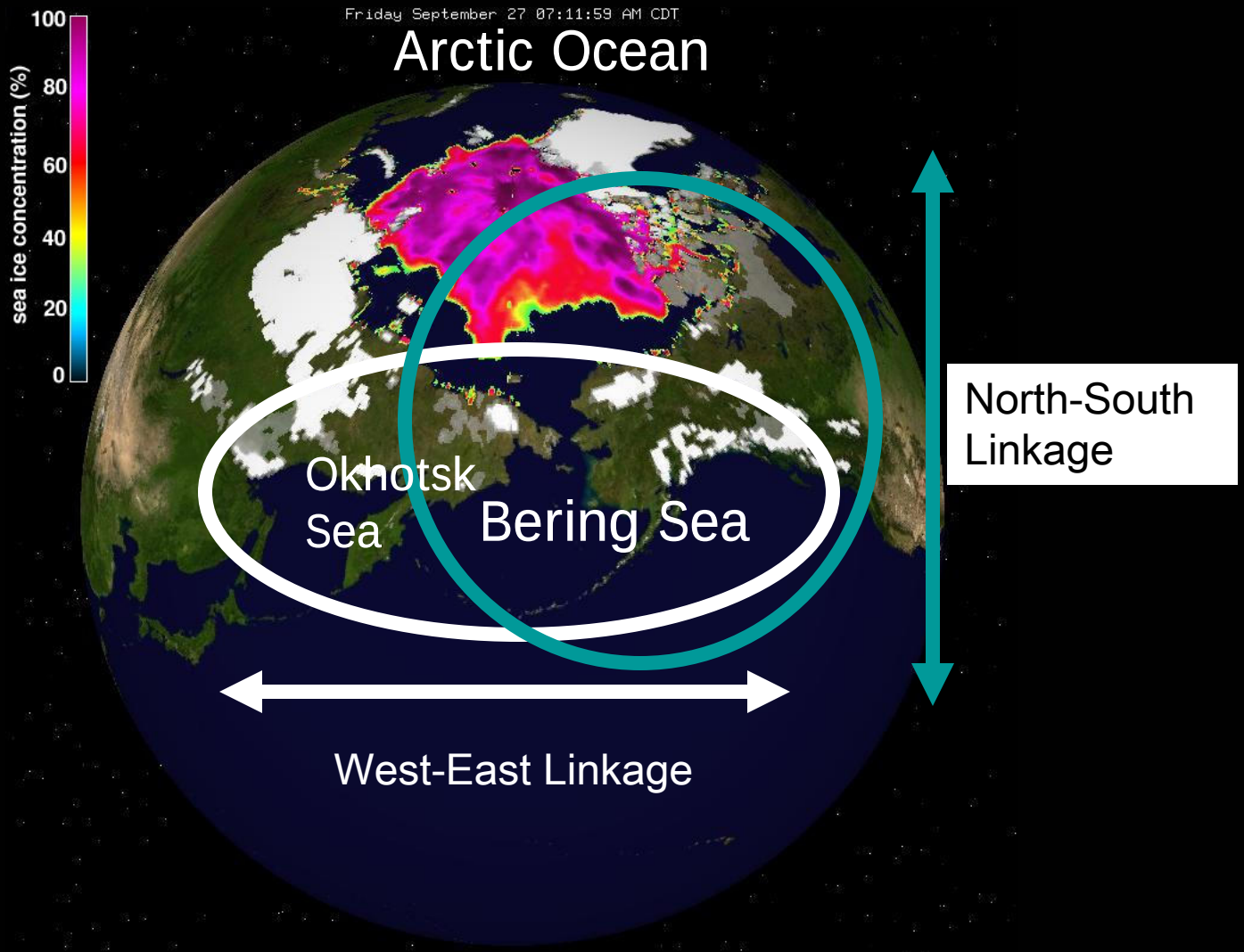
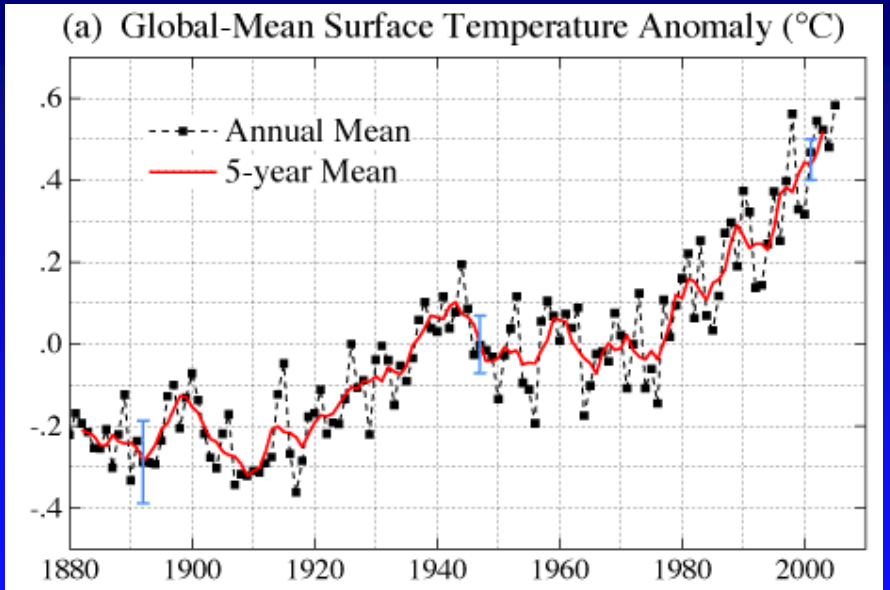
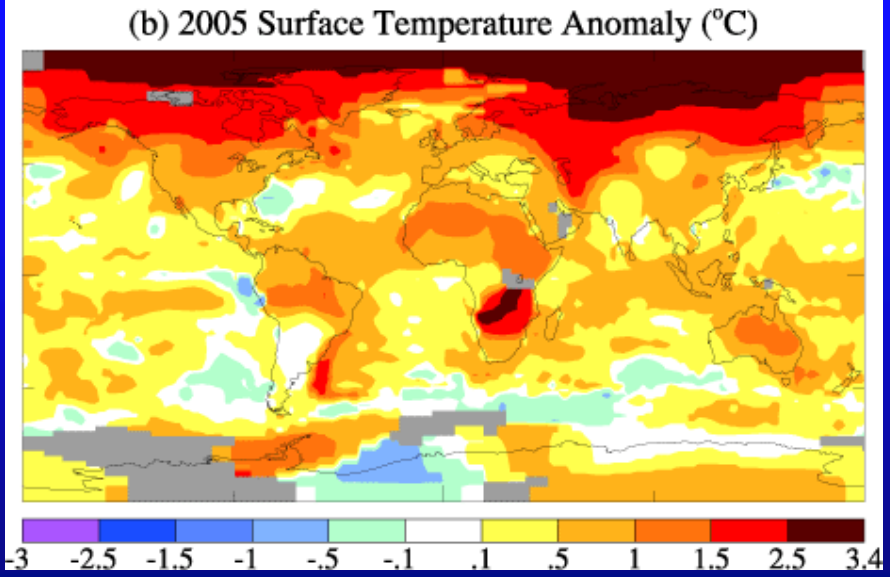
Russian-American Cooperative Observations in the Pacific Arctic







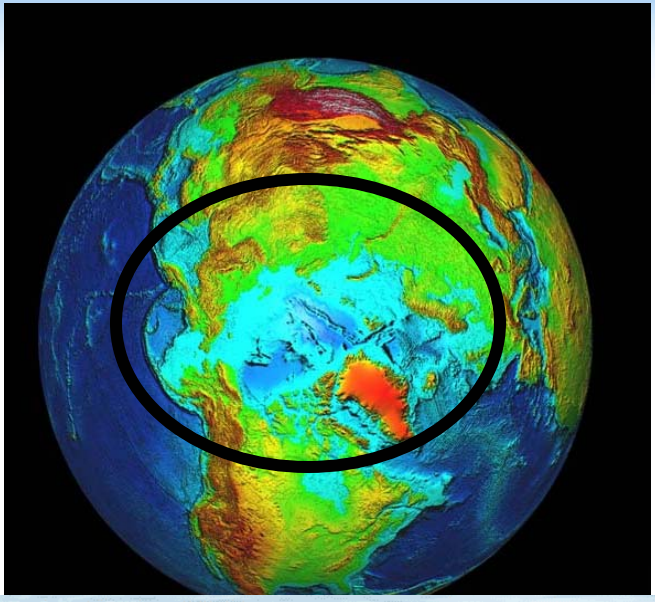
A NOAA Climate Driver in the Arctic

Temperature anomalies are higher In the Arctic than the rest of the world

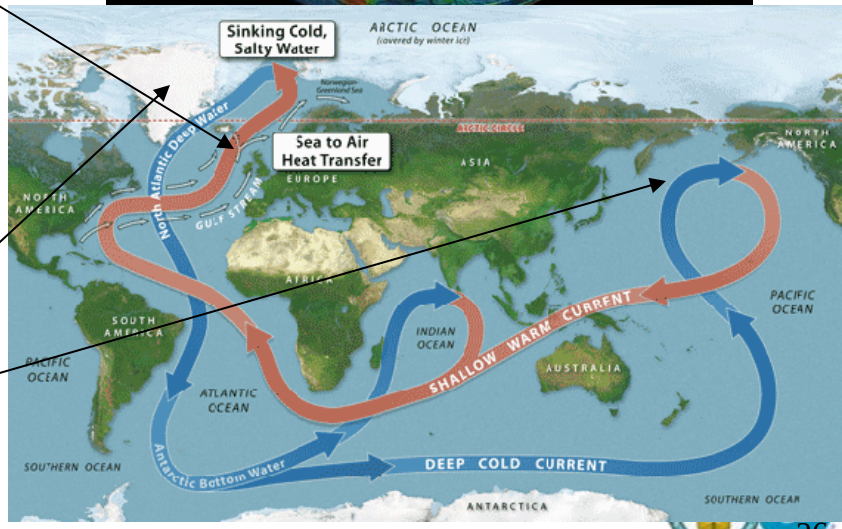
http://www.arctic.noaa.gov/detect/global-temps.shtml

Global - Global Temperature Trends: 2005 Summation

Possible Arctic Influences on Global Climate Change:



- Increase of methane in the atmosphere due to a thaw in the permafrost on land and under water
- Fresh water /salt water unbalances, Ocean circulation disruption
- Changing albedo of the planet due to melting of sea ice
- Extinction or migration of many species
- Rising sea level due to the melting of the Greenland Ice Cap.
- Increase in severe weather.



The Bering and Chukchi Seas, Alaska and Chukotka show amplified responses to climate change.

The United States and the Russian Federation are working together to monitor the change in flux into and out of the Arctic through the Bering Strait-the Pacific Gateway to the Arctic.

