

Science, Service, Stewardship



NOAA's Role in the Science and Management of Arctic Fish, Marine Mammals, and their Habitats

Jon Kurland
Acting Deputy Regional Administrator
NOAA Fisheries, Alaska Region

Mike Sigler
Program Leader, Habitat & Ecological Processes Research Program
NOAA Fisheries, Alaska Fisheries Science Center

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NOAA

NOAA Strategic Plan for the Arctic



2010-2020

Pre-decisional - Draft





NOAA Fisheries' Arctic Activities

- Actively involved in a wide variety of research and management activities related to conservation of Arctic fish and marine mammal populations
- Involvement has been ongoing for many years
- Scope and breadth of our Arctic work have expanded substantially in the past few years and will continue to grow with climate change and the loss of sea ice



NOAA Fisheries' Arctic Activities

This presentation:

An overview of NOAA Fisheries' current science and management activities in the Arctic as we begin addressing the consequences of climate change and the associated loss of sea ice, and as we prepare for the resource management challenges that lie ahead

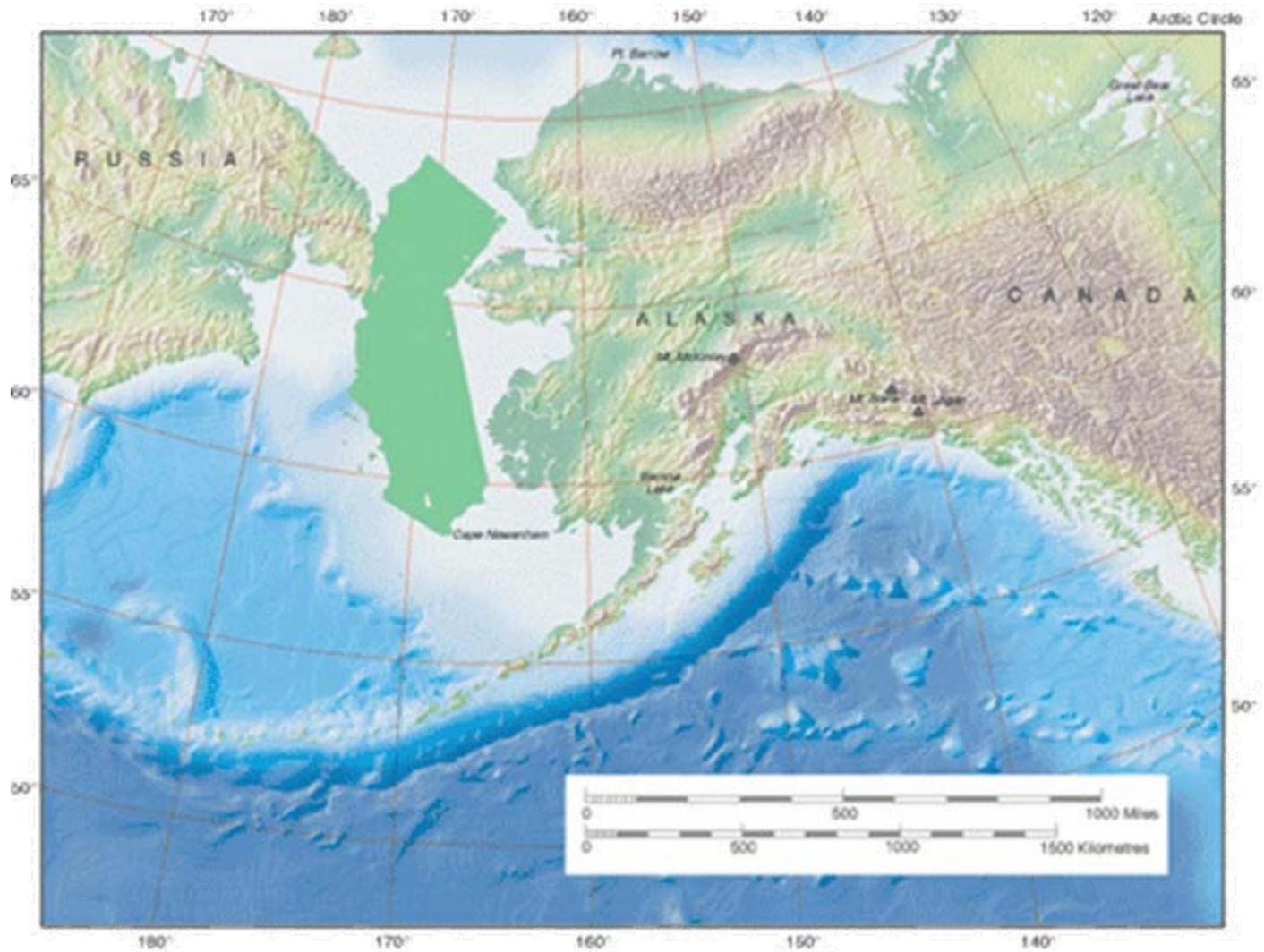


NOAA Fisheries' Arctic Activities

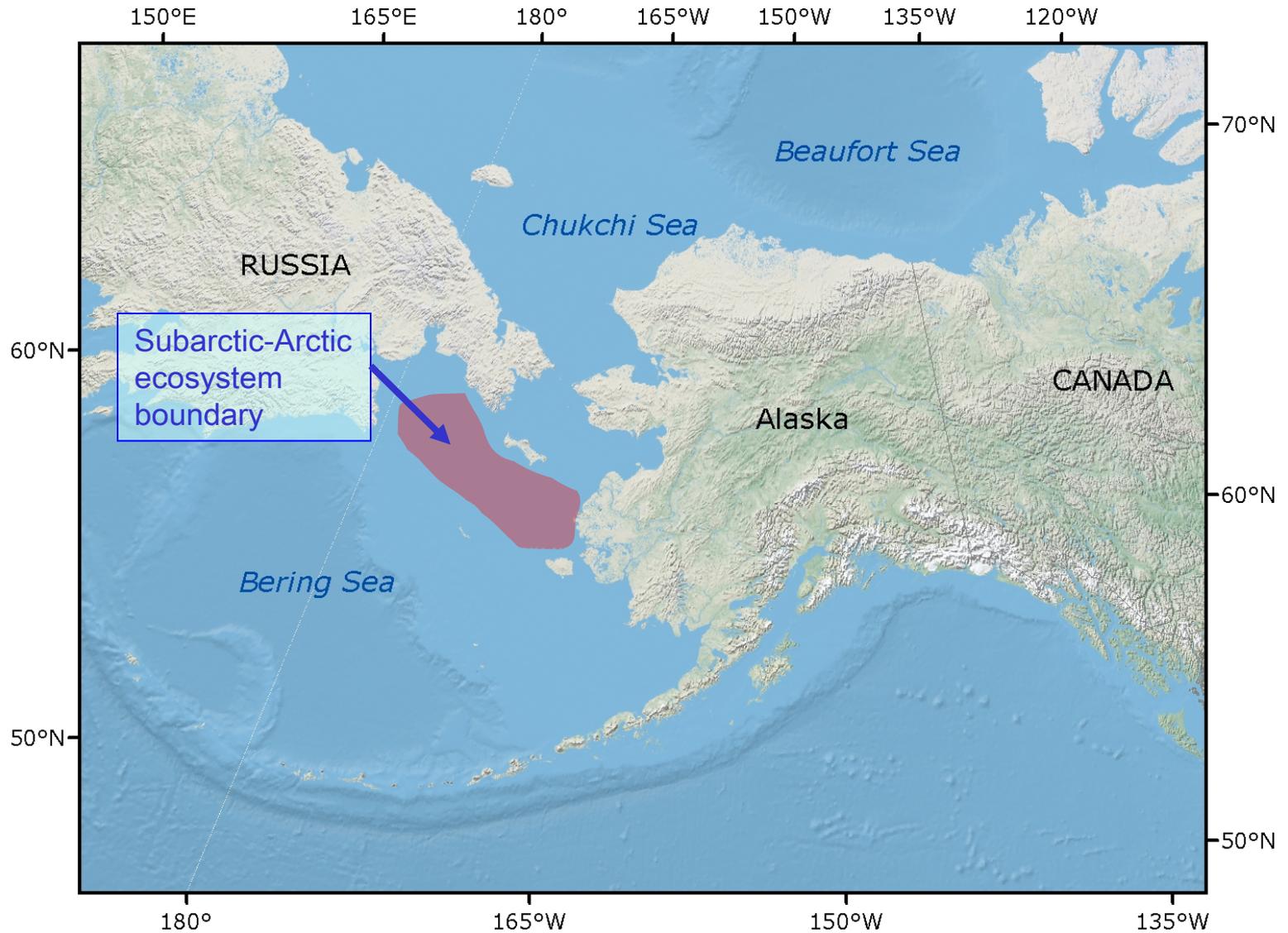
This presentation:

- Overview of U.S. Arctic geography and ecosystem and its importance: economic, ecological, and cultural
- Ecosystem changes and their implications
- NOAA Fisheries' science activities in the Arctic
- NOAA Fisheries' management activities in the Arctic
- Next steps: future needs for sustainable management of fish, marine mammals, and their habitats in the Arctic

Scale Matters: California Fits into the Bering Sea



U.S. Arctic and Subarctic



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



Arctic Ecosystem (benthic dominant)



