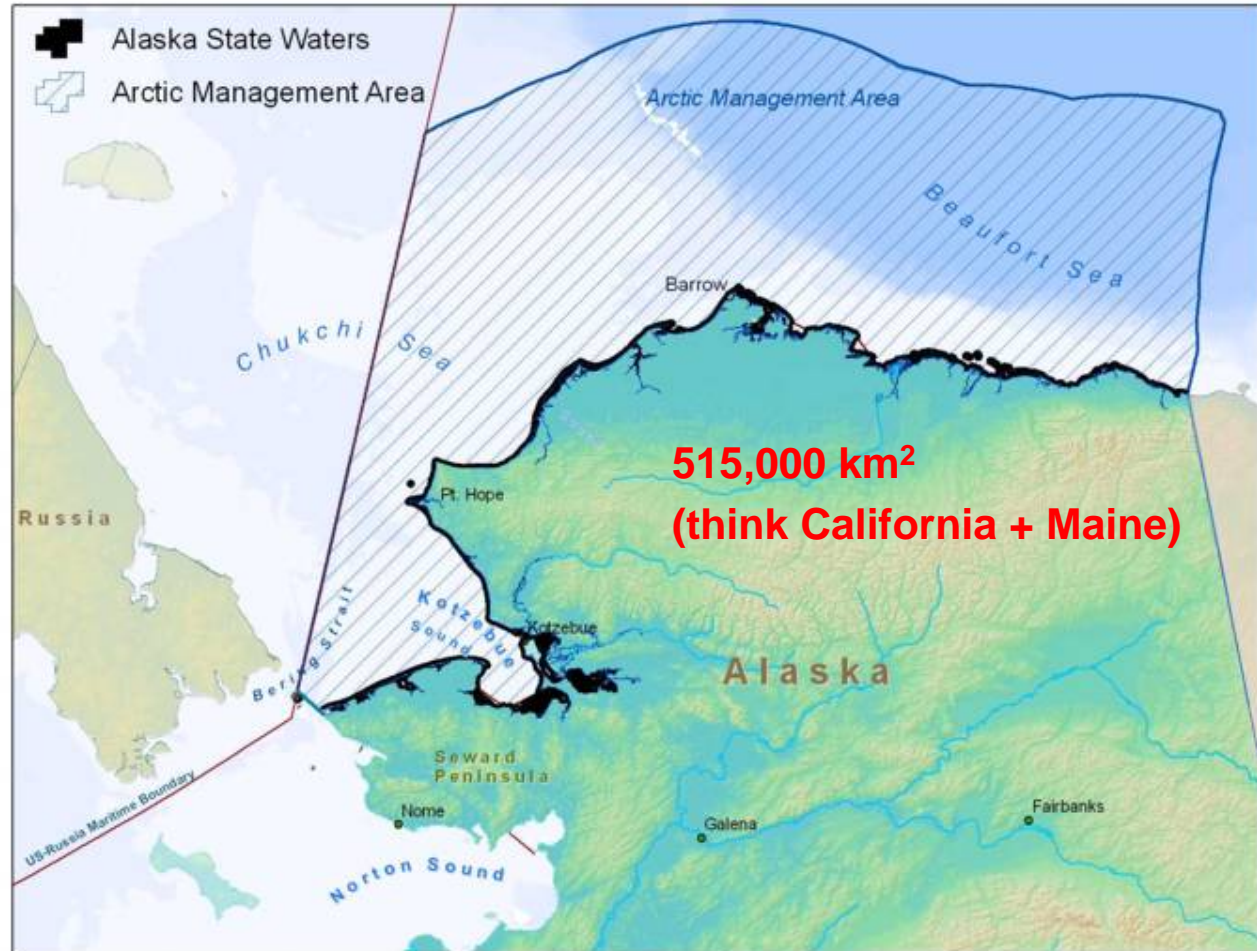


NOAA Policies on Arctic Fishing



Arctic Fishery Management Plan

- Closes Arctic Management Area to commercial fishing
- Public comment period and Secretarial review