Russian-American Long-term Census of the Arctic: RUS

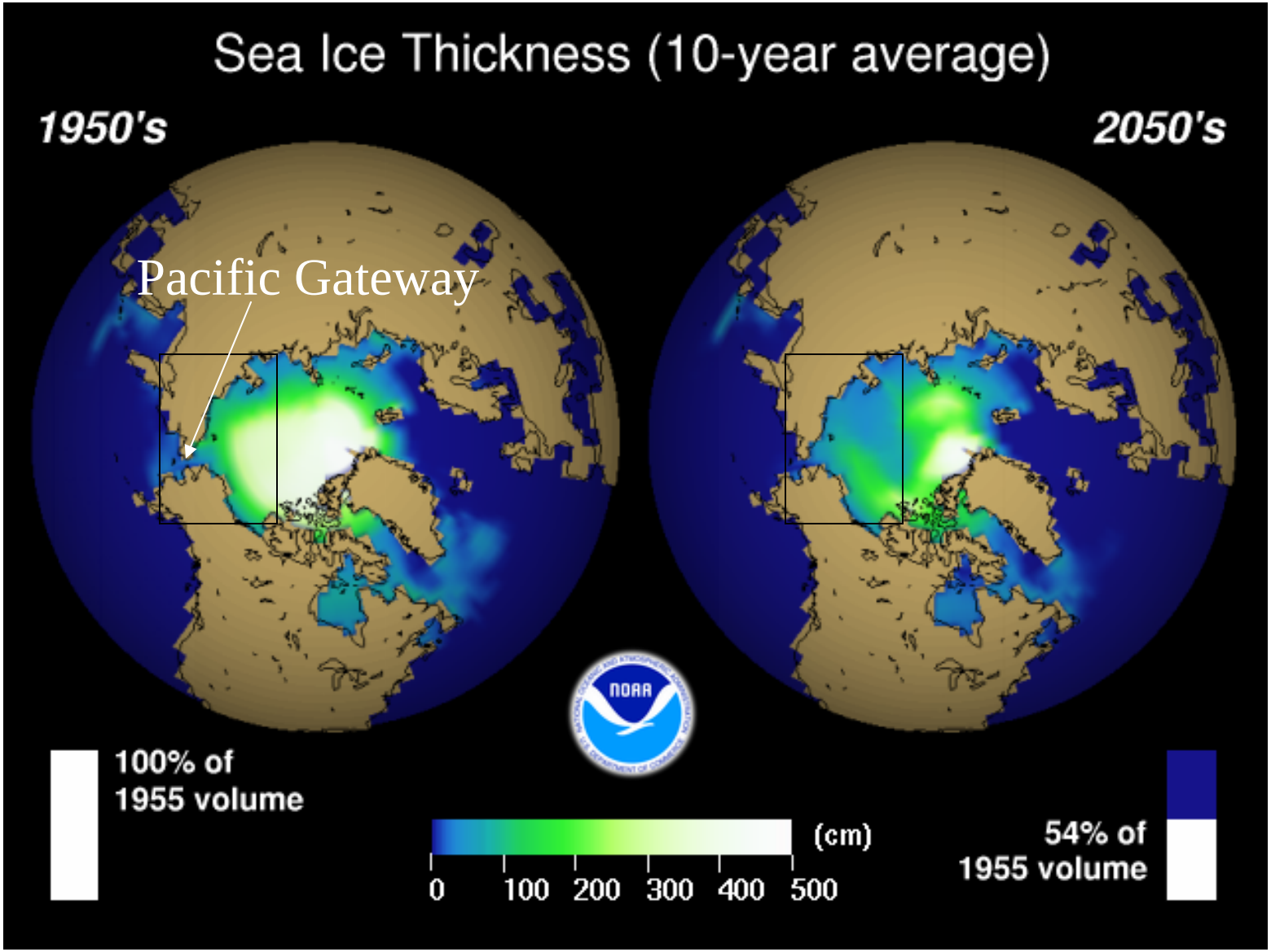
U.S.-Russian Federation S&T Agreement
MOU on World Oceans and Polar Regions, 2003

RUSALCA

RUSALCA Goals:

- Take observations where Arctic sea ice is reducing
- Monitor fresh water, nutrient fluxes
- Track the fate of Pacific water in the Arctic and monitor the influx of Atlantic water
- Monitor ecosystem indicators of climate change.
- Improve international Arctic science collaboration and explore the unknown Arctic

Russian American Long-term Census of the Arctic

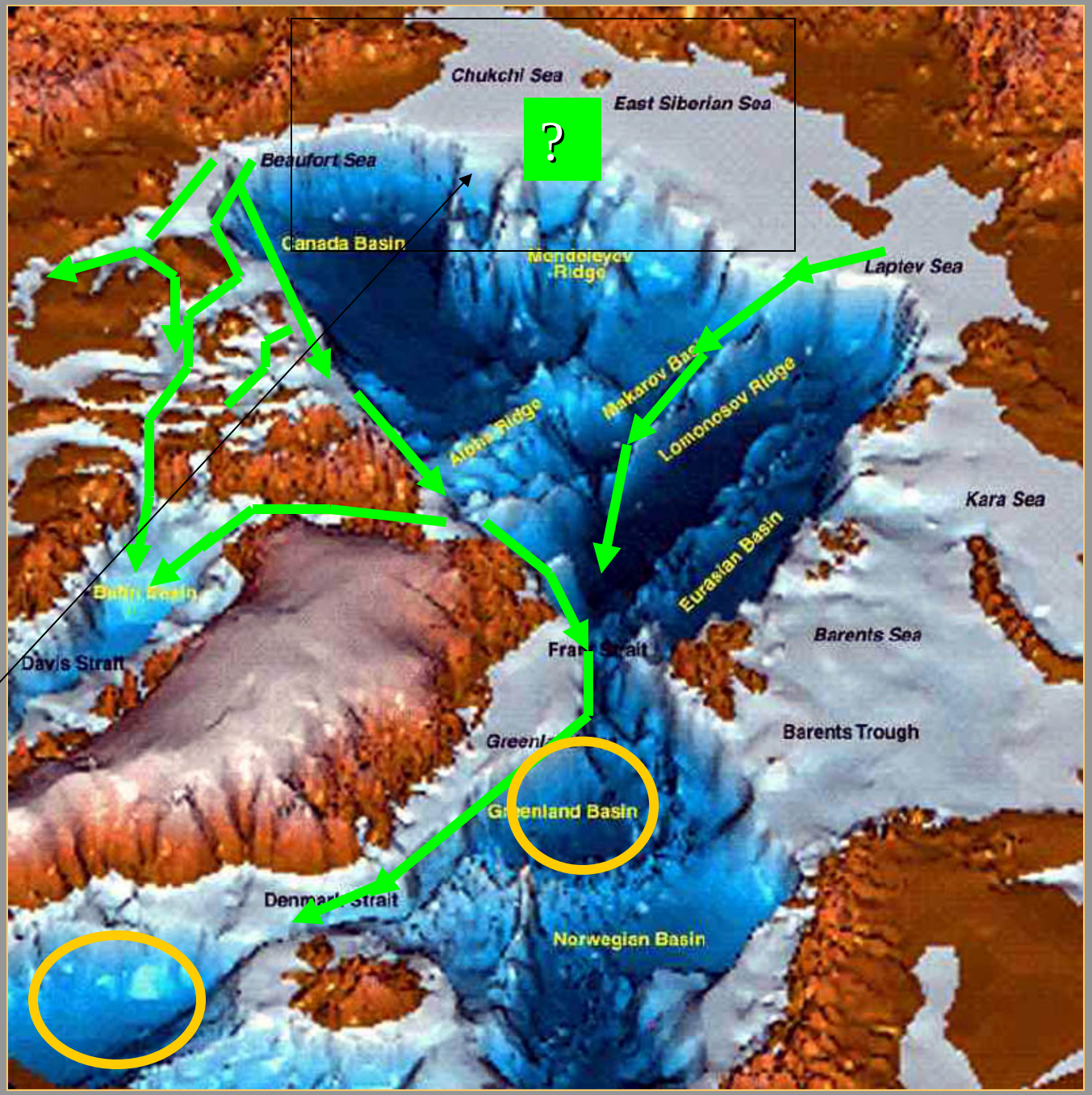


GOAL 1 (Sea Ice Thinning Observations)

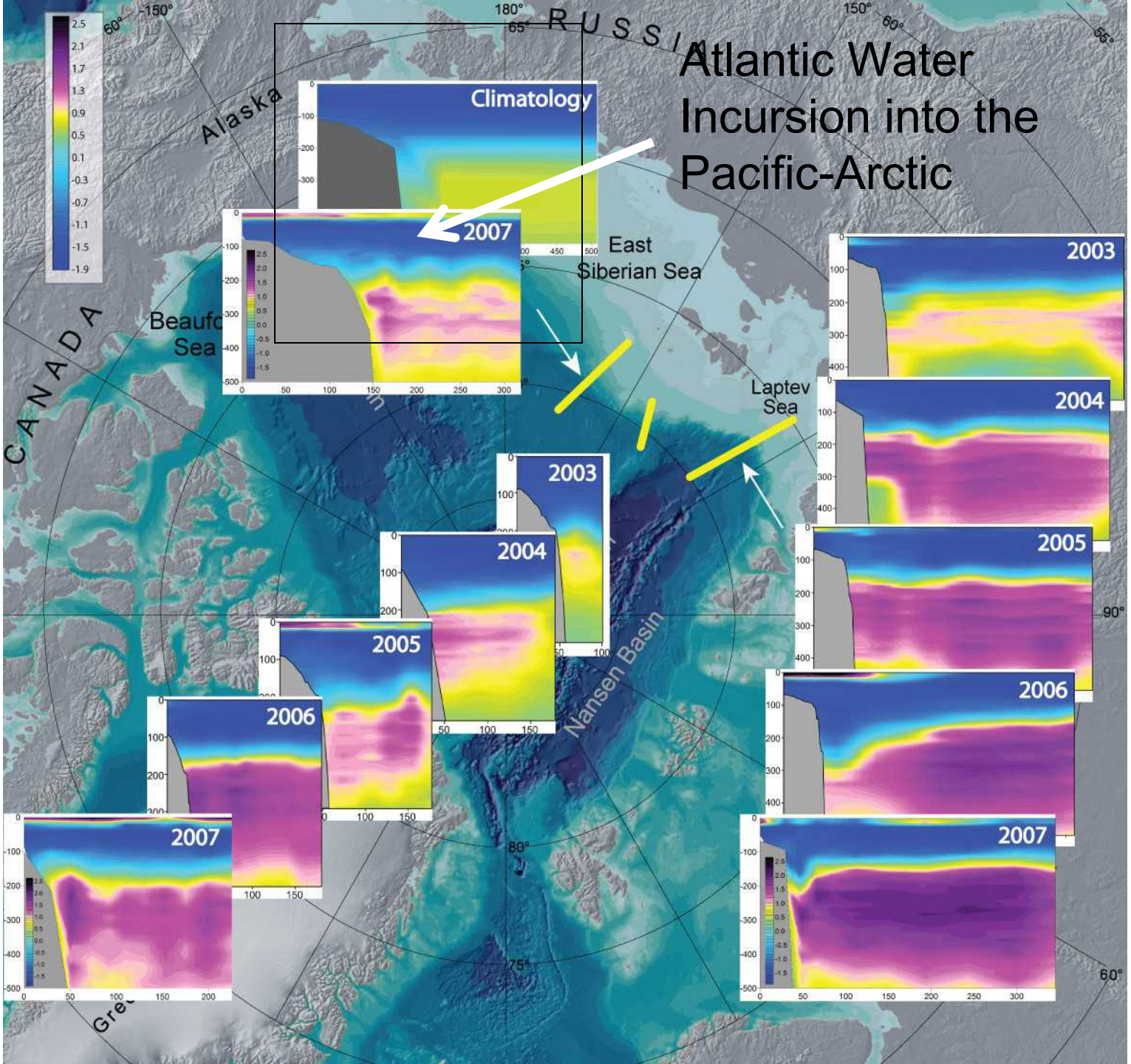
GOAL 2: Fresh water fluxes & pathways

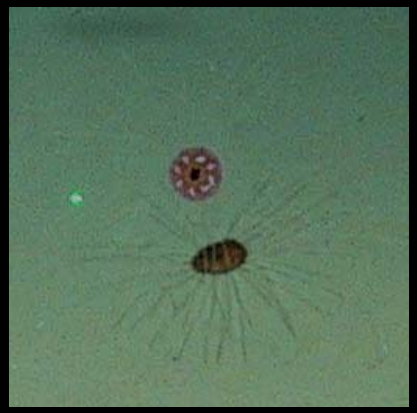
Increased fresh water flow from the Arctic to the north Atlantic

What are the pathways of fresh water flow across the Pacific Gateway ?