Walrus



Gray whales



Bivalves and
amphipods



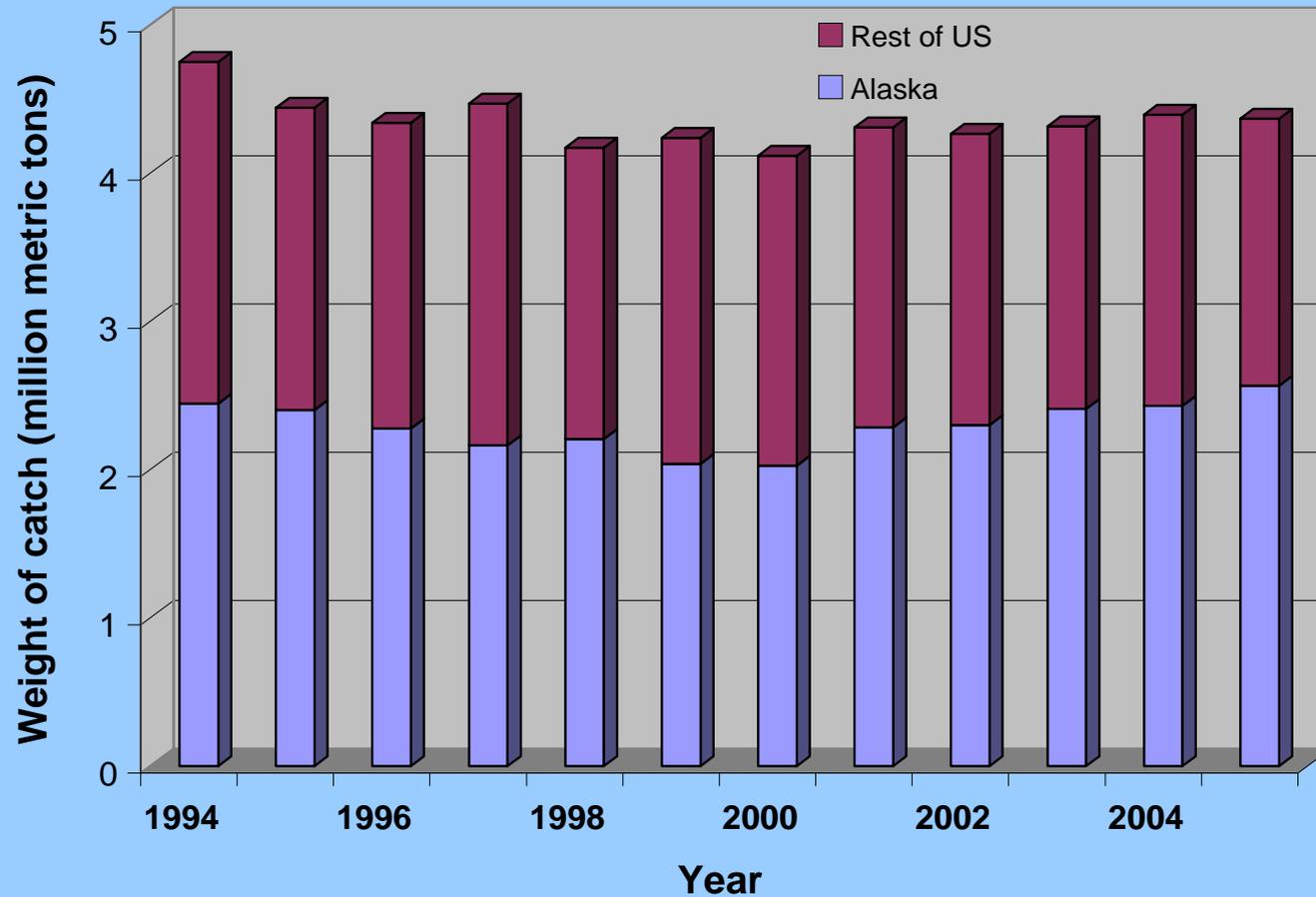
U.S. Arctic Fisheries

- 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

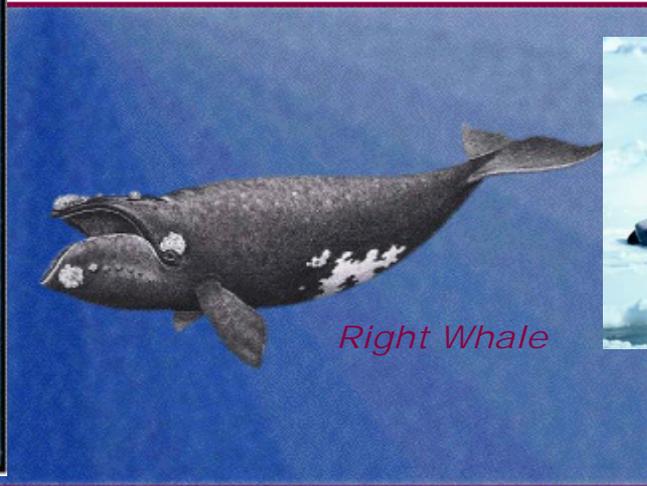
Several hundred tons annually?
(Arctic Ocean totals 12,800 t)

Alaska Feeds the Nation

US Domestic Commercial Fisheries



Protected, Endangered & Threatened Species



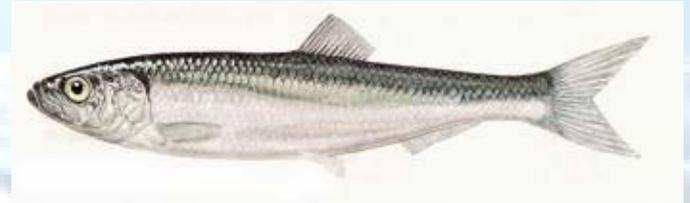
Subsistence Harvests



© RurAL CAP



©1987 ADF&G / Hyde



Inuit whaling boat



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



Importance of Alaska's Marine Resources

- Alaska waters provide half of all U.S. seafood
- Seafood industry is the largest private sector employer in Alaska
- Subsistence fisheries and marine mammal harvests are very important for Alaskans
- Significant ocean-dependent coastal communities
- Alaskan fishing ports consistently rank among the top in the U.S. in landings and value

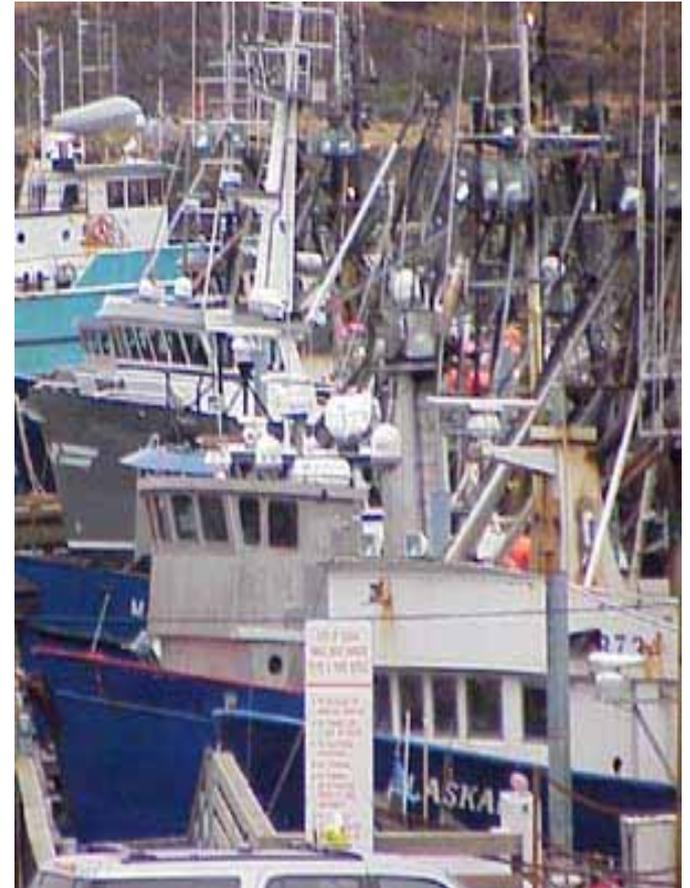
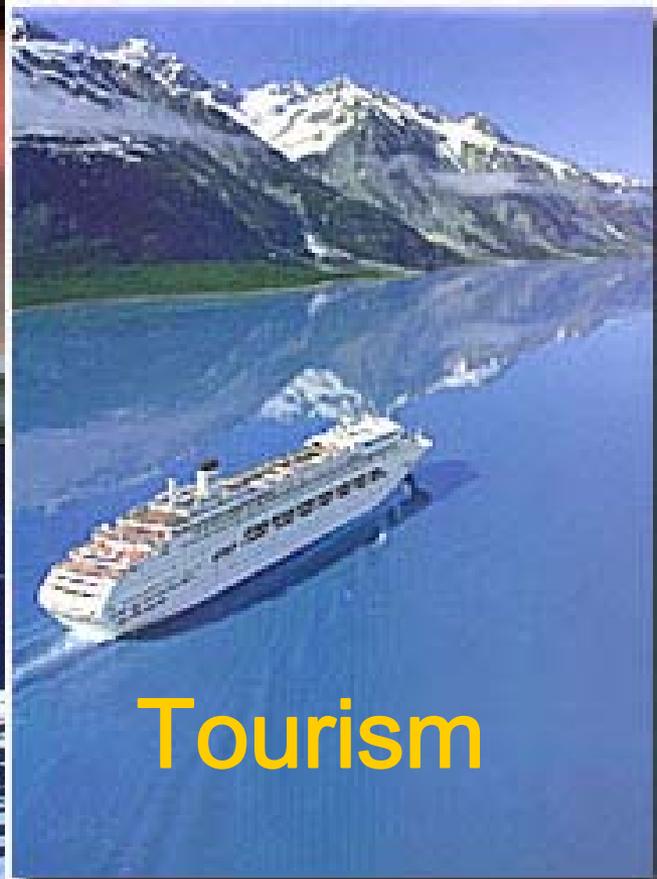




Photo by D. P. Ham, 1993, NMML



Tourism



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Ecosystem Changes and their Implications: Changes in Fish, Shellfish, and Marine Mammal Populations in the Northern Bering, Chukchi and Beaufort Seas



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[» Jana Goldman](#)
301-734-1123

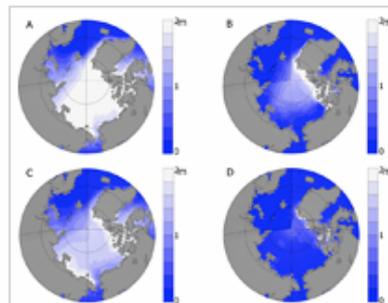
Ice-Free Arctic Summers Likely Sooner Than Expected

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.

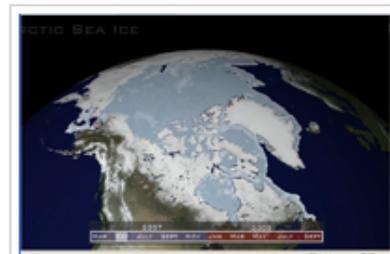
"The Arctic is changing faster than anticipated," said James Overland, an oceanographer at [NOAA's Pacific Marine Environmental Laboratory](#) and co-author of the study, which will appear April 3 in *Geophysical Research Letters*. "It's a combination of natural variability, along with warmer air and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



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)



Data visualization: Arctic sea ice.

[Visualization](#) (Credit: 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.

Arctic Ice Is Melting

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The 30-year decline is accelerating, new data show.

Saturday, April 11, 2009; A12

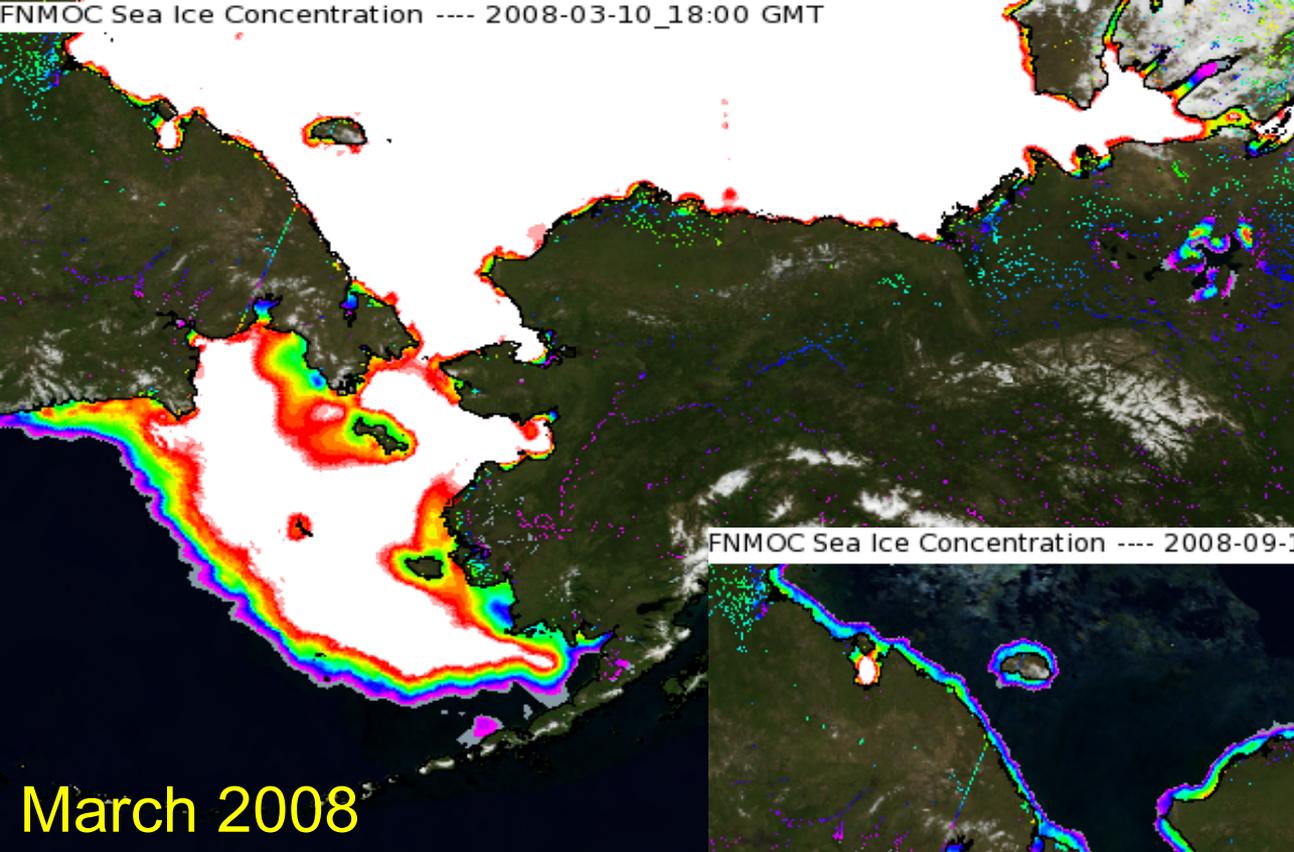
MAKE NO mistake, Arctic Sea ice is melting. According to the National Snow and Ice Data Center and the National Aeronautics and Space Administration, the maximum extent of the winter sea ice cover for 2008-09 was the fifth-lowest on record. Underscoring their point, the agencies added, "The six lowest maximum events since satellite monitoring began in 1979 have all occurred in the past six years (2004-09)."

