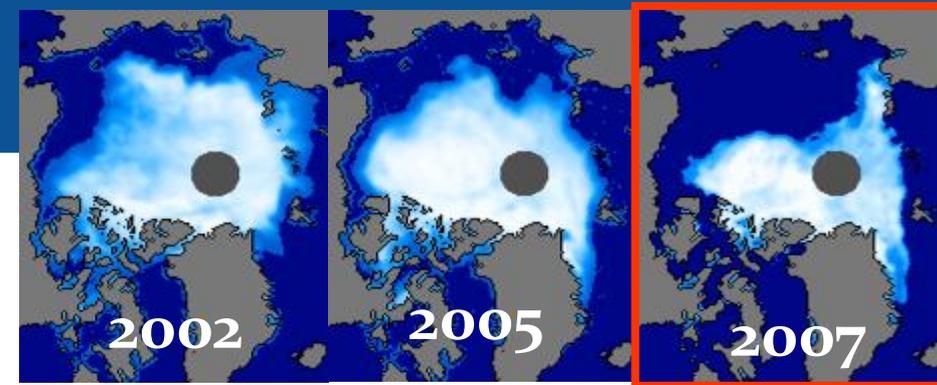


# The Arctic Research Program: International Ecosystem Activities



Kathleen Crane, NOAA  
Arctic Research Program/COD/CPO



# Arctic Research Program- Ocean-Ecosystem Observations

## GOALS: 2004-2014

- To understand the causes and consequences of climate change in the Arctic.
- To capture the transition of the Arctic from an ice covered ocean to an ocean where ice may disappear in the summer.
- To facilitate and deploy Arctic system-wide observing tools to track Pan-Arctic ice-ocean-ecosystem changes and impacts (3 main programs)
  - **RUSALCA,**
  - **CBMP,**
  - **PAG**



### U. S. Strategic Partners:

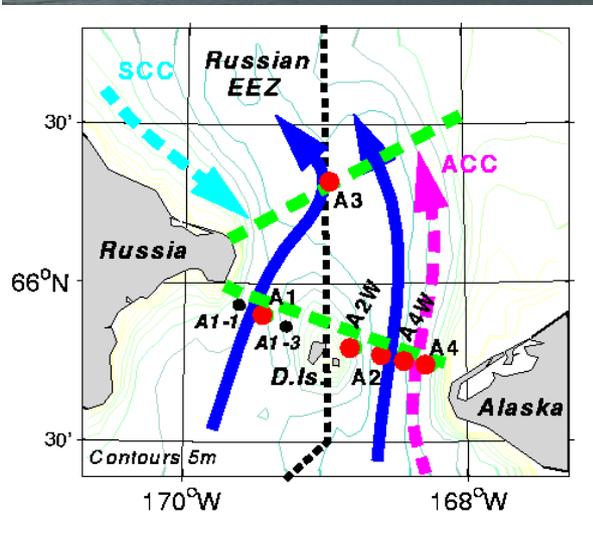
**OAR** OER, ESRL, PMEL, GLERL, AOML, GFDL  
**NOAA Lines** NMFS-AFSC, NESDIS-NIC, NOS-AOOS  
**Interagency** NSF, ONR, FWS, BOEM, NASA, USGS  
**US Academia** UAF, WHOI, UW, UMD, OSU, Cis