Goal 3

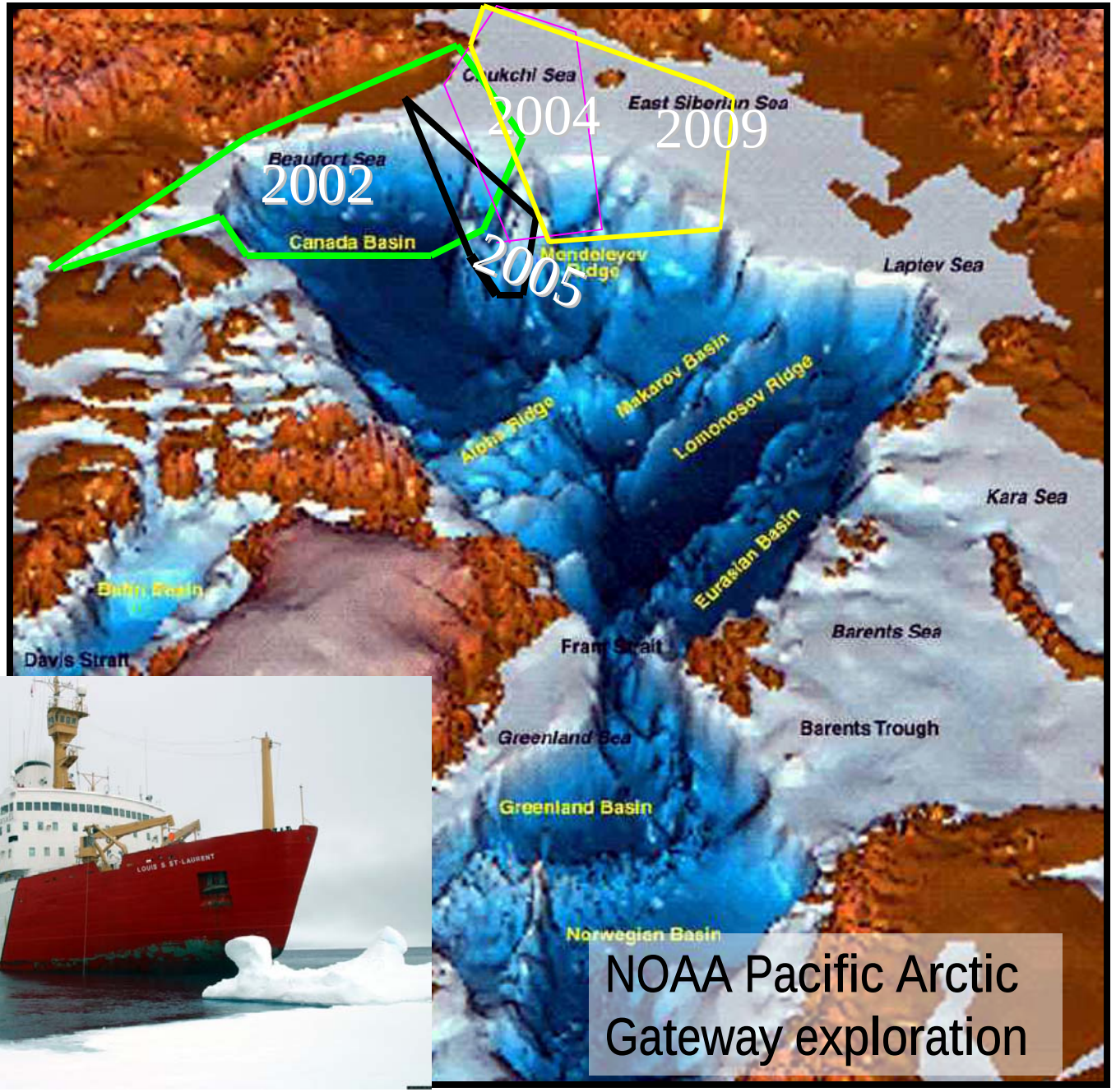

Atlantic Water Incursion into the Pacific-Arctic
Climatology
2007
2003
2004
2005
2006
2007
East Siberian Sea
Laptev Sea
Nansen Basin
Alaska
CANADA
RUSSIA
Beaufo Sea
2.5
2.1
1.7
1.3
0.9
0.5
0.1
-0.3
-0.7
-1.1
-1.5
-1.9



GOAL 4
Monitor Eco-system changes and take an Arctic Census of Marine Life

ECOSYSTEM INDICATORS OF CLIMATE CHANGE

GOAL 5
Explore The unknown Arctic Ocean



NOAA Pacific Arctic Gateway exploration


RUSALCA
Moscow, 2003
Russian American Long-term Census of the Arctic

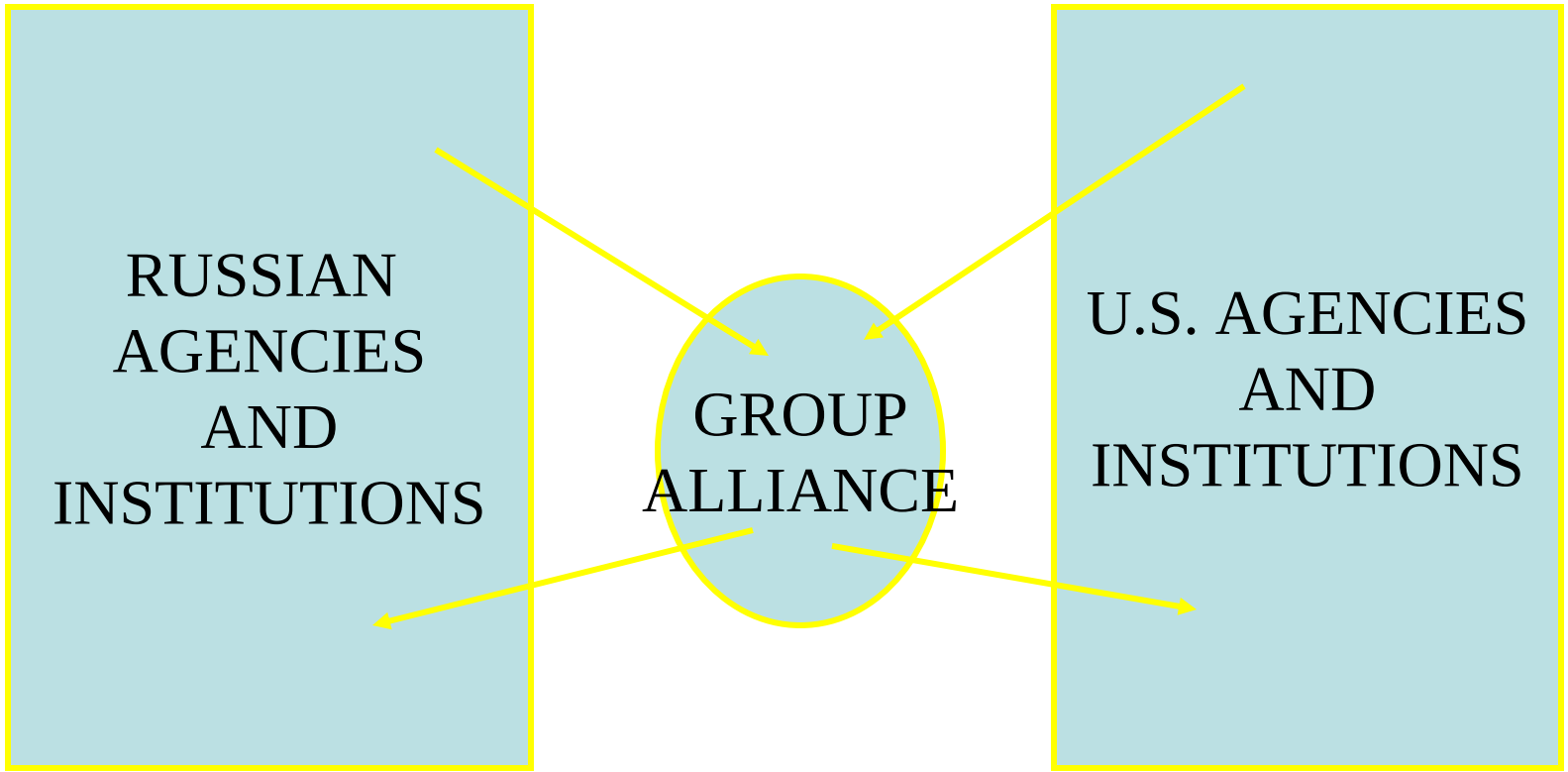
RUSALCA Russian Government Partners

- Russian Academy of Sciences
  - Shirshov Institute of Oceanology
  - Zoological Institute
  - Institute of Microbiology
  - Pacific Oceanological Institute
- Roshydromet
  - AARI
  - FEHRI

- Ministry of Defense
  - Russian Federation Navy
- Ministry of Natural Resources
  - VNIIOkeangeologica
- Ministry of Sciences
- Foreign Ministry

RUSALCA U.S. PARTNERS

- NSF- Bering Strait Moorings
- NOAA funded (CPO, OER, NMFS)
  - CIFAR- University of Alaska
  - Smithsonian Institution
  - Pt. Stephens Research
  - University of Tennessee
  - University of Washington
  - Woods Hole Oceanographic Institution


RUSSIAN AGENCIES AND INSTITUTIONS
GROUP ALLIANCE
U.S. AGENCIES AND INSTITUTIONS

Structure of the Shipboard Operations

- ROSHYDROMET

  Captain and crew
- MINISTRY OF DEFENSE

  Chief of Expedition
- RUSALCA MISSION COORDINATORS

  K. Crane USA-M. Zhdanov, Russia
- U.S. CHIEF SCIENTIST'S

__Kevin Wood, NOAA, Terry Whitledge, UAF

SCIENTIFIC PARTY

- SCIENTISTS WRITE PROPOSALS TO THEIR OWN FUNDING AGENCIES
- Russians- Russian Academy of Sciences
- US - CIFAR, JISAO, CICOR (NOAA's Cooperative Institutes at the University of Alaska, Washington and WHOI)
- Most teams have both Russian and American partners, e.g. Biodiversity of Fish, Census of Zooplankton, Nutrients