Global warming is doing a number on Arctic Sea ice. The report noted that the Arctic winter was 1.8 to 3.6 degrees Fahrenheit warmer than average. This and other factors are causing the surface ice to melt. That ice is vital for reflecting the light and heat of the sun. Without it, the heat warms the Arctic Ocean, which then melts the ice below the surface of the water. This, along with older ice moving out of the Arctic, decreases the thickness of sea ice cover, which then melts more easily in the summer. "Ice older than two years now accounts for less than 10 percent of the ice cover," according to the study. "From 1981 through 2000, such older ice made up an average of 30 percent of the total sea ice cover at this time of the year."

These new data come as predictions of an ice-free Arctic Sea during the summer get ever closer. Just two years ago, an NSIDC scientist estimated that worrisome event could happen within 20 to 30 years. Last month, Warwick Vincent, director of the Center for Northern Studies at Laval University in Quebec, told Reuters, "2013 is starting to look as though it is a lot more reasonable as a prediction."

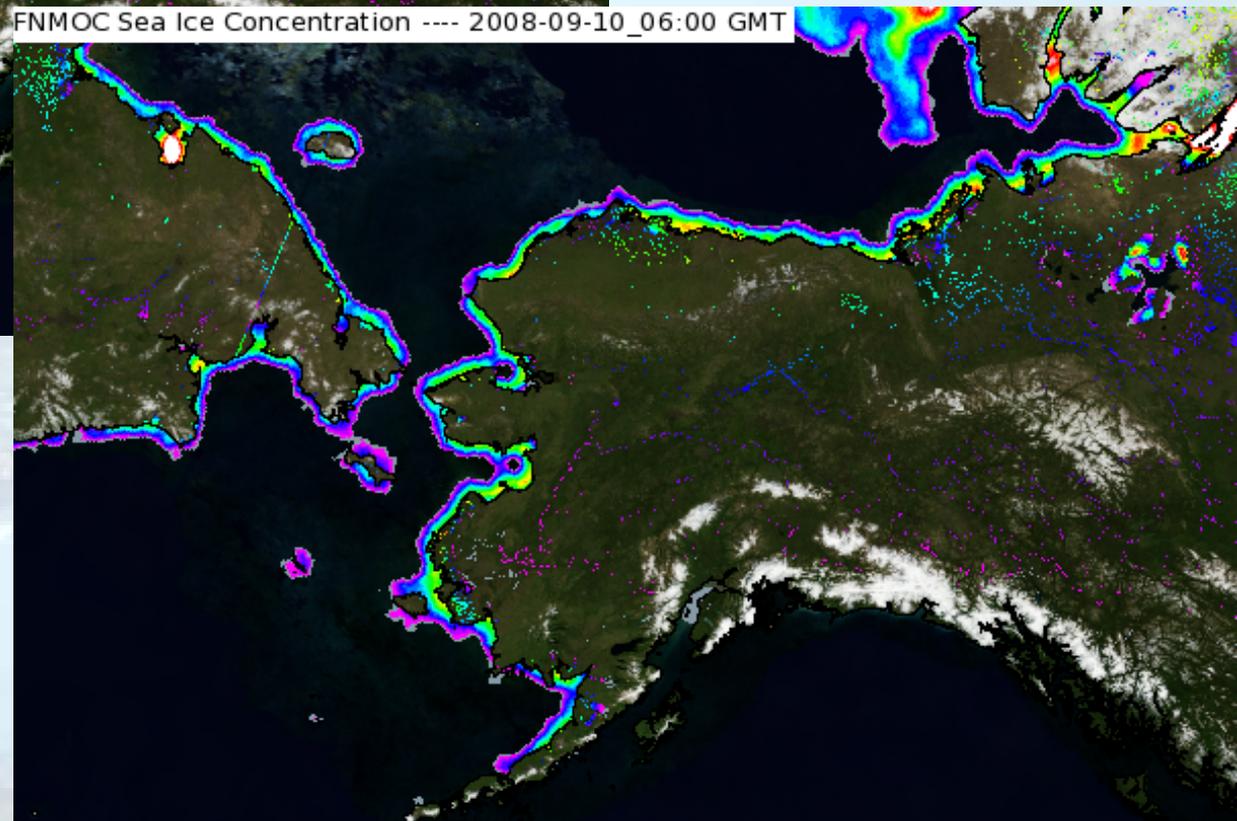
That forecast, if proven true, would have dire consequences for the polar bear. A 2007 report from the U.S. Geological Survey revealed that a melting of Arctic ice caused by global warming would wipe out two-thirds of the world's polar bear population, estimated at 20,000 to 25,000, and all of Alaska's estimated 4,700 polar bears, by 2050. The polar bear is now listed as threatened under the Endangered Species Act. But we're all threatened as long as the build-up of greenhouse gases renders climate studies and models seemingly obsolete the moment they're released.

FNMOG Sea Ice Concentration ---- 2008-03-10_18:00 GMT



Seasonal Ice

FNMOG Sea Ice Concentration ---- 2008-09-10_06:00 GMT



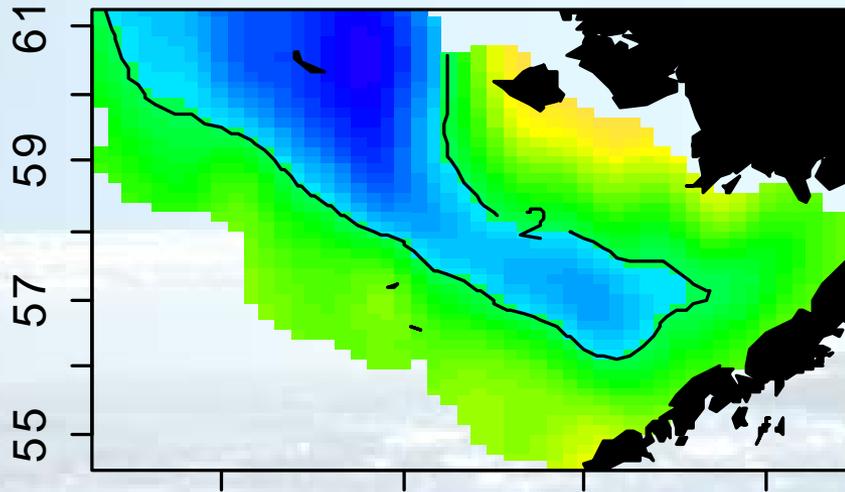
March 2008

September 2008

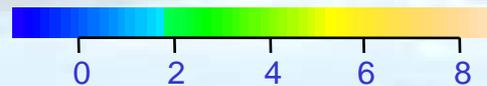
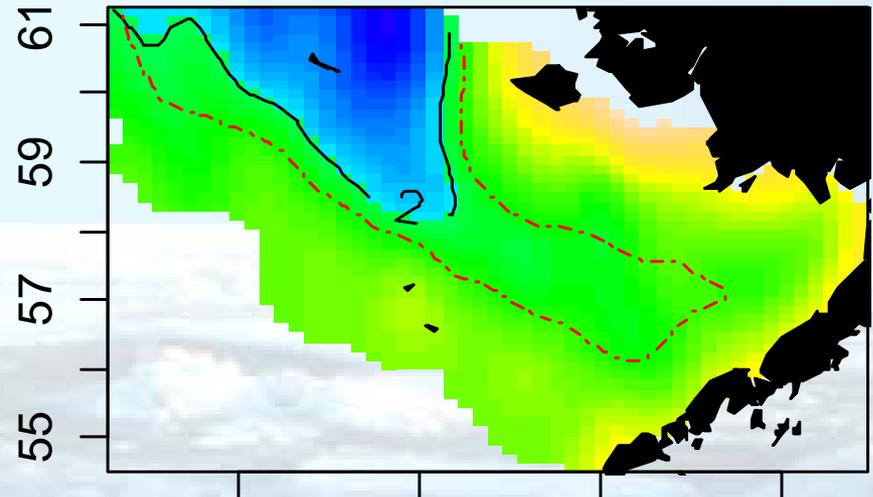