**International Strategic Partners:** Arctic Council countries, China, Korea, Japan

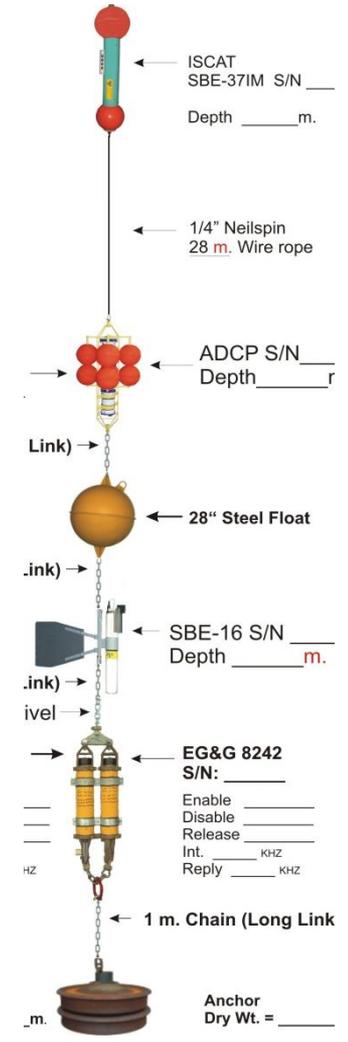
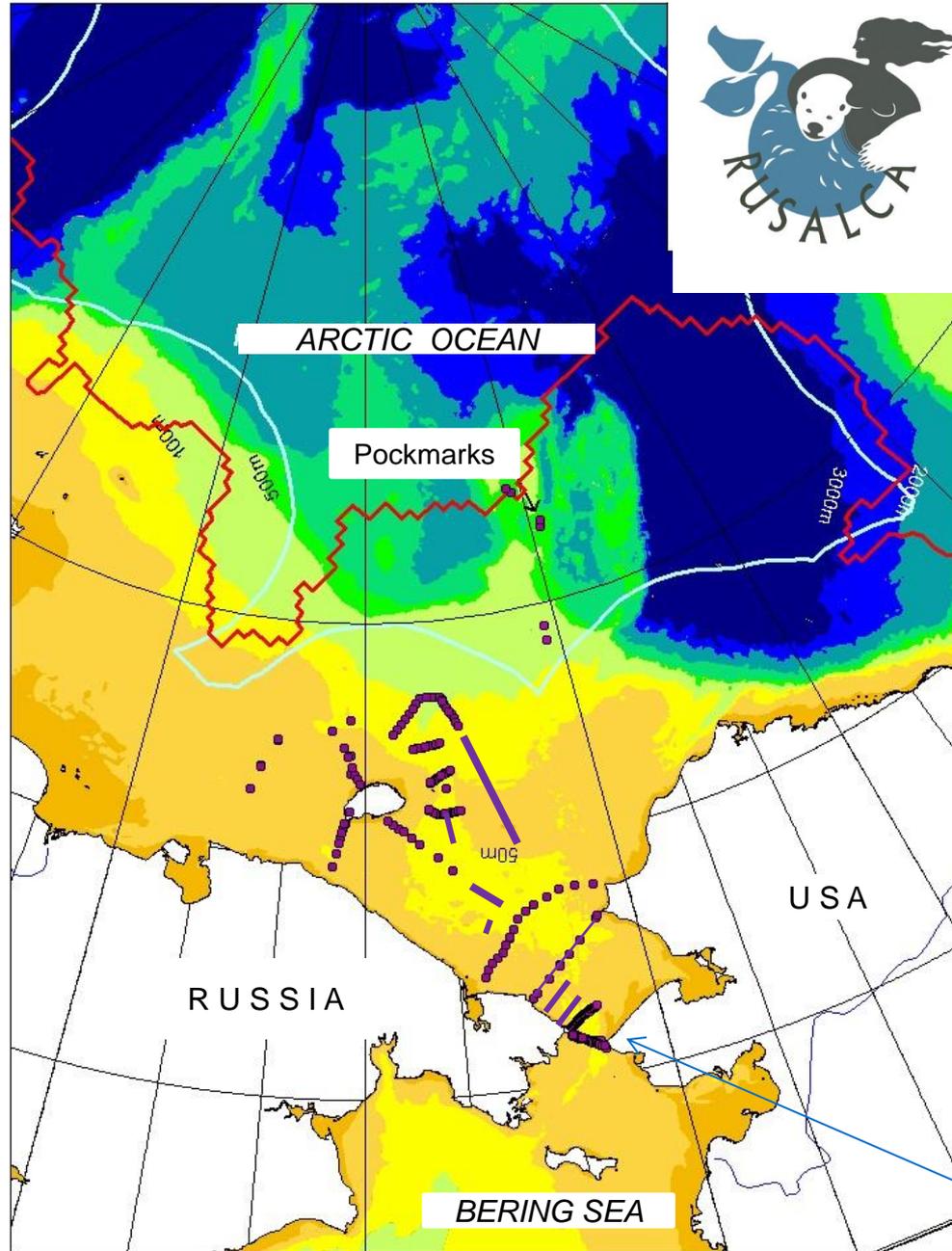
# RUSALCA 1<sup>ST</sup> DECADE



- Monitor fresh water, heat, nutrient fluxes through the Bering Strait
- Monitor ecosystem indicators of climate change in the Chukchi Sea and Pacific Arctic region
- Model and forecast changes in ecosystems and Arctic wide physical systems



# RUSALCA STATIONS 2004-2014



Oceanic fluxes of volume and heat through the Bering Strait increased by ~50% between 2001 and 2011