RUSALCA
TIME LINE

2003 Sign Memorandum of Understanding, Russian Academy and NOAA

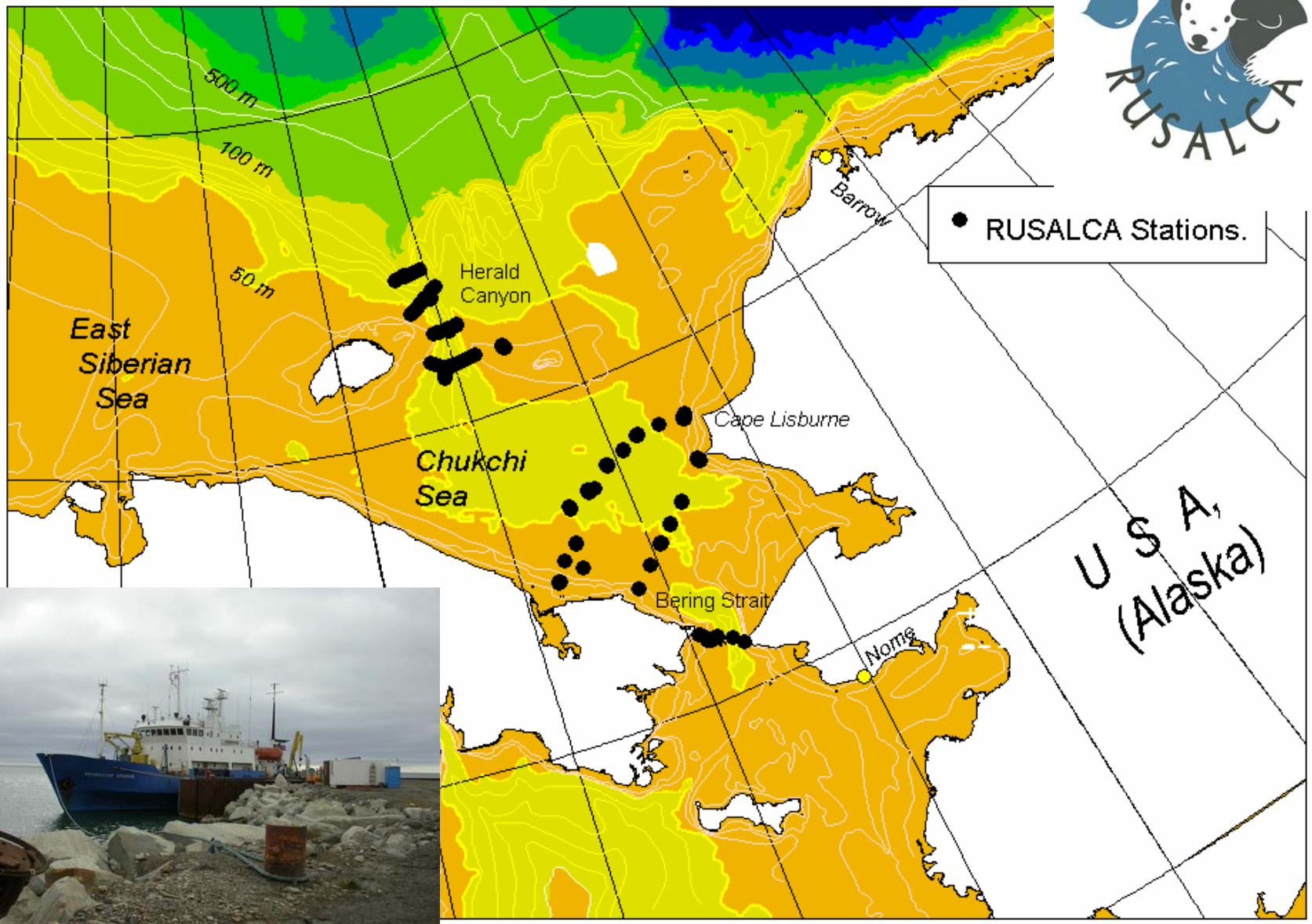
2004 Khromov expedition Bering-Chukchi Seas

- Census of Marine Life and exploration of the Chukchi Sea
- Monitoring current fluxes through the Bering Strait and Herald Canyon
- Methane exploration

2005, 2008 retrieval of mooring data

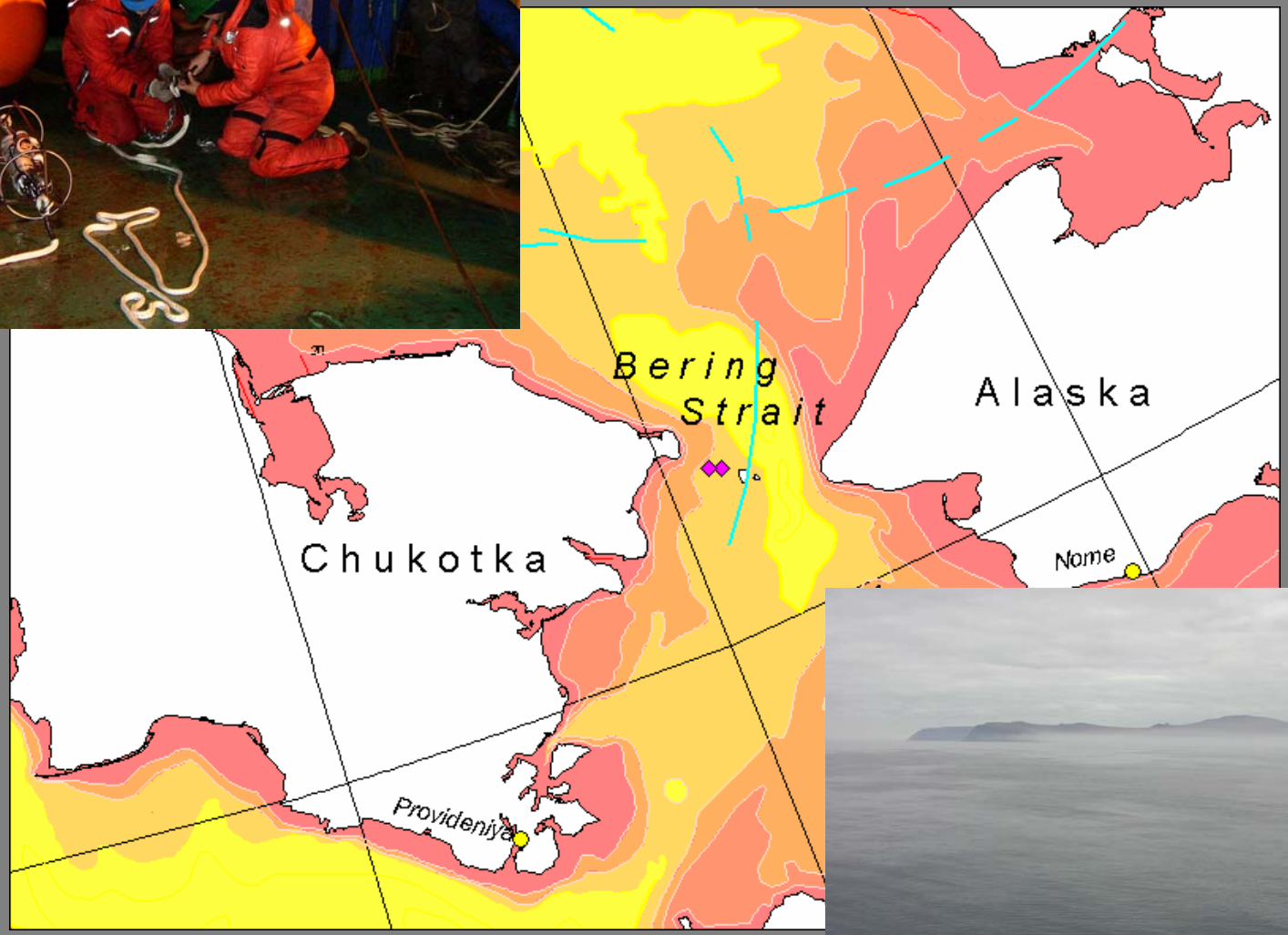
2009 Large scale expedition

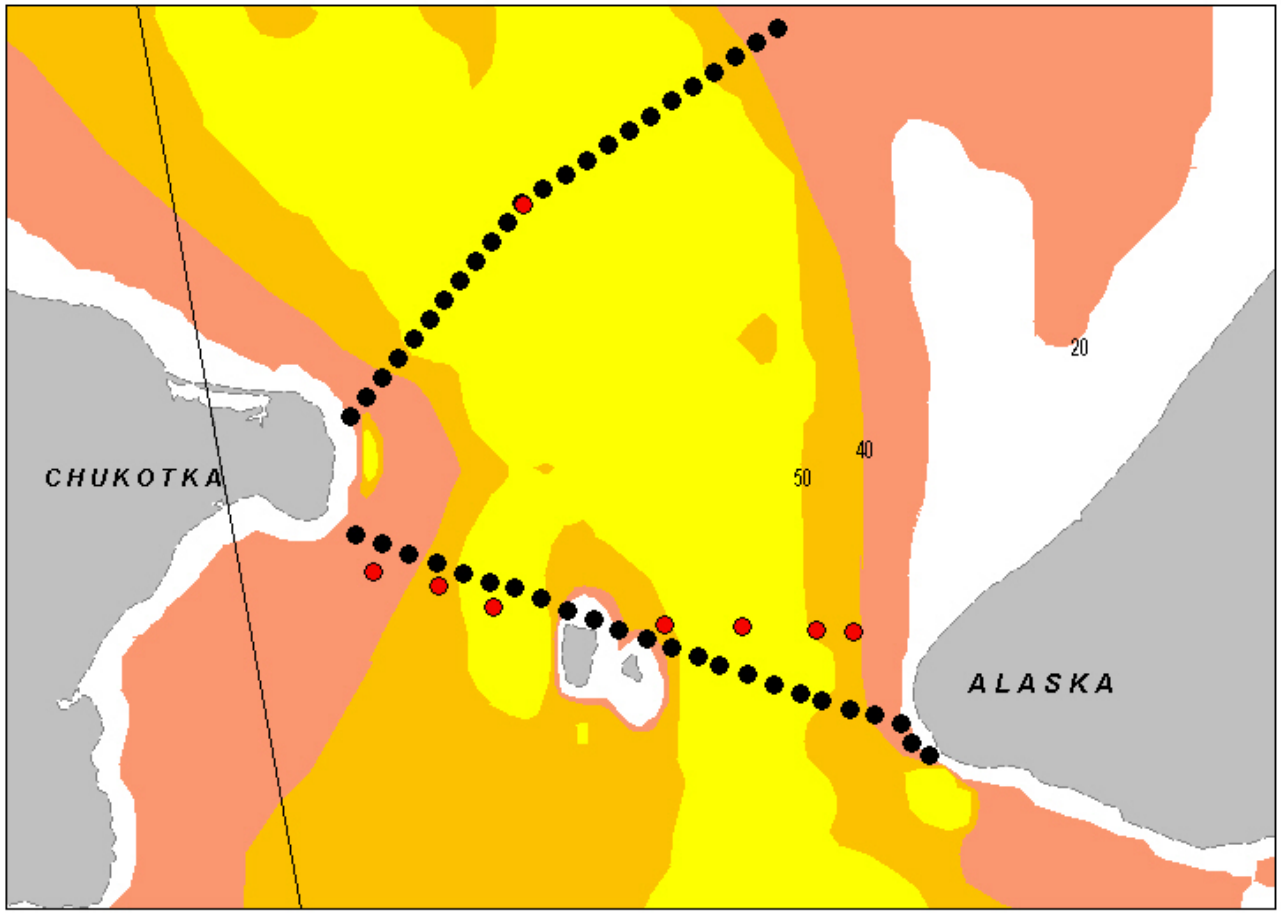

Arctic Ocean
Chukchi Sea
Barrow
U. S. A.
Nome
RUSSIA
Provideniya
Gulf Of Alaska
Bering Sea
RUSALCA 2004
Piips Volcano
Leg 1