Bering Sea Cold Pool

1982-1986



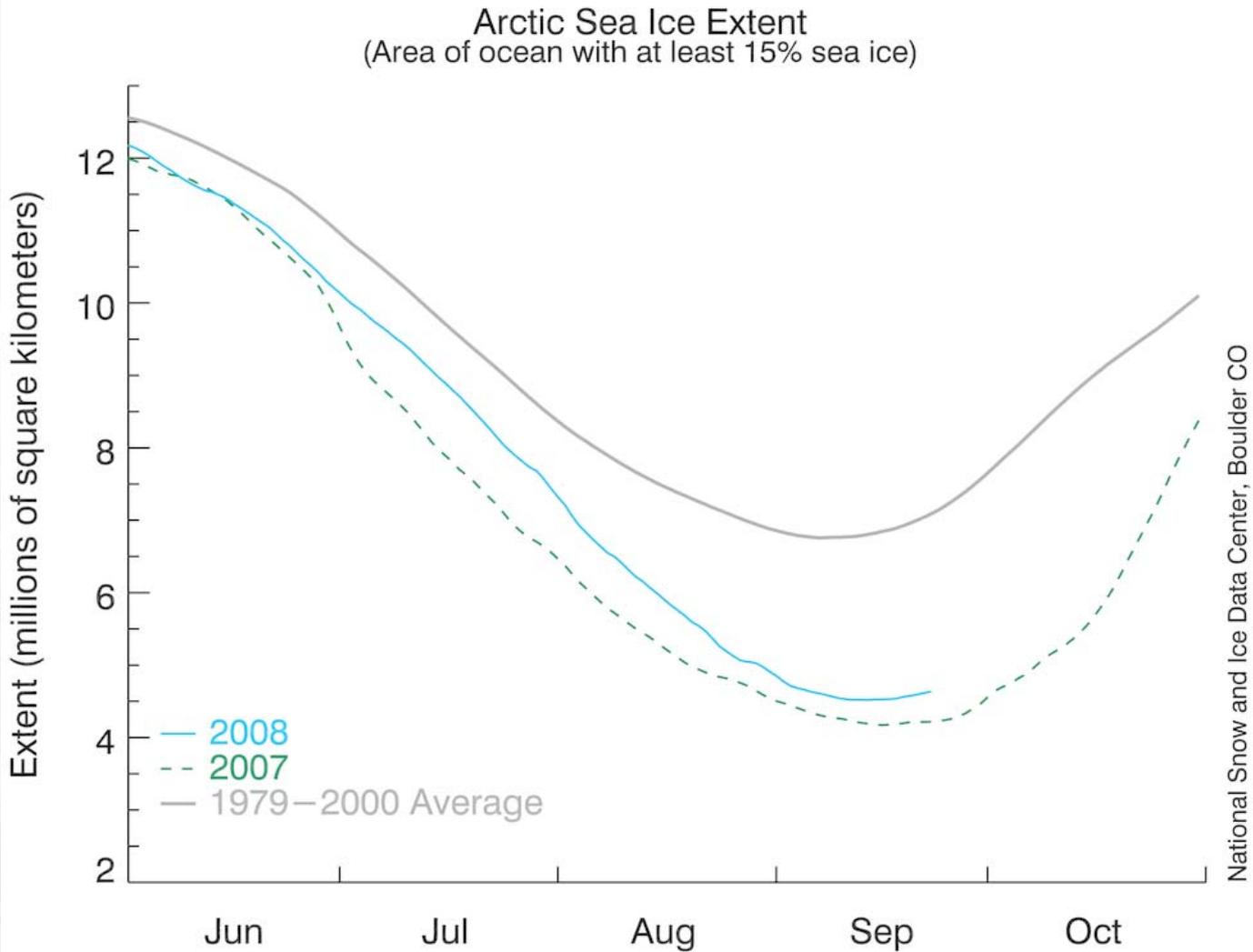
2002-2006



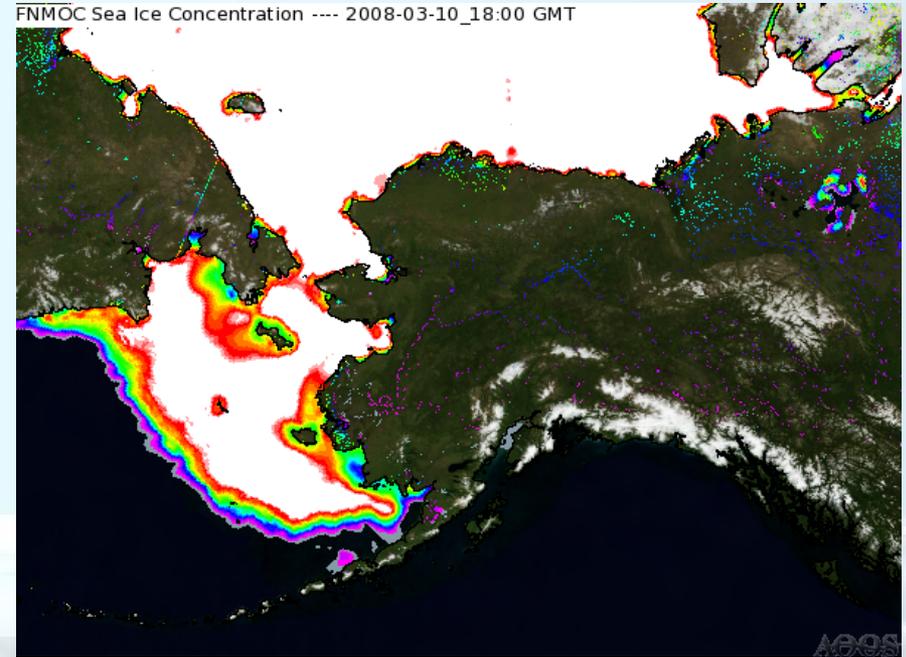
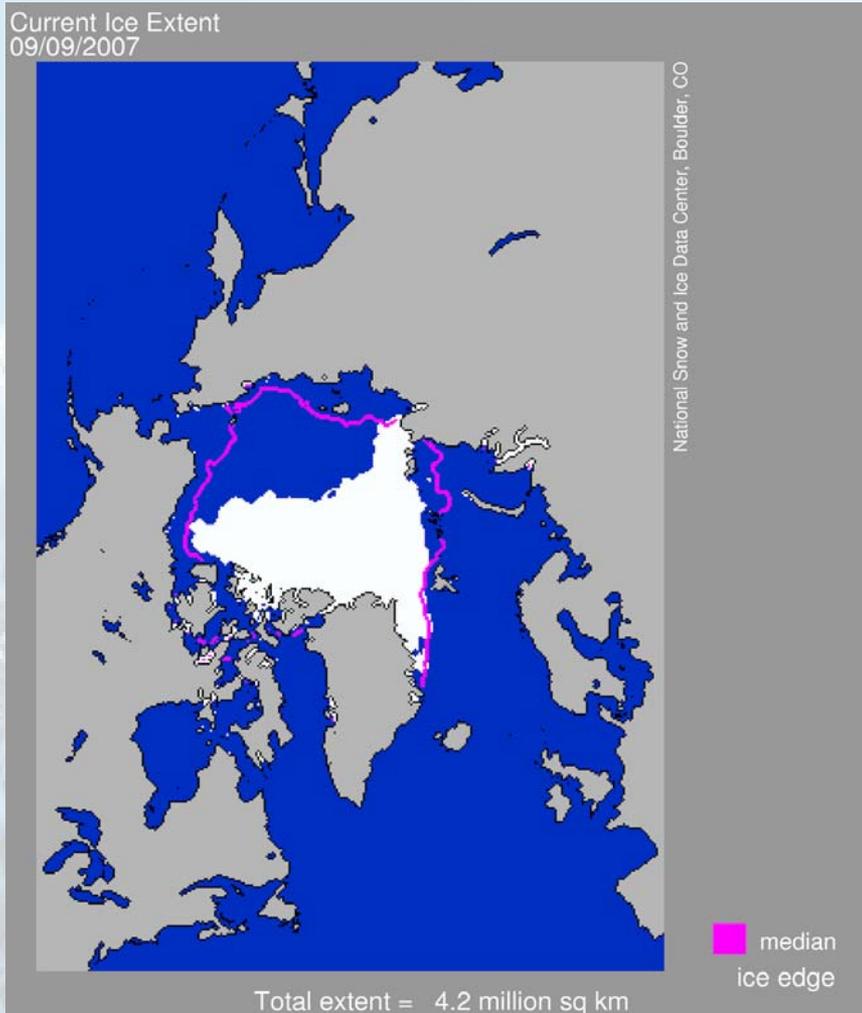
Temperature ($^{\circ}$ C)

Mueter, F.J. and M.A. Litzow. 2008. Sea ice retreat alters the biogeography of the Bering Sea continental shelf. *Ecol. Appl.* 18: 309-320.

Arctic Sea Ice Extent

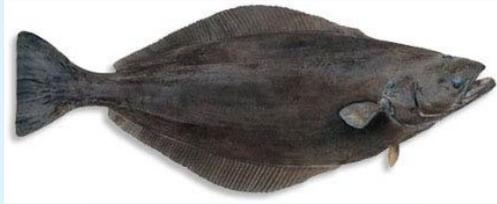


Arctic Ocean summer ice cover diminished to a historic low in 2007...



...yet Bering Sea winter ice cover reached a 30-year high and Alaska shivered through cold and wet in 2008.