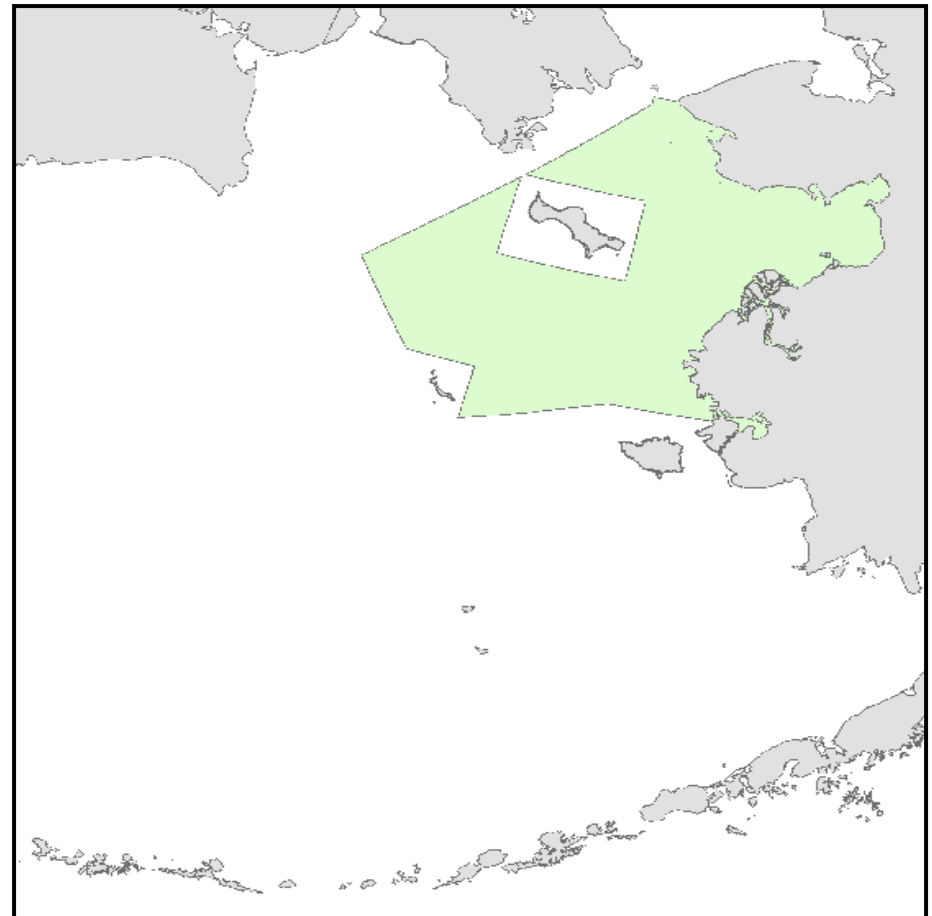


Per NPFMC final action
in February 2009

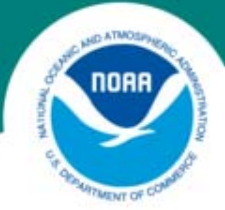


Northern Bering Sea Research Area

Closed to bottom trawling
until research
conducted and a plan
developed to manage
fishing in the area,
including appropriate
protection measures



Per NPFMC final action in June 2007
Effective August 25, 2008 (73 FR 43362)



Endangered Species Act Listing Determinations for Ice Seals

- Ribbon seal: Listing not warranted (12/08) because annual ice (critical for reproduction, molting and resting) will continue to form each winter in the Bering Sea and Sea of Okhotsk, where most ribbon seals are located.
- Ringed, spotted, and bearded seals: Status reviews underway.





Summary

- Arctic ecosystem benthic dominant;
Subarctic ecosystem pelagic dominant
- Species shifting northward
- Arctic ecosystem closed to commercial fishing

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NOAA Strategic Plan for the Arctic



2010-2020

Pre-decisional - Draft



International Arctic Fisheries Symposium

Purpose: To initiate international discussions for conserving and managing future fisheries in the Arctic Ocean including managing migratory, transboundary and straddling fish stocks.

19-21 October 2009, Anchorage, Alaska <http://www.nprb.org/iafs2009/index.htm>