Bering Strait

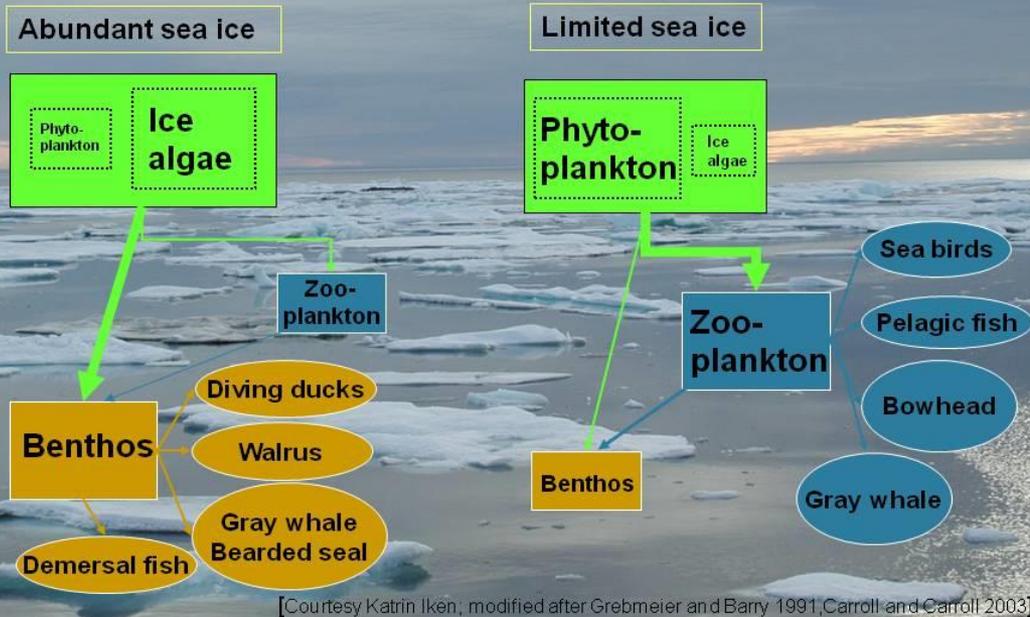
# LOSS OF SEA ICE AND ECOSYSTEM CHANGES (RUSALCA) REPEAT, AND MULTIDISCIPLINARY OBSERVATIONS



## Linking Ice Cover to Ecosystem Structure the 'Conceptual Model'

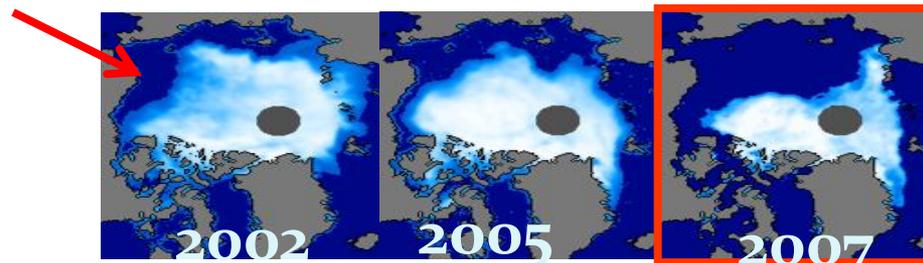
Past

Future? More Storms



1. Ocean Acidification,
2. Benthic and Epibenthic Census and Processes,
3. Census of Zooplankton
4. Biodiversity of Fish and Assessment
5. Nutrients and Productivity
6. Physical and Chemical Oceanography (Bering Strait Fluxes)
7. Paleo-oceanography, geology and seafloor-ocean fluxes
8. Seafloor permafrost stability
9. Methane
10. Census of Marine Mammals