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



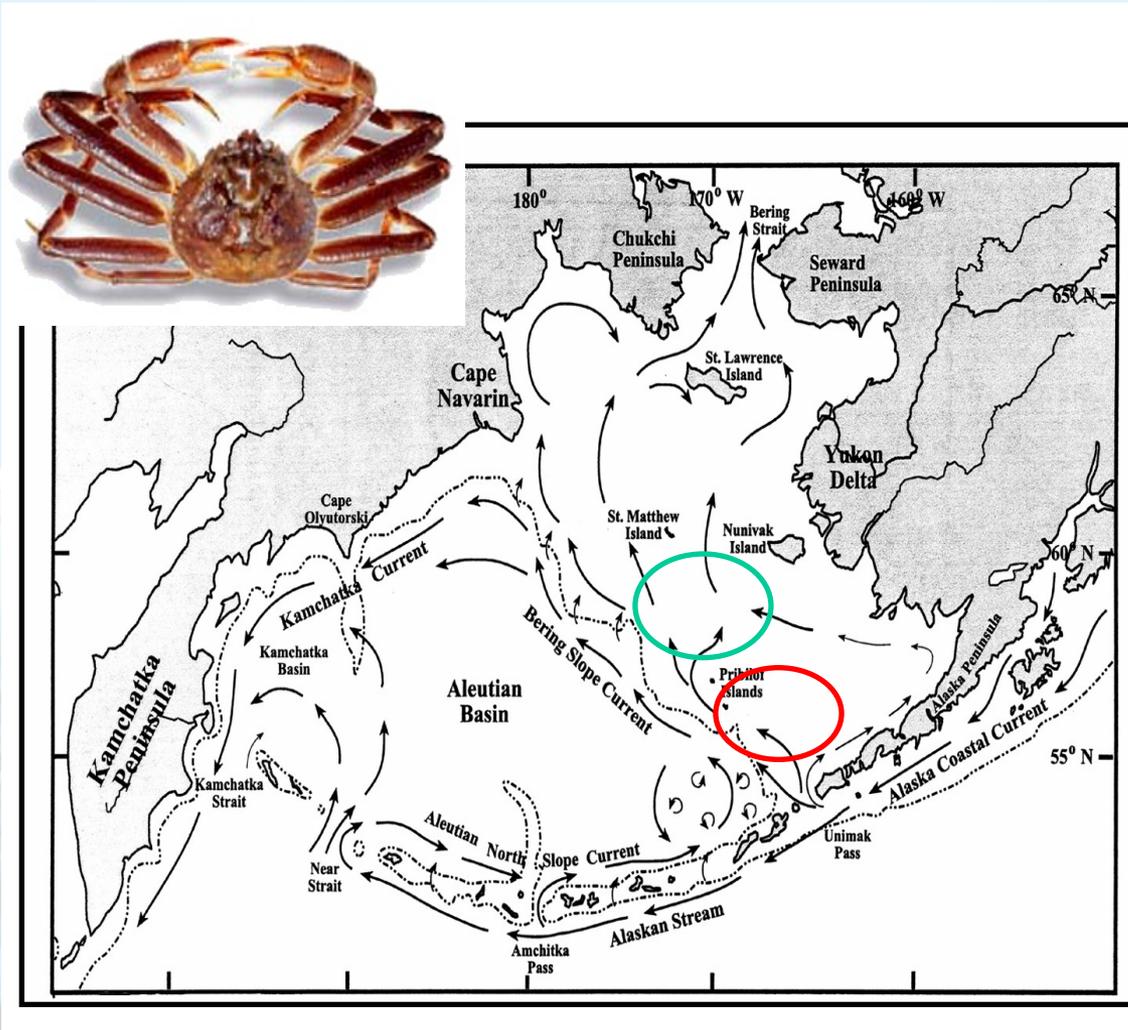
Flathead sole 57 km



Pacific halibut 55 km

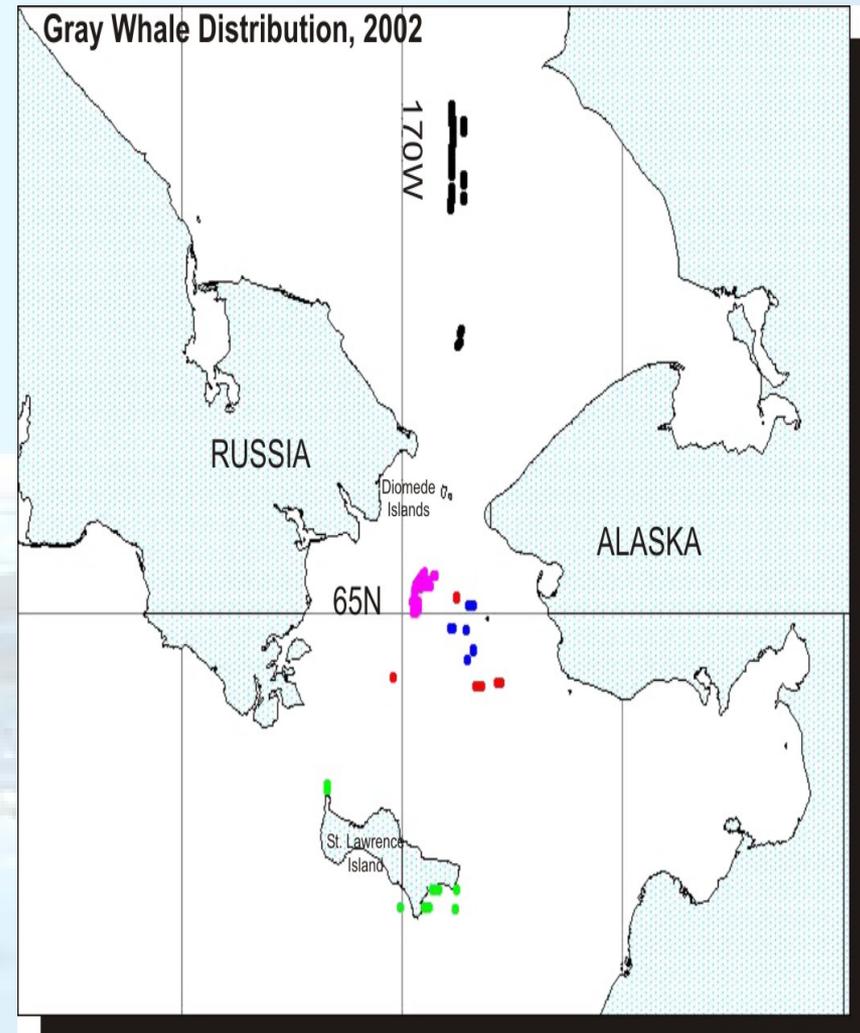
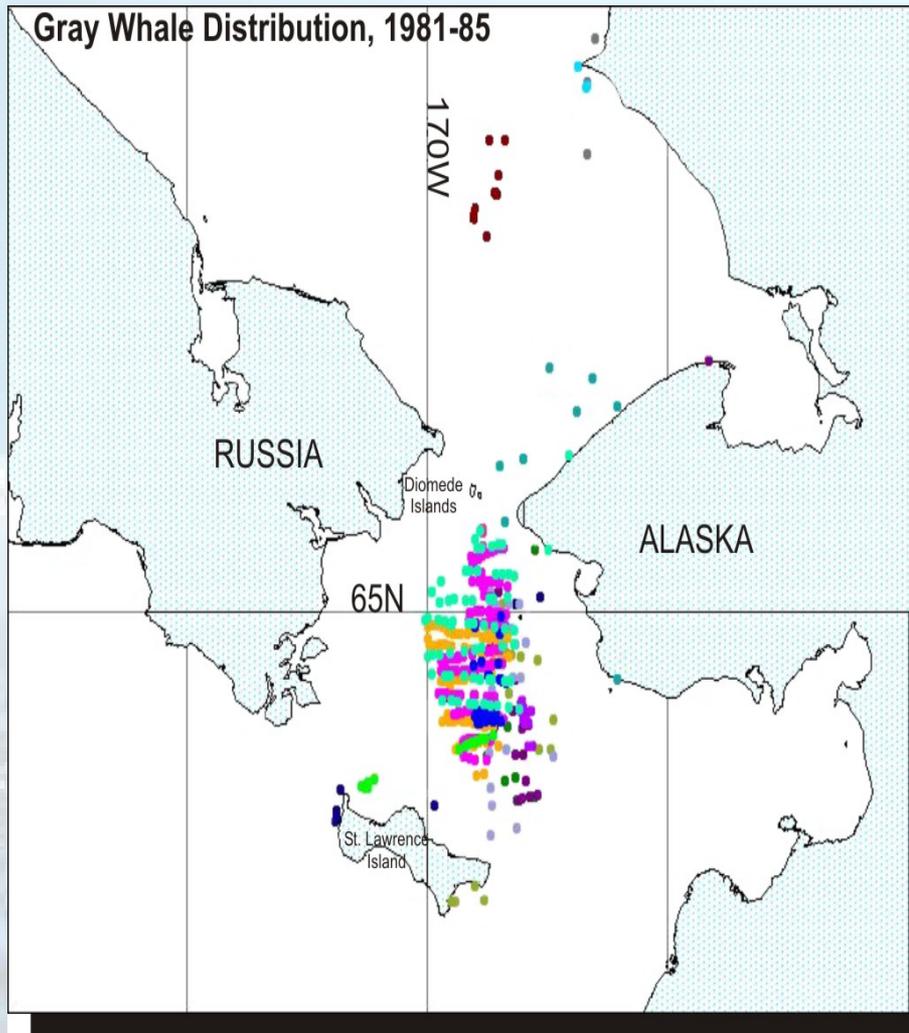
Plus 8
other
species

Snow Crab Population Has 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.

Gray Whale Feeding Grounds Have Changed



Gray whale feeding grounds have changed. Moore, S.E., Grebmeier, J.M., and Davies, J.R. 2003. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. *Can. J. Zool.* 81: 734-742.

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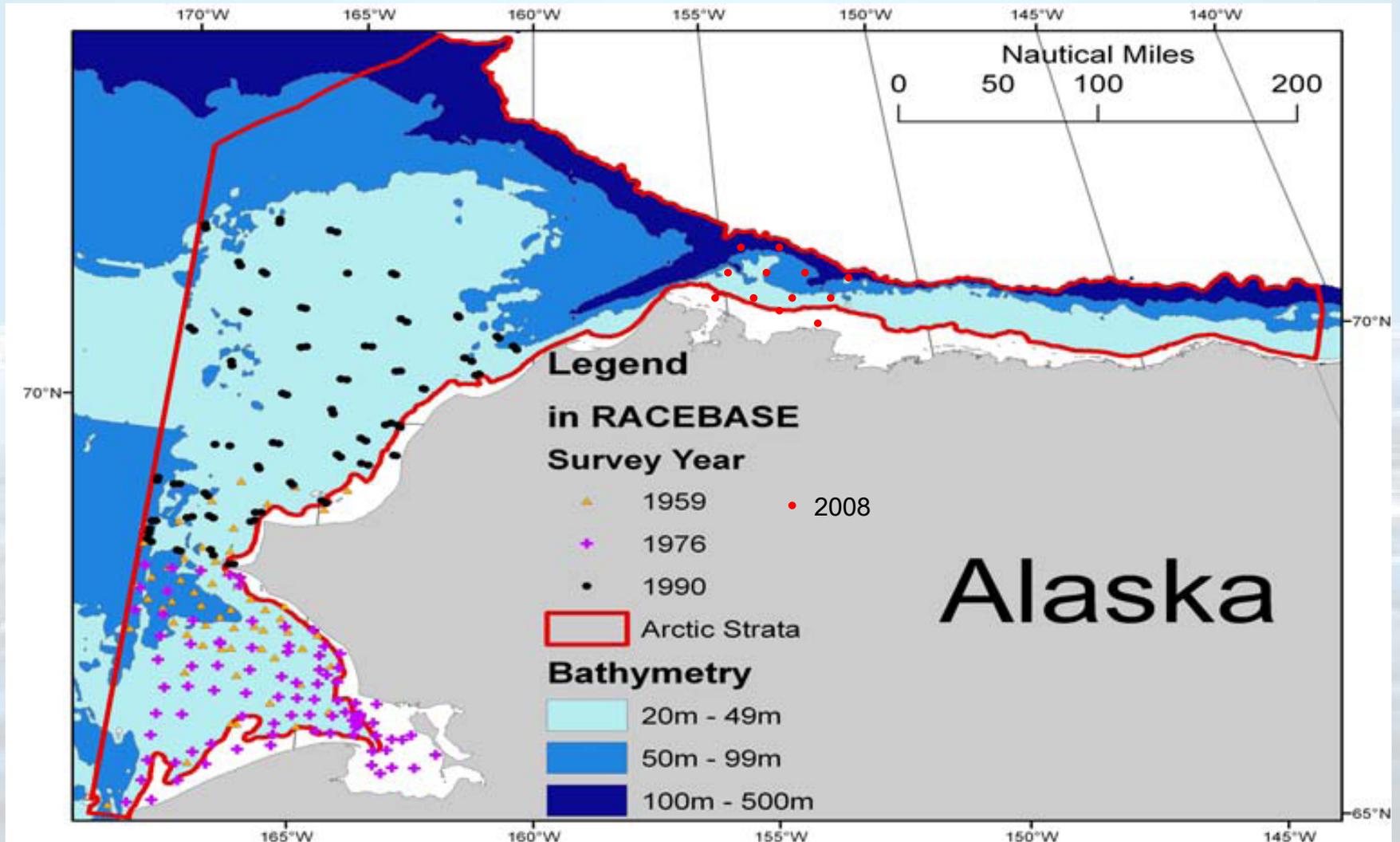
What Type of Science is NOAA Fisheries Doing to Assess Changes to the Arctic Ecosystem?



Surveys in the Northern Bering, Chukchi and Beaufort Seas

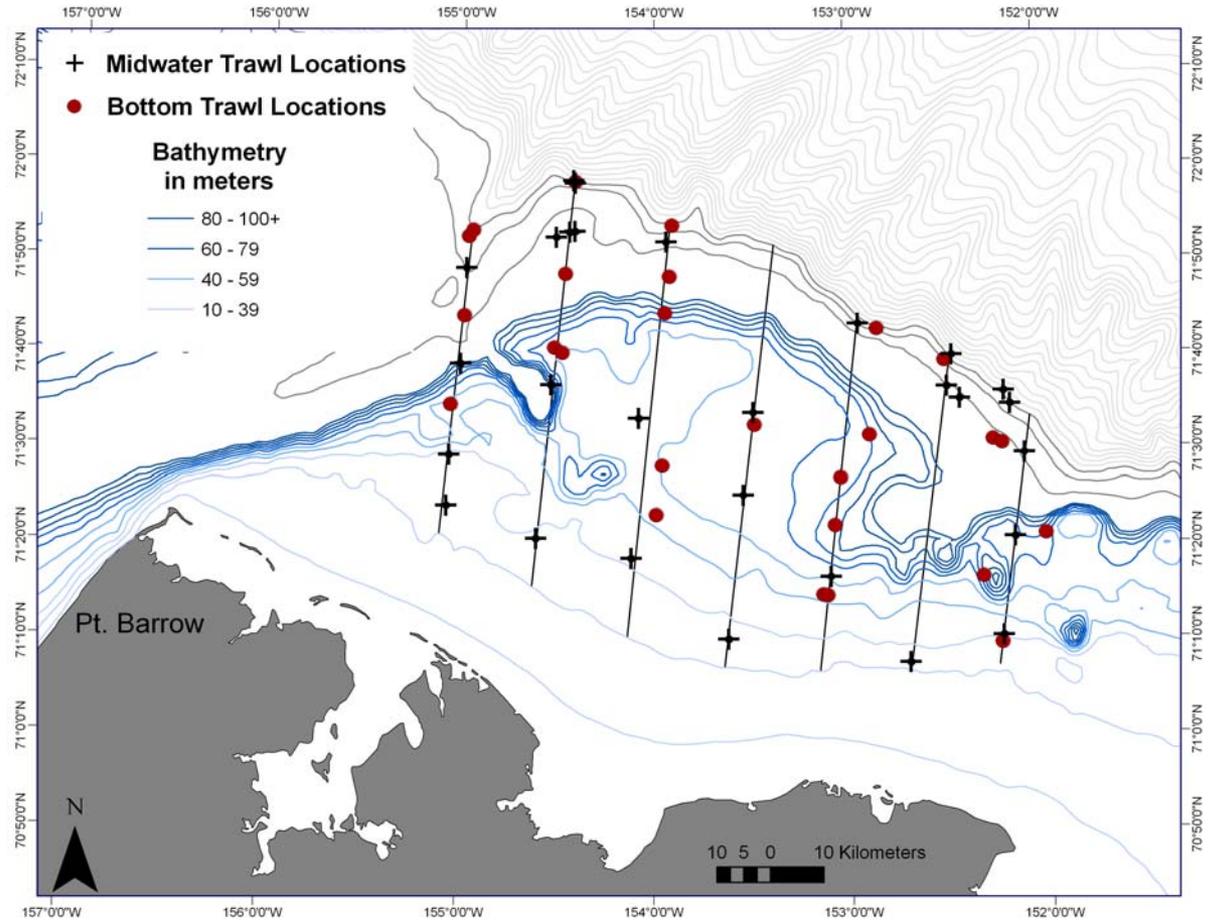
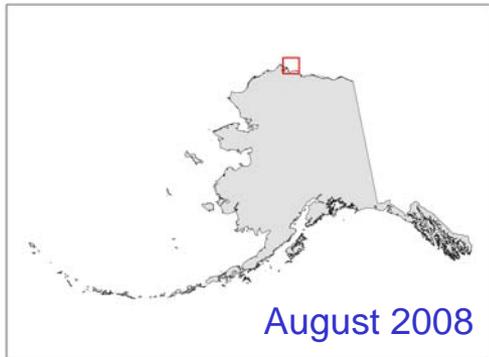
- NOAA's data in the Arctic are insufficient to make adequate assessments of commercial fish, shellfish, and cetacean stocks and their associated habitat needs in the northern Bering Sea and the Beaufort and Chukchi Seas.
- These stocks are inadequately assessed because some species have shifted outside of areas NOAA presently monitors, or are currently not monitored.