Actual RUSALCA Stations, 2004

RUSSIAN-AMERICAN MOORING LOCATIONS



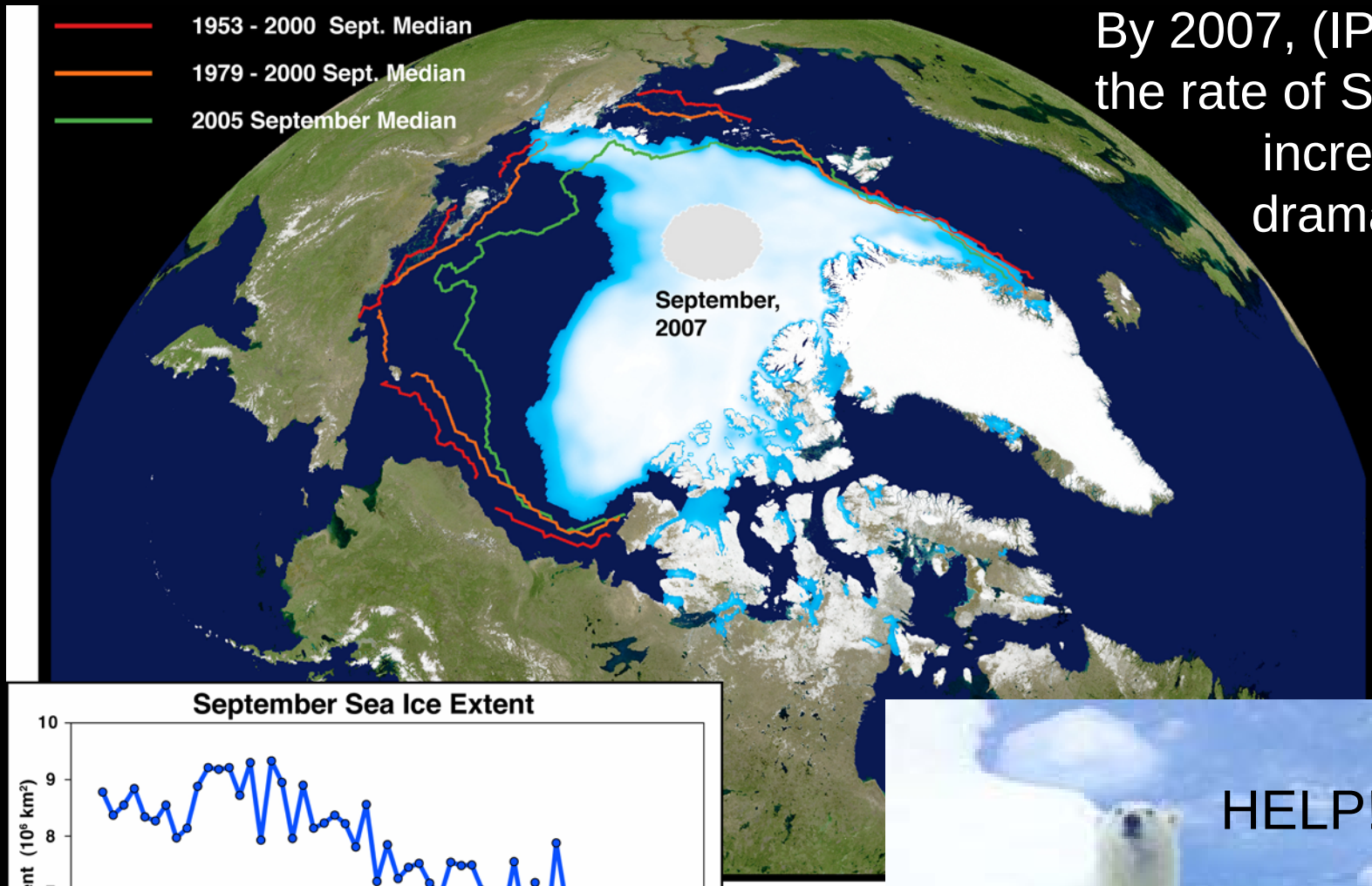


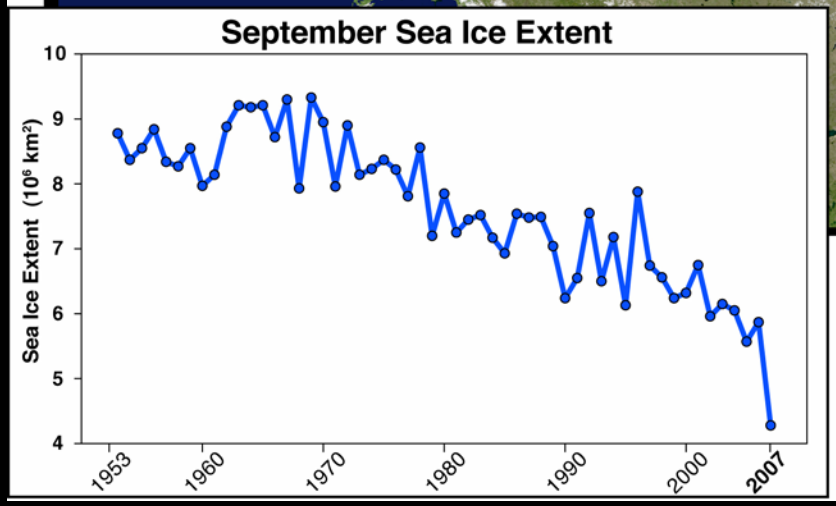
RUSALCA STATIONS, BERING STRAIT

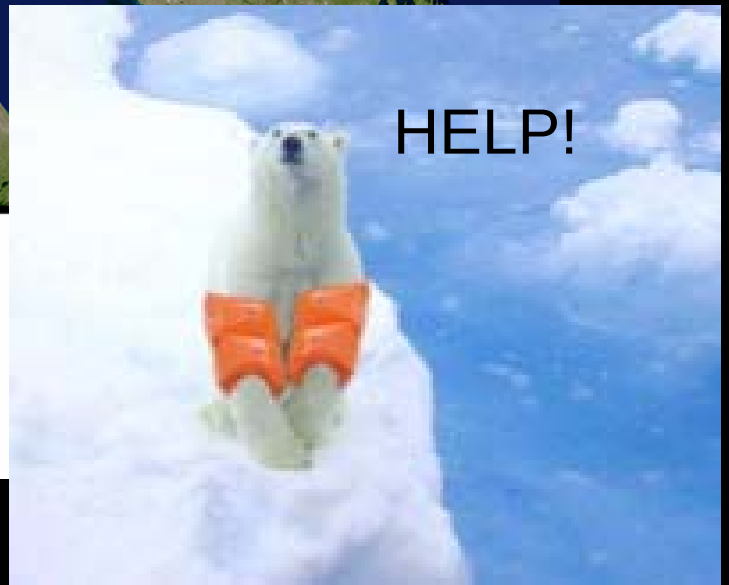
PROPOSED MOORING LOCATIONS

RUSALCA Mooring Locations 2007-2008

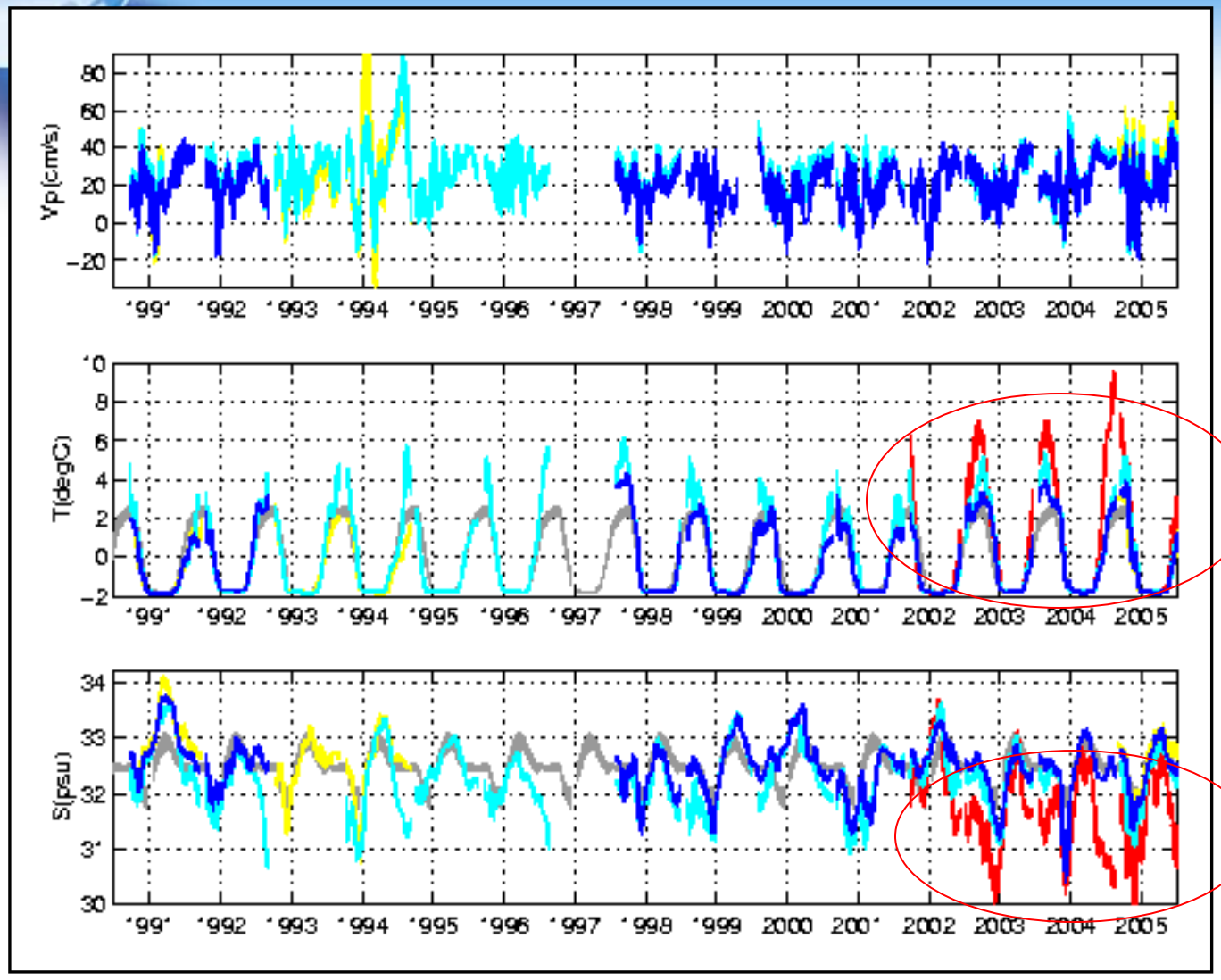
By 2007, (IPY)
the rate of Sea ice loss
increased
dramatically