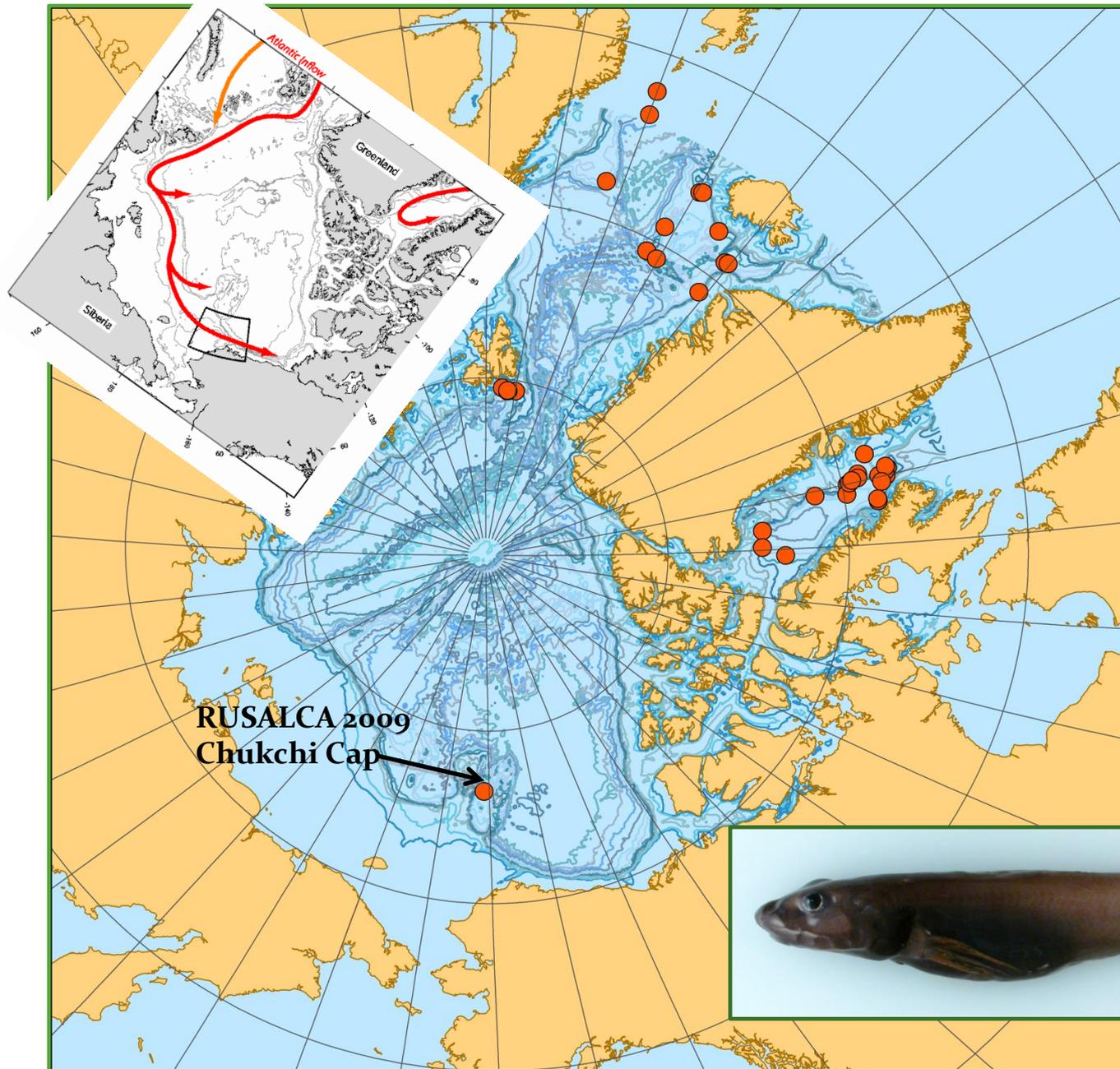
**Heat From the Bering Strait Triggers Sea Ice Loss**