Limited Information

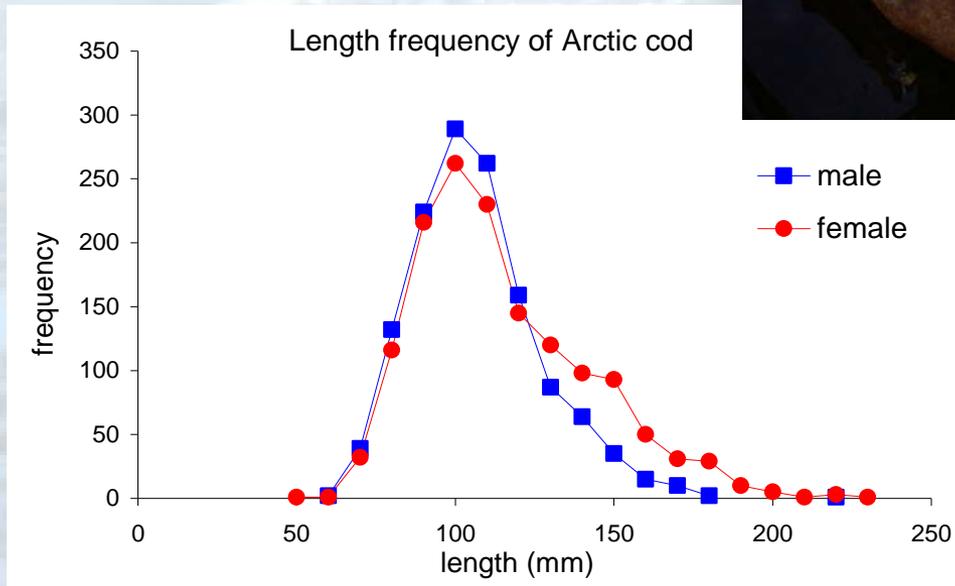




Beaufort Sea Survey



Brittle Stars and Arctic Cod Were Dominant



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

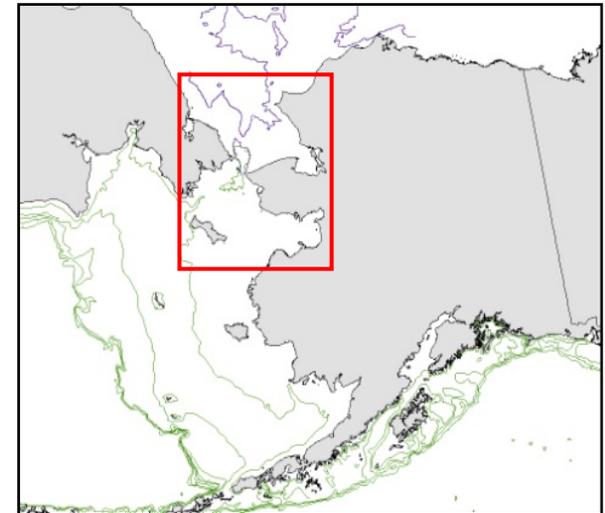


Salmon snailfish



Bering-Aleutian Salmon International Survey (BASIS): Chukchi Sea Survey

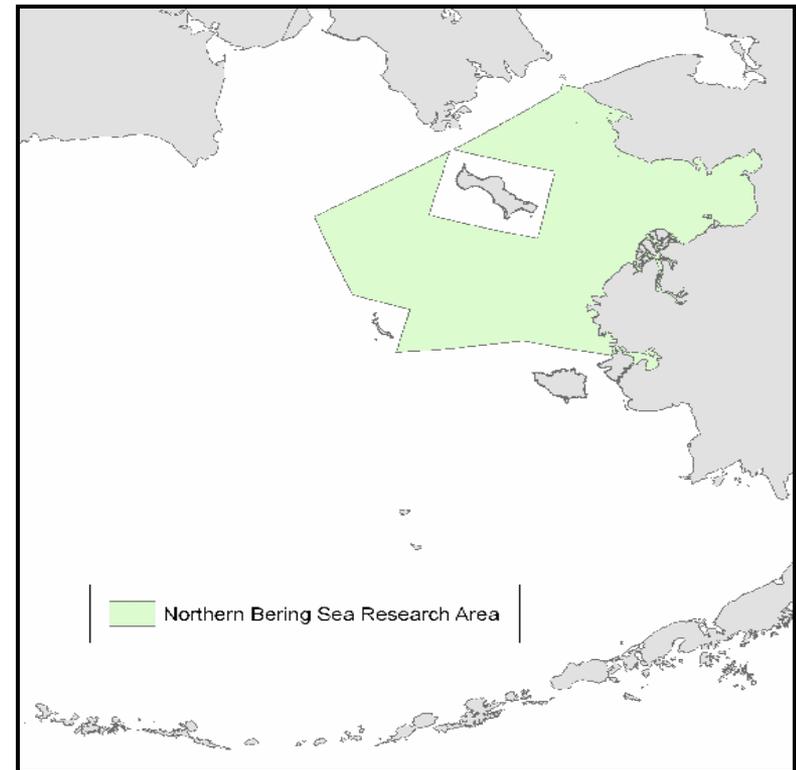
- Study the effects of climate change (loss of sea ice) on oceanography and pelagic/benthic fish communities
- BASIS doesn't routinely go this far north
- Conducted aboard R/V Oscar Dyson in 2007
- Sampling included vertical profiles for oceanography, net tows to determine biomass and species composition of zooplankton, surface trawl to capture pelagic fish, and a beam trawl to capture benthic fish
- Documented range extensions for salmon sharks and Atka mackerel





New Northern Bering Sea Research Area

- Designated by the North Pacific Fishery Management Council for further study before bottom trawling is allowed
- Will remain closed to bottom trawling until the Council develops a plan to manage fishing in the area, including appropriate protection measures
- Experimental trawling will adhere to a scientific research plan to be developed by NOAA Fisheries by 2010 – adaptive management

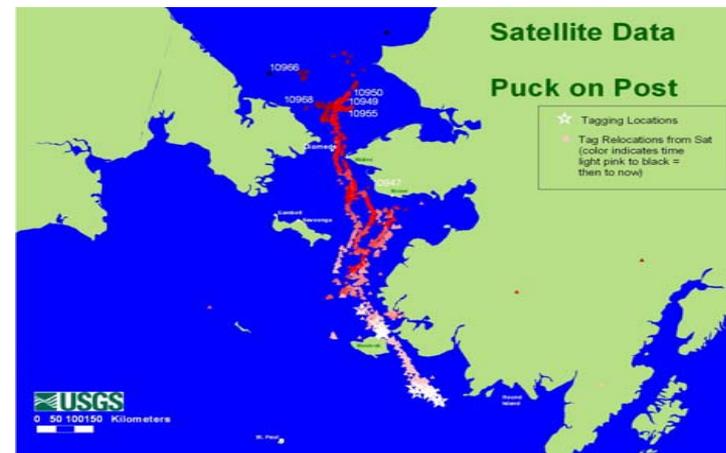
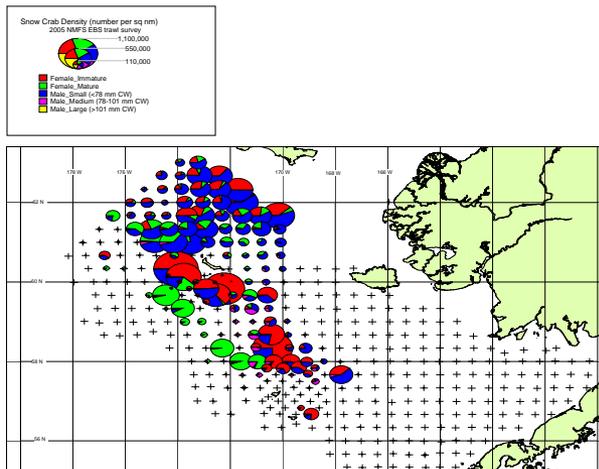




What Do We Know About NBSRA Habitat?

Area is important for bottom habitat dependent species

- *C. opilio* crab
- Blue king crab
- Marine mammals (ice seals, walrus, whales)
- Seabirds (sea ducks)





NBSRA Trawl Impact Assessment

Investigative: identify effects

Interpretive: ecological implications

Decision-making: cost-benefit analyses

Research Objectives

- Identify short-term effects
- Monitor recovery process
- Identify management measures