Flow Through Bering Strait warmer and fresher

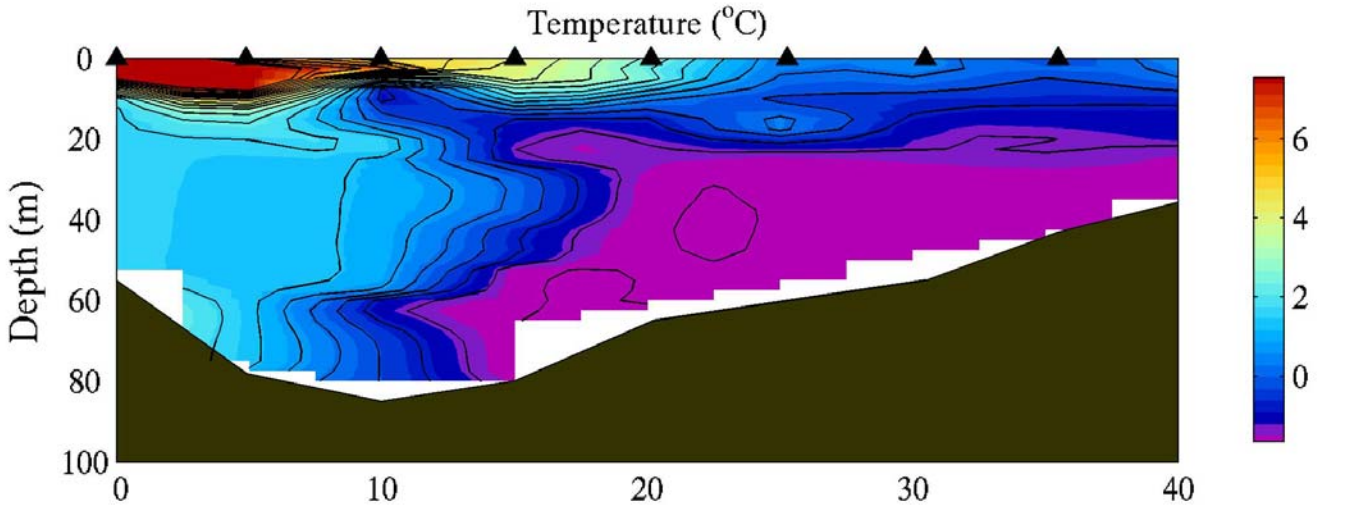


Temperature Is Rising

Salinity Is Falling

From Rebecca Woodgate - UW/APL

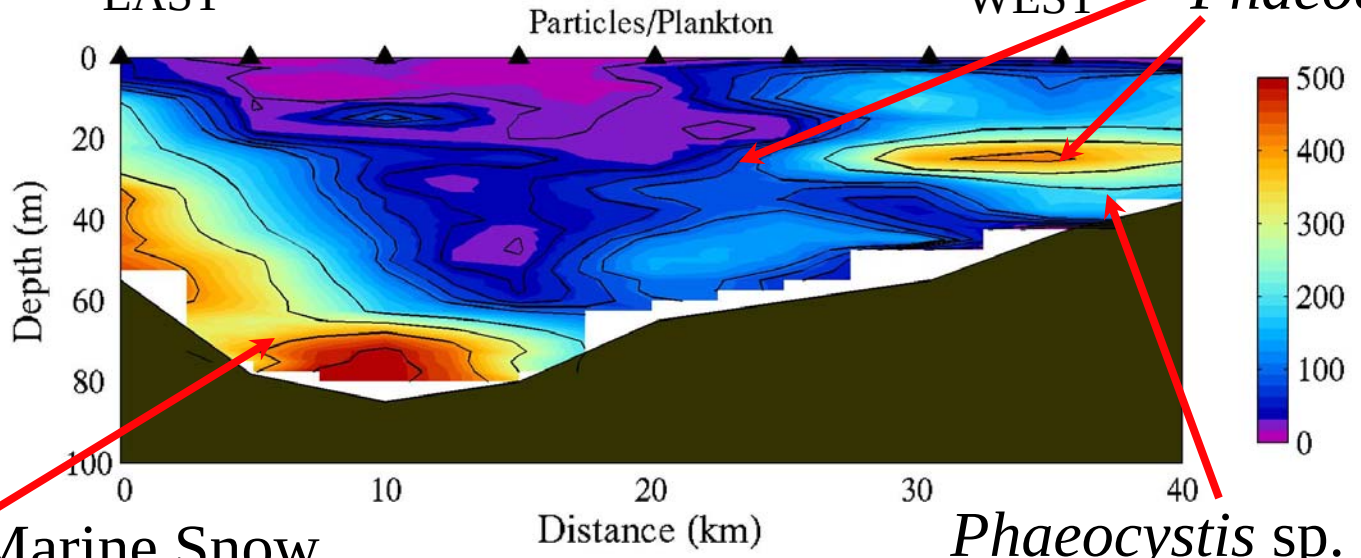
Observations of Marine Particles and Plankton : Chukchi Sea



EAST

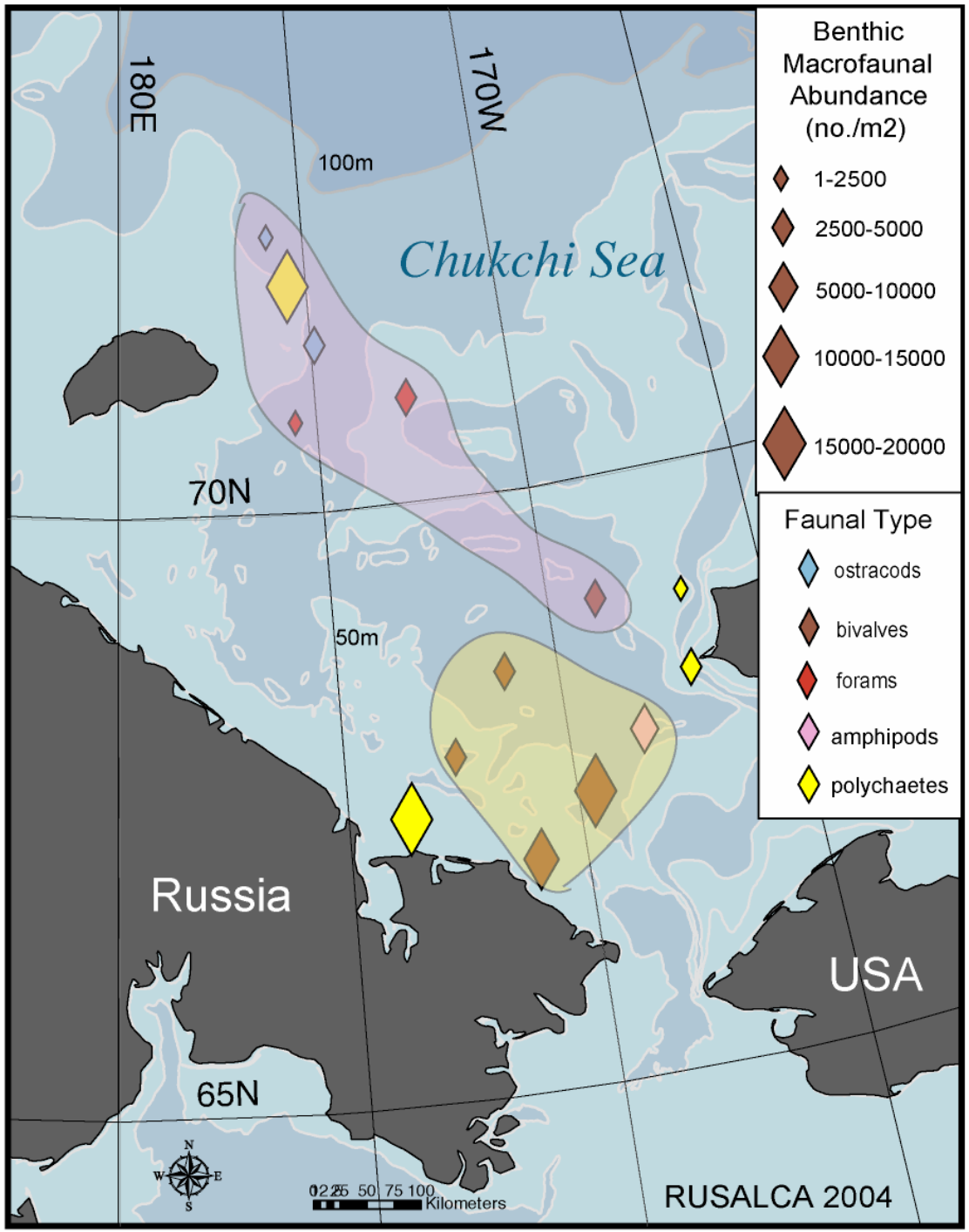
WEST

Phaeocystis sp.



Marine Snow

Phaeocystis sp. marine snow



Observations of Benthic Structure

two major cluster groups at 57% similarity level

yellow: "hot spot" in southern Chukchi Sea, high abundance level of bivalves and amphipods

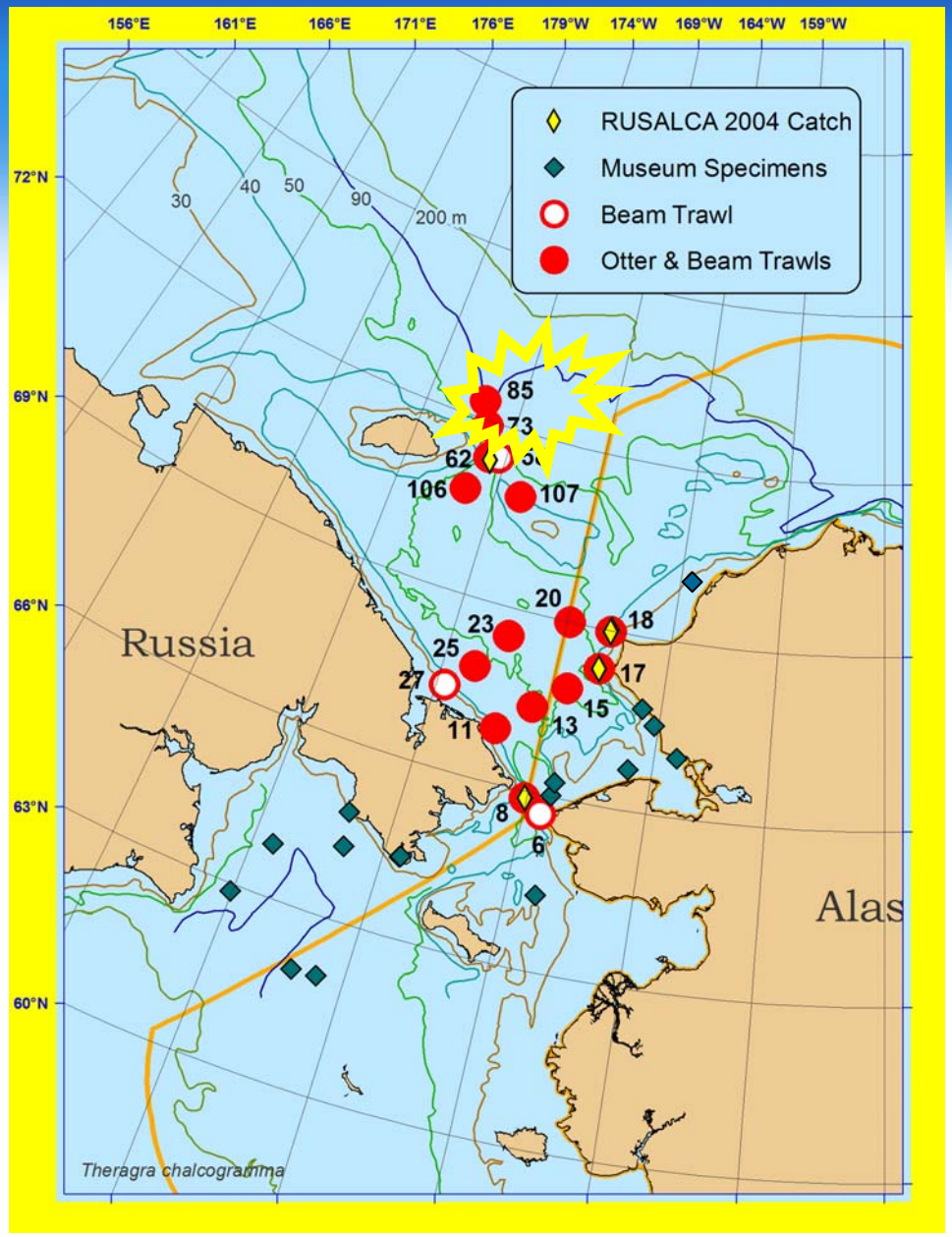
purple: downstream Herald Valley group, dominated by polychaetes, bivalves, forams and ostracods

Individual sites: in fast current regions along coastlines, dominated by suspension-feeding polychaetes

Impacts on Ecosystems

Fish Found Further North in the Arctic: Migrations from the Bering Sea?