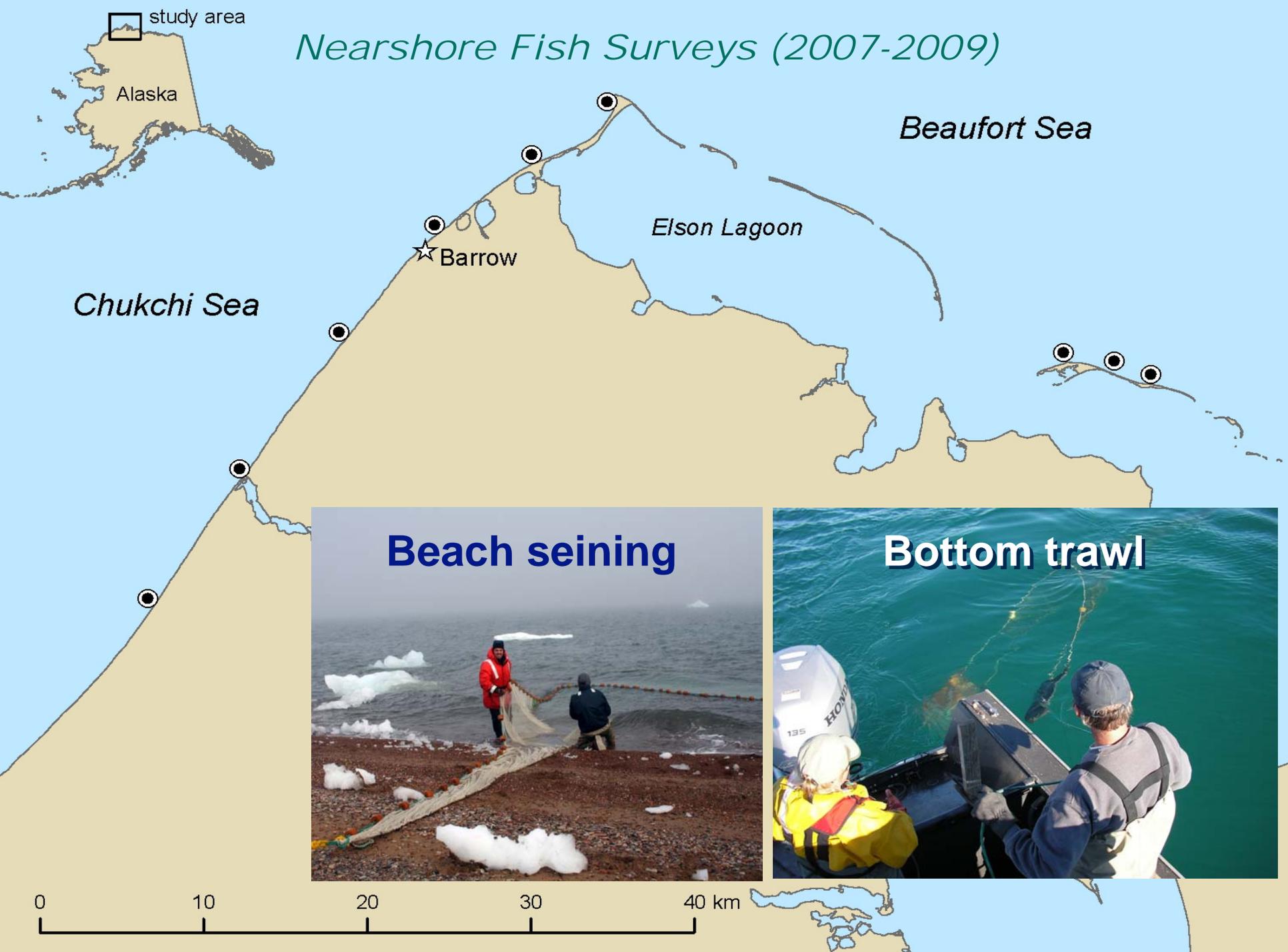




Nearshore Fish Surveys

- Inventory of nearshore fish assemblages in shallow marine waters near Barrow, Alaska
- Opportunistic fish surveys partially funded by Corps of Engineers to assess proposed erosion control sites
- Surveys conducted during 2007-2009
- Established sites for long term fish monitoring in the Chukchi/Beaufort Seas

Nearshore Fish Surveys (2007-2009)





Ice Seal Research

- **Surveys to estimate population abundance and distribution**
- **Satellite telemetry for studies of movements, habitat use, foraging behavior, and haul-out time lines**
- **Comprehensive reviews of conservation status to support Endangered Species Act determinations (with focus on risks from climate change and loss of sea ice)**

Bearded Seal



Erignathus barbatus

Ringed Seal



Phoca hispida

Spotted Seal



Phoca largha

Ribbon Seal



Histiophoca fasciata



Ice Seal Status Reviews: General Approach

- **Where, when, and how does the species use sea ice?**
- **Within this context, what are the expectations for future ice conditions?**
- **What are the implications for the fate of the species?**

Bearded Seal



Erignathus barbatus

Ringed Seal



Phoca hispida

Spotted Seal



Phoca largha

Ribbon Seal



Histiophoca fasciata



- Surveying ice seals with Insight Unmanned Aircraft Systems
- 10 foot wingspan, 44 lbs, digital still and video cameras
- Launched from pneumatic catapult
- Recovered on “SkyHook” a 40’ vertical ¼” nylon rope outboard
- Tested aboard *Oscar Dyson*, October 2008
- 1st survey planned for Bering Sea aboard *McArthur II*, May-June 2009



Cetacean Assessments



photo © National Geographic

- Data and scientific expertise to support bowhead assessments: abundance for Bering-Chukchi-Beaufort stock in 2004 was 11,800 whales, growing at 3.4% per year
- Continued monitoring of the population and the hunt
- Studies of bowheads relative to oil and gas development
- Studies of the effects of climate change on whales and their prey

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What Management Activities is NOAA Fisheries Pursuing in Response to Changes to the Arctic Ecosystem?



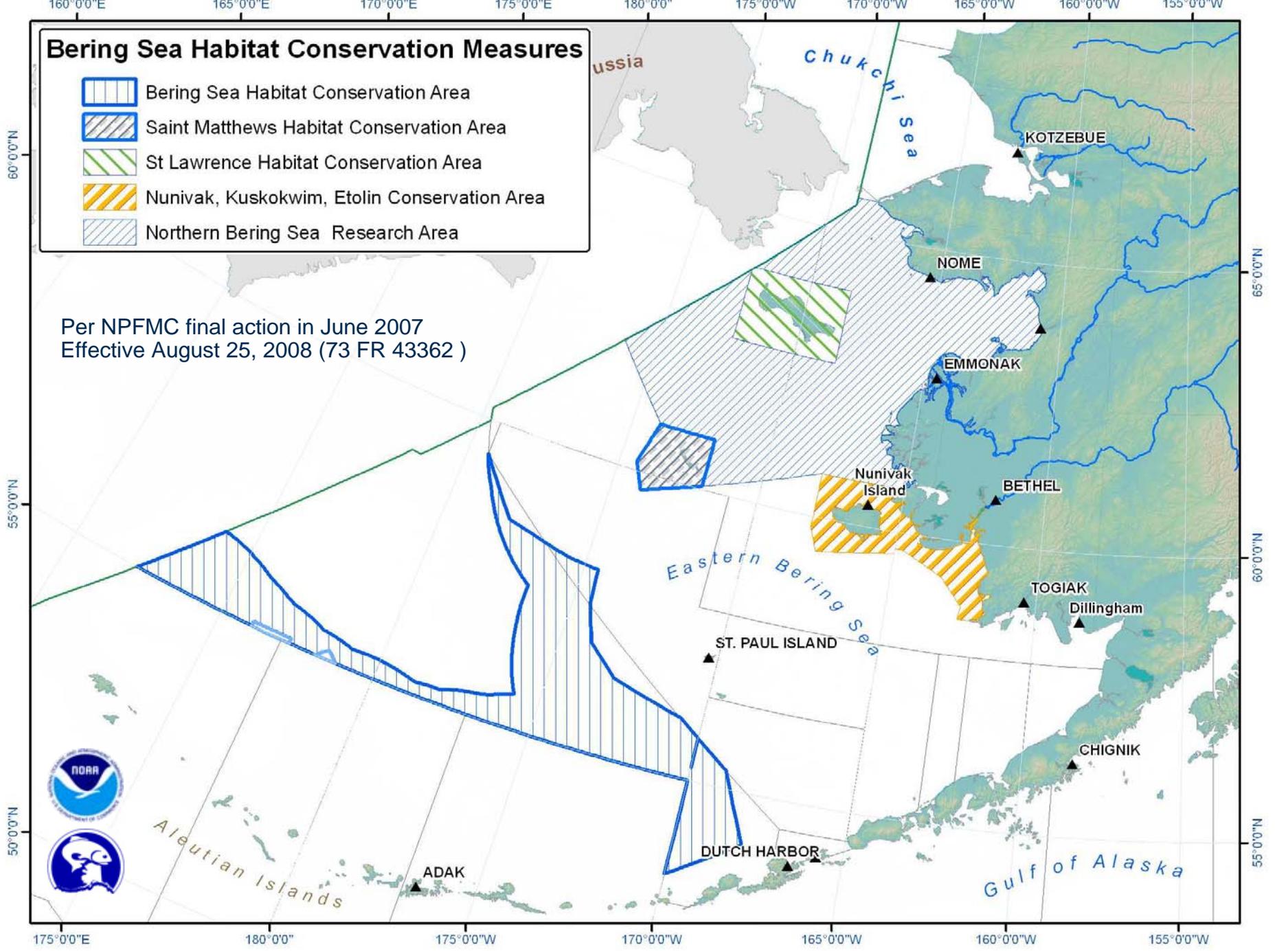
New Habitat Conservation Measures in the Bering Sea

- North Pacific Fishery Management Council adopted new measures to protect Essential Fish Habitat in the Gulf of Alaska and Aleutian Islands in 2005
- Council then initiated new analysis for the Bering Sea to consider options to reduce potential adverse effects of bottom trawling
- Final measures recommended by the Council in 2007 included bottom trawl closures in areas that haven't previously been fished, nearshore areas that support subsistence marine resources, and a research area for further study of the effects of bottom trawling

Bering Sea Habitat Conservation Measures

-  Bering Sea Habitat Conservation Area
-  Saint Matthews Habitat Conservation Area
-  St Lawrence Habitat Conservation Area
-  Nunivak, Kuskokwim, Etolin Conservation Area
-  Northern Bering Sea Research Area

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



Bering Sea Closures

- St. Matthew HCA
- Chinook Savings Area
- St. Lawrence HCA
- Nunivak/Kuskokwim Closure Area
- Northern Bering Sea Research Area
- Nearshore Bristol Bay No Trawl
- Wálrus Island Closure
- Bogoslof No Fishing
- Bering Sea Closure to bottom trawling
- Chum Savings Area
- SSL No Trawl Zone
- RKC Closure

Statewide Closures

- State Waters No Trawling
- 3nm No Transit

GOA Closures

- Gulf of Alaska Coral Habitat Protection Areas
- Gulf of Alaska Slope Habitat Conservation Areas
- SE AK Trawl Closure
- Alaska Seamount Habitat Protection Areas

Aleutian Islands

- Bowers Ridge Habitat Conservation Zone
- Aleutian Islands Coral Habitat Protection Areas
- Aleutian Islands Habitat Conservation Area
- Seguam Pass No Fishing



0 70 140 210 280
Nautical Miles



Arctic Fishery Management Plan

- New management plan under the Magnuson-Stevens Fishery Conservation and Management Act
- Identifies Arctic cod, saffron cod, and snow crab as target species; others as ecosystem component species
- Approved by North Pacific Council in February 2009
- If approved by the Secretary, it will close the entire Arctic Management Area to commercial fishing until information is available to support sustainable management

PUBLIC REVIEW DRAFT

Fishery Management Plan

for Fish Resources of the Arctic Management Area



North Pacific Fishery Management Council
605 W. 4th Avenue, Suite 306
Anchorage, Alaska 99501

PHONE: (907) 271-2809
FAX: (907) 271-2817

January 2009

NOTE: This is a draft of the Arctic FMP that is intended to provide the Council and the public with a general idea of how the Arctic FMP will be structured and its substantive content. It is written assuming the Council chose Alternative 2 (closing the Arctic Management Area to commercial fishing), and option 3 (setting fishery conservation and management measures). The Council has NOT selected its preferred alternative or option, so this draft is an example of the FMP at this time. Please refer to the accompanying Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis document for detailed analyses of the alternatives and options and for additional background information. This draft FMP will be modified to reflect the preferred alternative and option ultimately selected by the Council and any other necessary changes.