Walleye Pollock
Theragra chalcogramma



From K. Mecklenburg

RUSALCA

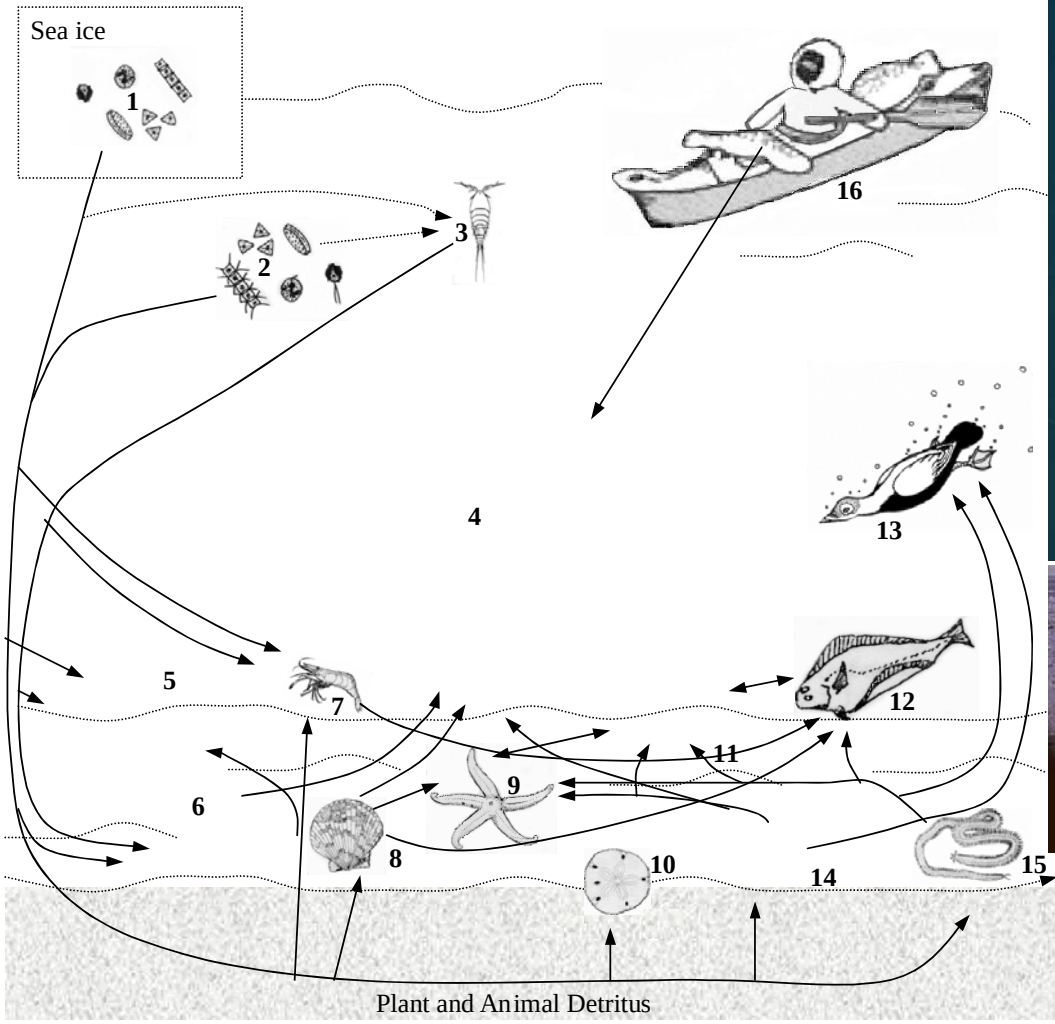


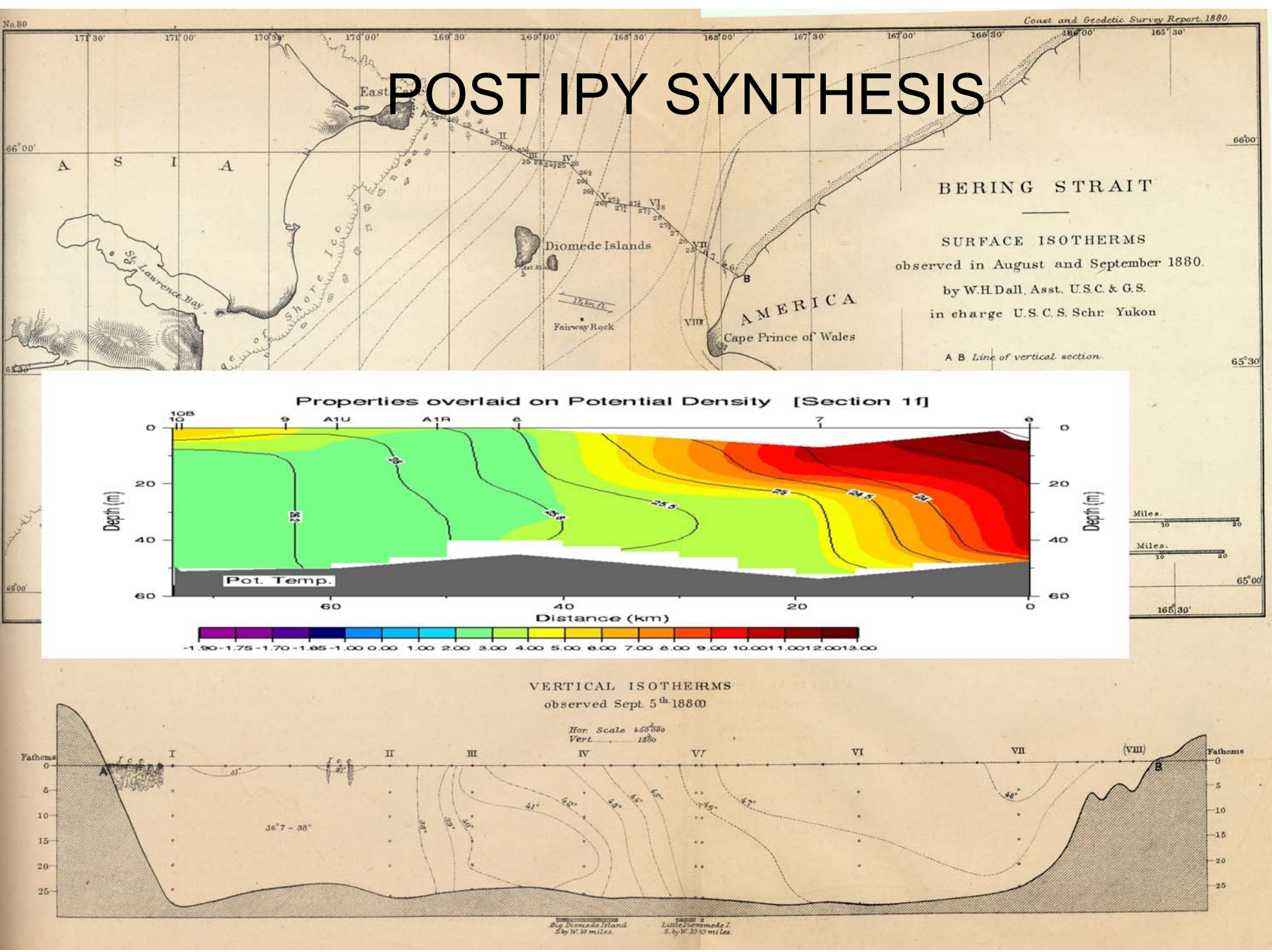
Figure 3. Representation of a simplified northern Bering/Chukchi Sea food web. The high density and abundance of benthic biota reflects the large proportion of phytoplankton that falls directly to the seabed, ungrazed by pelagic organisms. The direct assimilation of phytoplankton by the benthos results in shorter food chains and a more efficient transfer of carbon to large marine mammals and diving seabirds.

Organisms are: 1: ice algae; 2: phytoplankton; 3: copepods; 4: walrus; 5: basket stars; 6: ascidians; 7: shrimps; 8: filter-feeding bivalves; 9: sea stars; 10: sand dollars; 11: crabs; 12: bottom feeding fishes; 13: diving seabirds; 14: deposit feeding bivalves; 15: polychaetes, 16: native subsistence hunters.

The first four years of RUSALCA shows the Importance of long-term observations of the ecosystem.

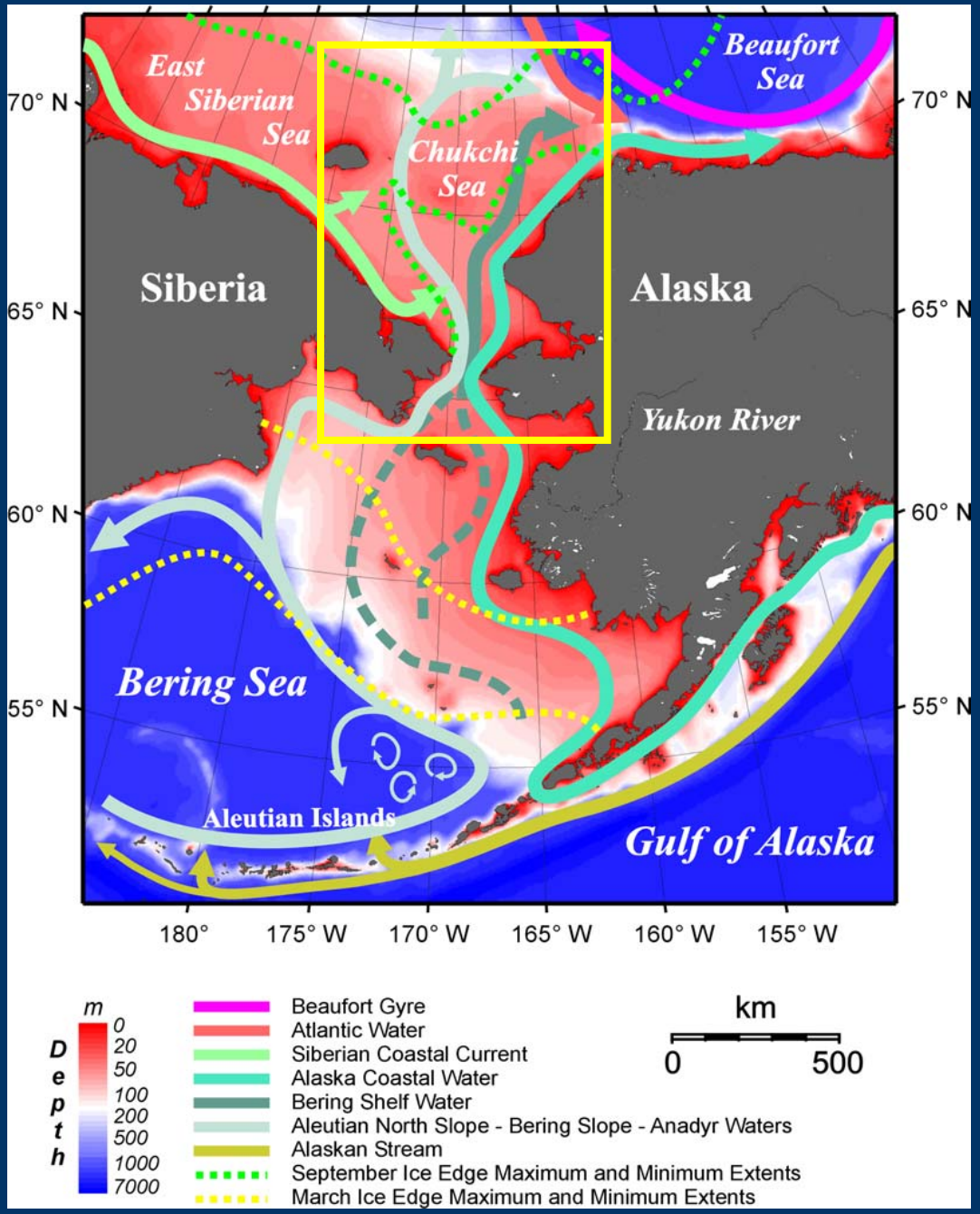
[Grebmeier and Dunton 2000]

POST IPY SYNTHESIS



Post IPY Studies

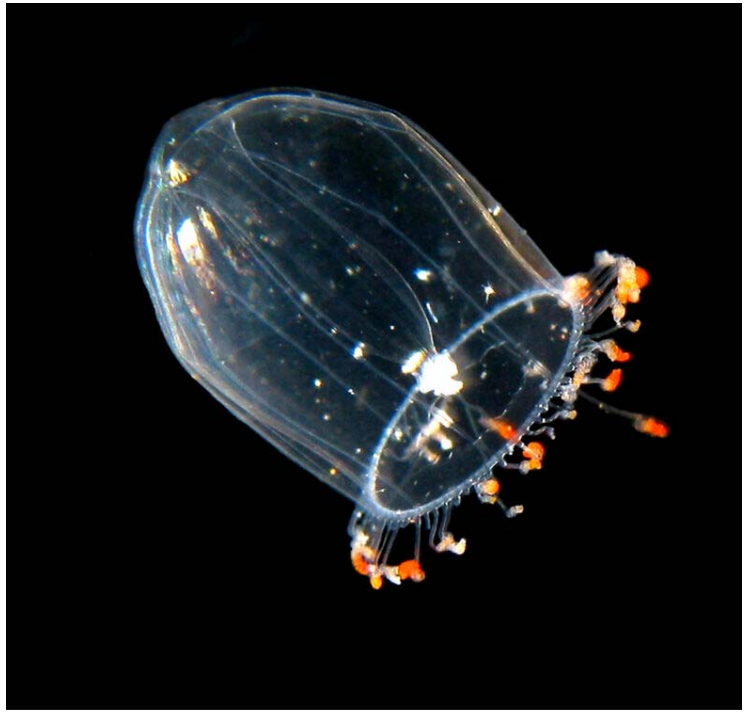
- Pacific Arctic Shelf Circulation & Ecology
  - Improve knowledge of circulation between Bering Sea and the Arctic Basin
  - Improve knowledge of water mass type and ecological processes
  - Improve knowledge of propagation of ecological signatures through Bering-Chukchi ecosystems within the context of climate change



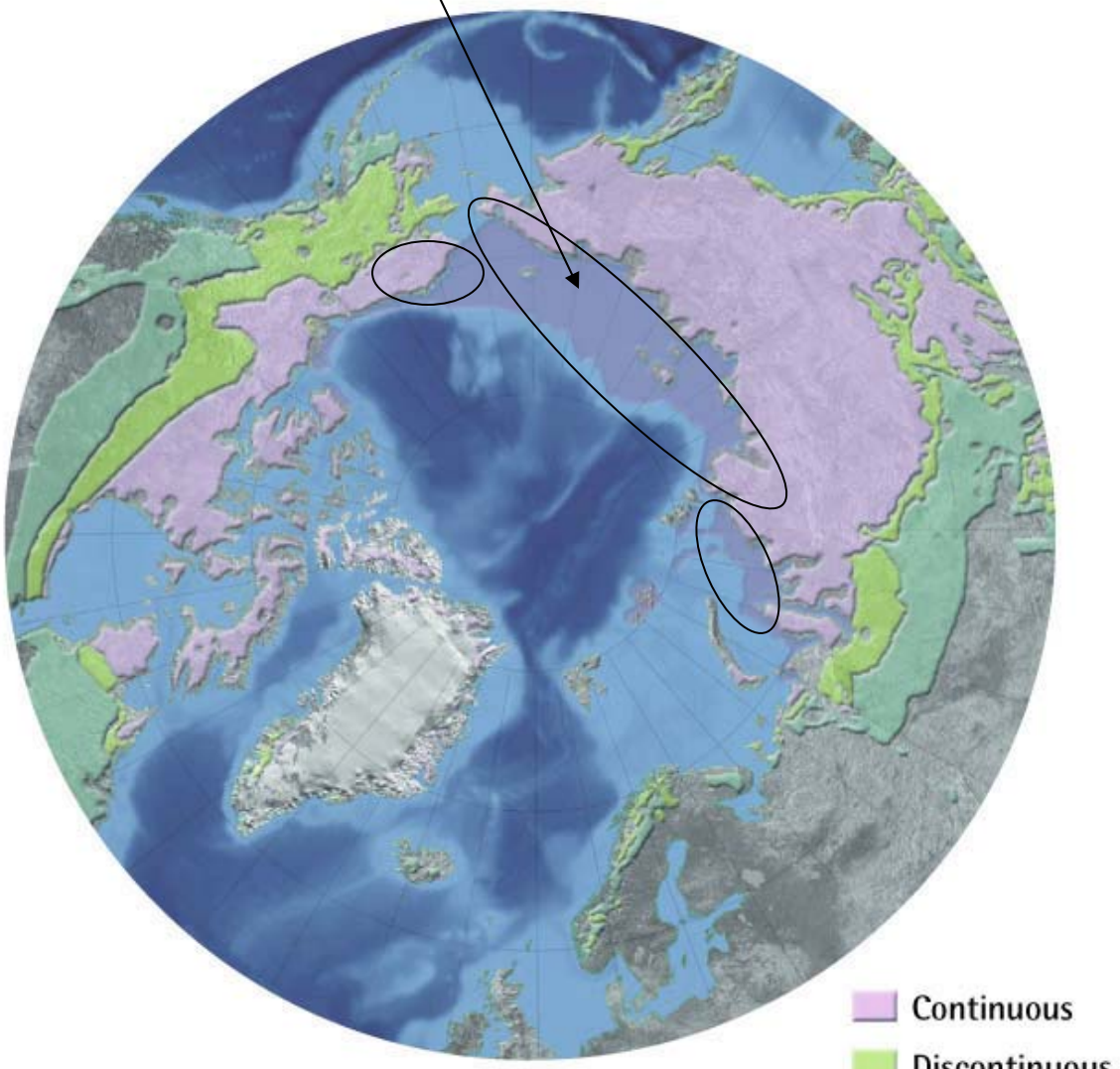
[Courtesy: T. Weingartner & S. Danielson, UAF]

Post International Polar Year: *Exploration*

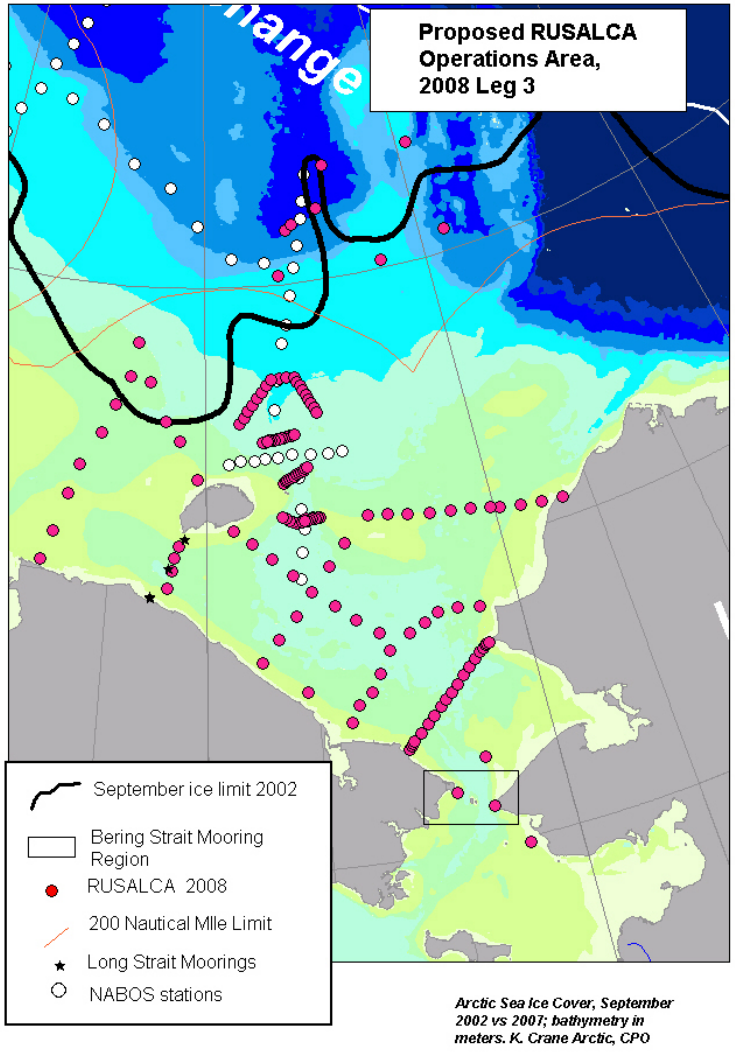
RUSALCA: Exploration of Marine Life in the Pacific-Arctic: What lives in this part of the Arctic Ocean?



Post IPY Goal:
Monitoring the State of Sub-sea Permafrost



PRIORITY 2009, RUSALCA:Climate Obs in the Pacific-Arctic

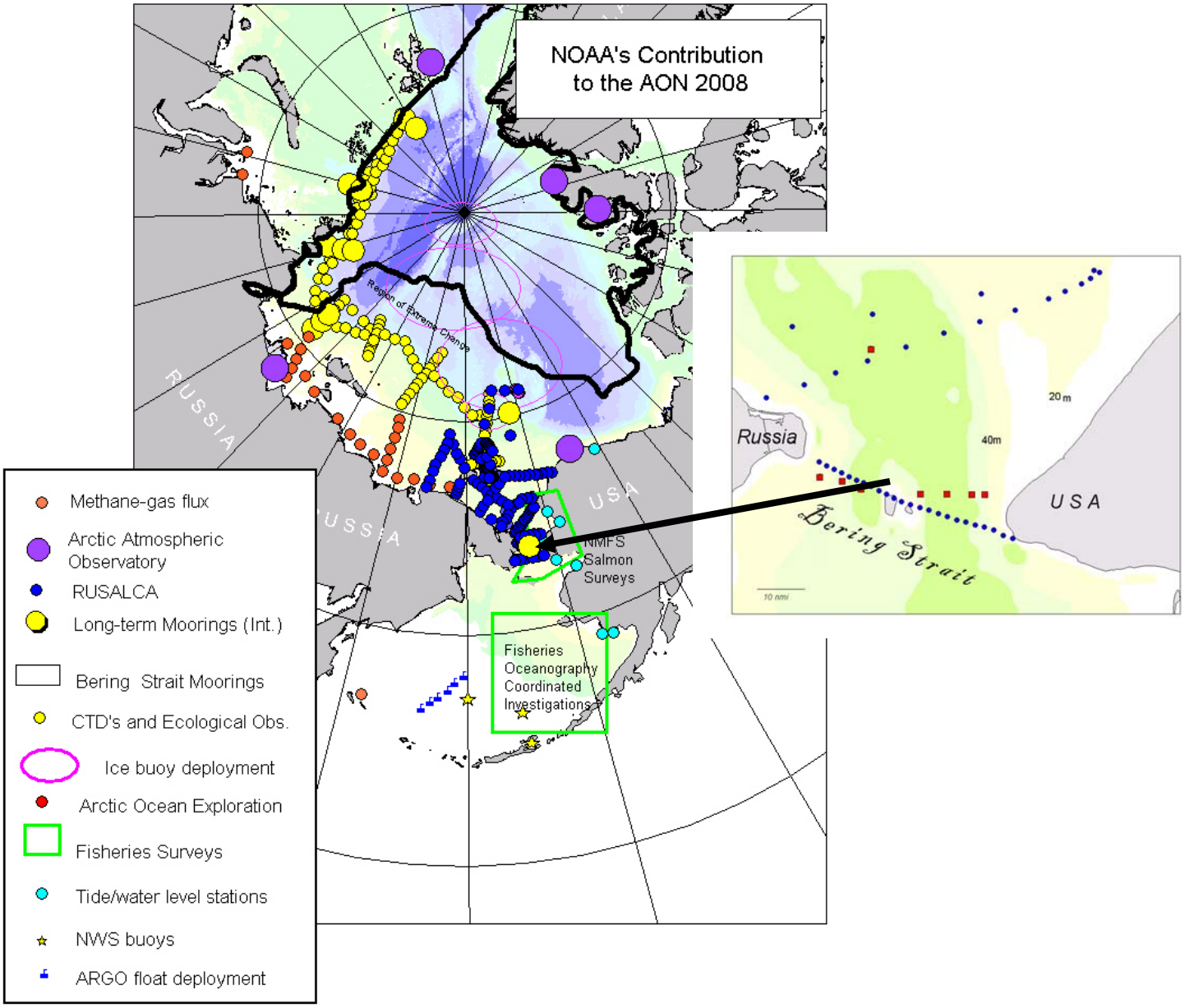


Arctic Sea Ice Cover, September 2002 vs 2007; bathymetry in meters. K. Crane Arctic, CPO

FY2009: RUSALCA will revisit the Chukchi Sea and regions within the region of extreme sea ice loss to:

- Document changes in the oceanography and ecosystems
- Provide observations to provide boundary conditions for improving the integration of ecosystem and physical models.

Proposed 2008 Observations



PRODUCT: Yearly State of the Arctic Report

Many More Products to Come

Thank You!