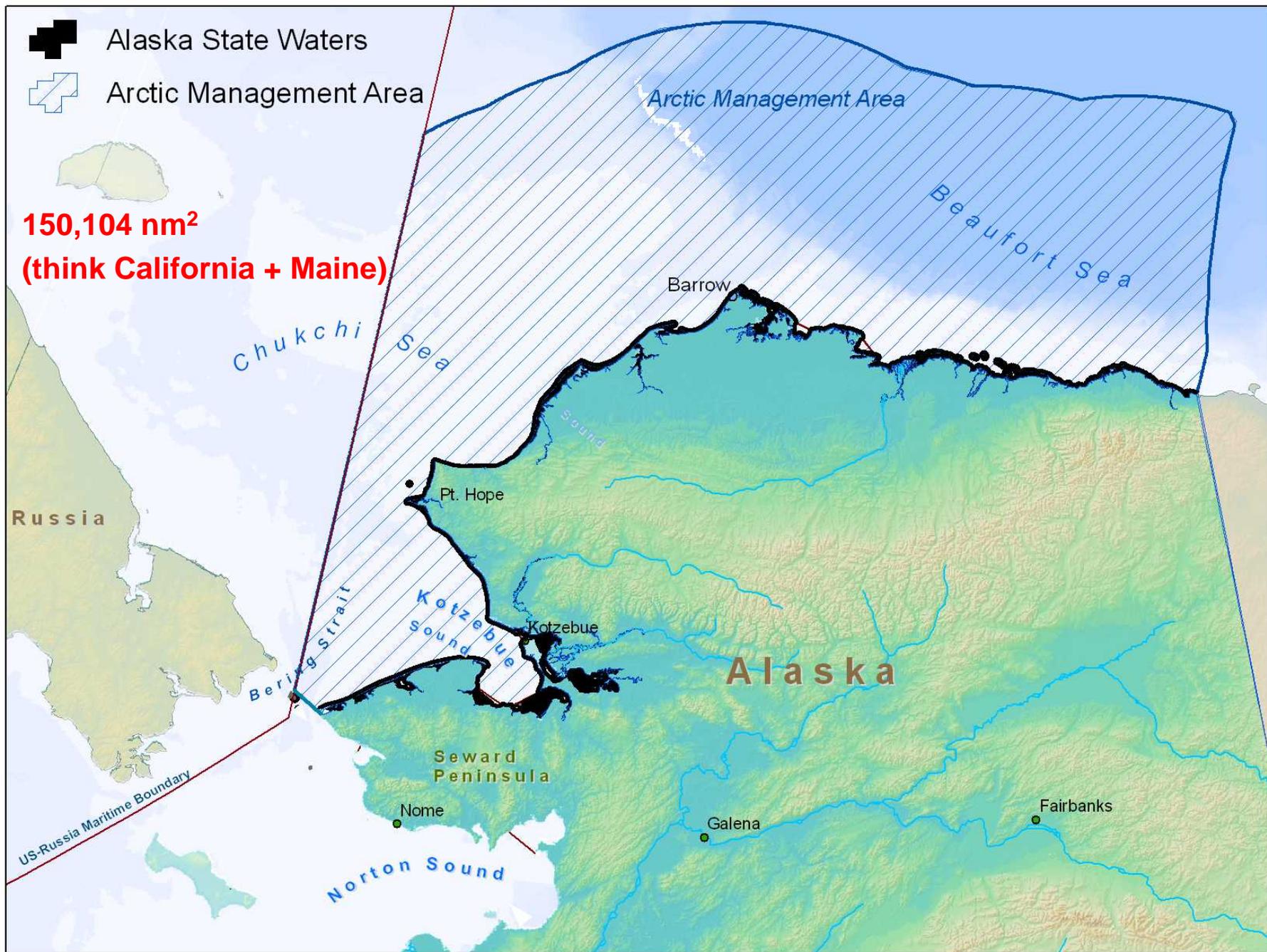
Alaska State Waters



Arctic Management Area

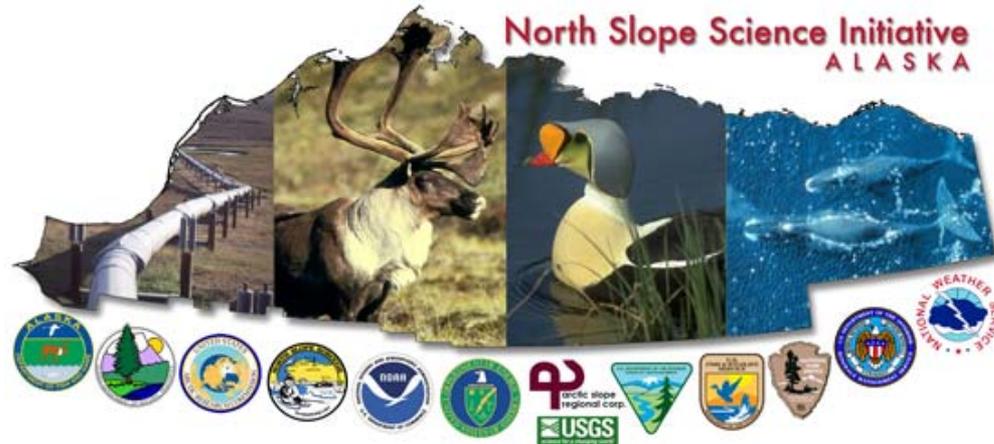
150,104 nm²

(think California + Maine)





North Slope Science Initiative



NSSI is an intergovernmental partnership amongst federal, state, and local agencies to coordinate research, inventory, and monitoring activities related to development on the North Slope of Alaska. Established in Energy Policy Act of 2005.

- Oversight Group (NMFS is a voting member, NWS is an advisory member)
- Senior Staff Committee
- Science/Technical Advisory Panel

Many entities are involved in North Slope science, so collaboration is key!



Alaska Marine Ecosystem Forum

- AMEF is a partnership amongst federal and state agencies with management jurisdiction over some aspect of Alaska's marine environment
- Formed in 2006 after initial discussions amongst NOAA Fisheries, North Pacific Fishery Management Council, and state's Ocean Policy Cabinet
- Stemmed from national initiatives calling for more systematic collaboration on ocean issues: fishing and non-fishing
- Participating agencies coordinate and share information regarding activities of mutual interest

Alaska Marine Ecosystem Forum
Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

Between

U.S. DEPARTMENT OF COMMERCE
NATIONAL MARINE FISHERIES SERVICE
and
THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
and
U.S. DEPARTMENT OF INTERIOR
U.S. FISH AND WILDLIFE SERVICE
and
U.S. DEPARTMENT OF INTERIOR
U.S. MINERALS MANAGEMENT SERVICE
and
U.S. DEPARTMENT OF INTERIOR
U.S. NATIONAL PARK SERVICE
and
U.S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
and
U.S. ENVIRONMENTAL PROTECTION AGENCY
and
U.S. DEPARTMENT OF AGRICULTURE
U.S. FOREST SERVICE
and
U.S. DEPARTMENT OF HOMELAND SECURITY
U.S. COAST GUARD
and
U.S. DEPARTMENT OF DEFENSE
ALASKAN COMMAND
and
U.S. DEPARTMENT OF DEFENSE
U.S. ARMY CORPS OF ENGINEERS
and
ALASKA DEPARTMENT OF FISH AND GAME
and
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
and
ALASKA DEPARTMENT OF NATURAL RESOURCES
and
ALASKA DEPARTMENT OF COMMERCE, COMMUNITY AND ECONOMIC
DEVELOPMENT

CONCERNING THE ESTABLISHMENT OF
THE ALASKA MARINE ECOSYSTEM FORUM



Consultations on Federal Actions

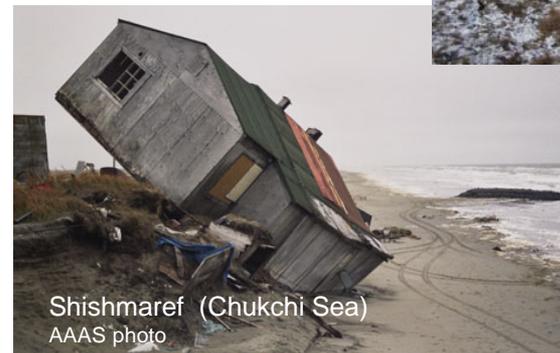
- Federal agencies must consult with NOAA Fisheries regarding effects of their actions on species listed under the Endangered Species Act and on Essential Fish Habitat for species managed under the Magnuson-Stevens Fishery Conservation and Management Act
- Entities that incidentally “take” marine mammals must also obtain NOAA authorization under Marine Mammal Protection Act



Endicott (Beaufort Sea)
ConocoPhillips photo



Barter Island (Beaufort Sea)
US Air Force photo



Shishmaref (Chukchi Sea)
AAAS photo



ESA Listing Determinations for Ice Seals

- NOAA Fisheries was petitioned to list ribbon seals under the Endangered Species Act; Determined 12/30/08 that listing is not warranted (annual ice, which is critical for reproduction, molting and resting, will continue to form each winter in Bering Sea and Sea of Okhotsk where most ribbon seals are located); Petitioner filed a 60-day notice of intent to sue on 3/31/09
- Also petitioned to list ringed, spotted, and bearded seals; Status reviews underway and determinations pending





Annual Arctic Open Water Meeting

- NOAA Fisheries, oil and gas industry, representatives of Alaska Native communities
- Review monitoring results from previous year's seismic operations, drilling, etc. and monitoring requirements for the upcoming open-water (ice free) season
- Discuss levels of “take”, mitigation requirements, avoidance of conflicts with subsistence hunting





Invasive Species Planning

- Invasive species may affect Alaska increasingly as climate changes
- Some invasives already present (riparian plants, several species of tunicates) with more threatening to expand (European green crab, New Zealand mudsnail, Atlantic cordgrass)
- Climate change may facilitate additional human activities that act as vectors for the spread of invasive species, and may allow some species not predicted to survive in Alaska to take hold
- Now is the time to monitor and establish response plans!





Tribal Consultation

- Executive Order 13175 requires government-to-government consultation; These requirements extend to Alaska Native corporations per the Consolidated Appropriations Act of 2004
- Alaska Native groups are increasingly well informed and actively involved in pending actions
- NOAA Fisheries coordinated with tribes recently regarding Bering Sea habitat conservation measures, Arctic FMP, and reduction of salmon bycatch in the pollock fishery
- ~225 tribes, 13 regional corporations, 220 village corporations





Support for U.S. Delegation to the International Whaling Commission

- IWC gives hunting quota every 5 years based on abundance, population trend, population structure
- NOAA Fisheries provides data and scientific expertise; conducts, funds, or collaborates on relevant studies; completes required environmental analysis (EIS)



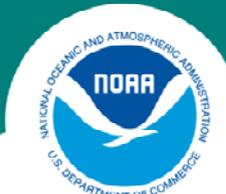
07B17, 856 cm, male; 9 October 2007
Barrow, Captain: Jonathan Aiken



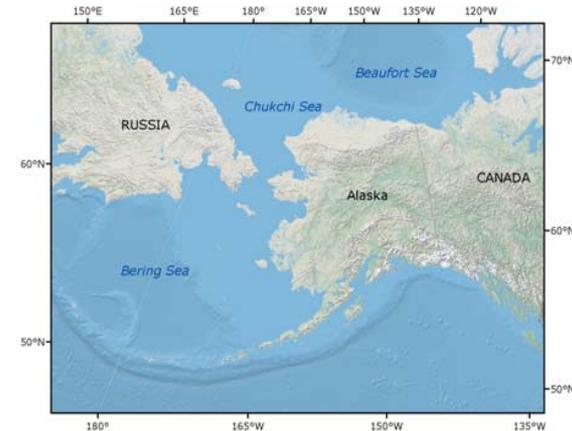
**NOAA
FISHERIES
SERVICE**



*What's Next for NOAA Fisheries
in the Arctic?*



Future Needs for Sustainable Management in the Arctic



- Extend existing fish surveys to the northern Bering, Chukchi, and Beaufort Seas; Periodically monitor fish and shellfish abundance using standard NOAA survey methods (bottom and surface trawls, acoustics, beach seines)
- Expand studies of marine mammals to better understand their seasonal distribution and habitat use in the Arctic, plus effects of development
- Conduct baseline habitat mapping and identify sensitive areas
- If additional species are listed under the ESA, establish recovery plans and programs
- Build capacity to handle increasing requests for consultation on development activities (ESA and EFH)
- Build capacity to handle management for expanded commercial fisheries and related requirements such as environmental and economic analyses and tribal consultation