# TRACKING MIGRATIONS FROM THE ATLANTIC

*Lycodes adolfi*  
Adolf's Eelpout

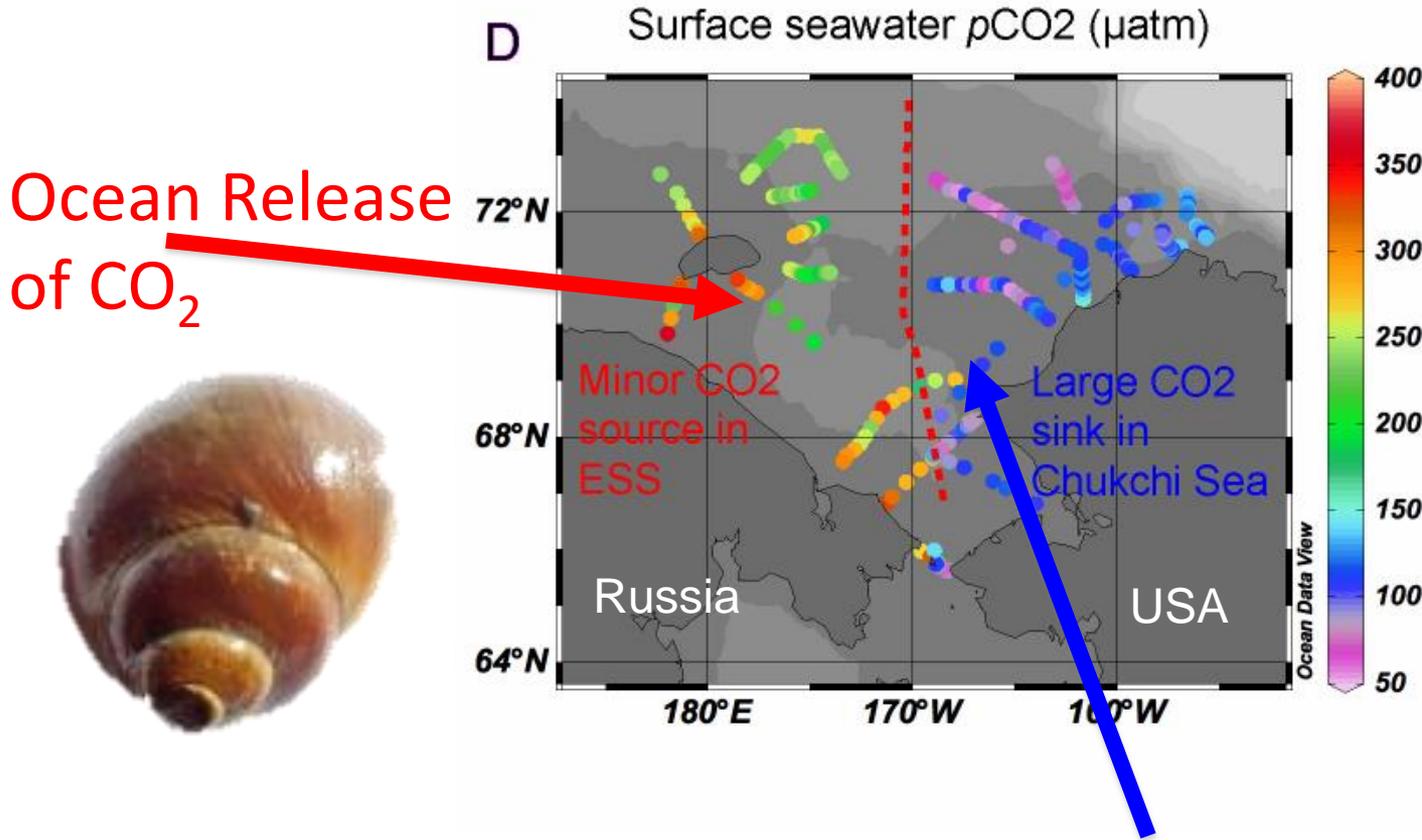
Nielsen & Fosså 1993



Found north of Spitsbergen on east side of Yermak Plateau in 2007–2009 (Byrkjedal In press), indicating distribution probably extends eastward along the upper slope of Nansen Basin (and thence to the Pacific-Arctic, where we caught it)



# LOSS OF SEA ICE IMPACTS ON ARCTIC OCEAN ACIDIFICATION RUSALCA



N. Bates, 2011

large ocean uptake of CO<sub>2</sub> in area of low seawater pCO<sub>2</sub>

# RUSALCA CONTRIBUTES TO THE CIRCUMPOLAR MARINE BIODIVERSITY MONITORING PROGRAM OF CAFF

Arctic Council effort uses existing member nation monitoring sites:

U.S. sites are coincident with the *Distributed Biological Observatory* and *RUSALCA* stations.



Arctic Biodiversity Portal  
Monitoring

Home Monitoring Assessments Strategies Policy Data Expert Groups Publications Program view

- > The CBMP
- > About the CBMP
- > Program areas
  - > Marine Ecosystem
  - > Freshwater Ecosystem
  - > Terrestrial Ecosystem
  - > Coastal Ecosystem
  - > Community based monitoring
- > Protected Areas
- > Indices and Indicators
- > Projects
- > e-CBMP Newsletter
- > Contact us

« October 2011 »

Su	Mo	Tu	We	Th	Fr	Sa
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

### Circumpolar Biodiversity Monitoring Programme - CBMP

The Circumpolar Biodiversity Monitoring Program (CBMP) is an international network of scientists, government agencies, Indigenous organizations and conservation groups working together to harmonize and integrate efforts to monitor the Arctic's living resources.

Our goal is to facilitate more rapid detection, communication, and response with respect to the significant biodiversity-related trends and pressures affecting the circumpolar world. The CBMP is the cornerstone program of the Arctic Council's Conservation of Arctic Flora and Fauna (CAFF) Working Group. The CBMP has been endorsed by the Arctic Council and is the biodiversity component of the Sustaining Arctic Observing Networks (SAON).

#### Events

No events

#### Greenland Quest Documentary

The documentary of the record-breaking Greenland Quest expedition is now showcasing on Emirates Airline inflight TV, prior to it's planned broadcast on National Geographic Channel next month.

#### CBMP Latest Publications

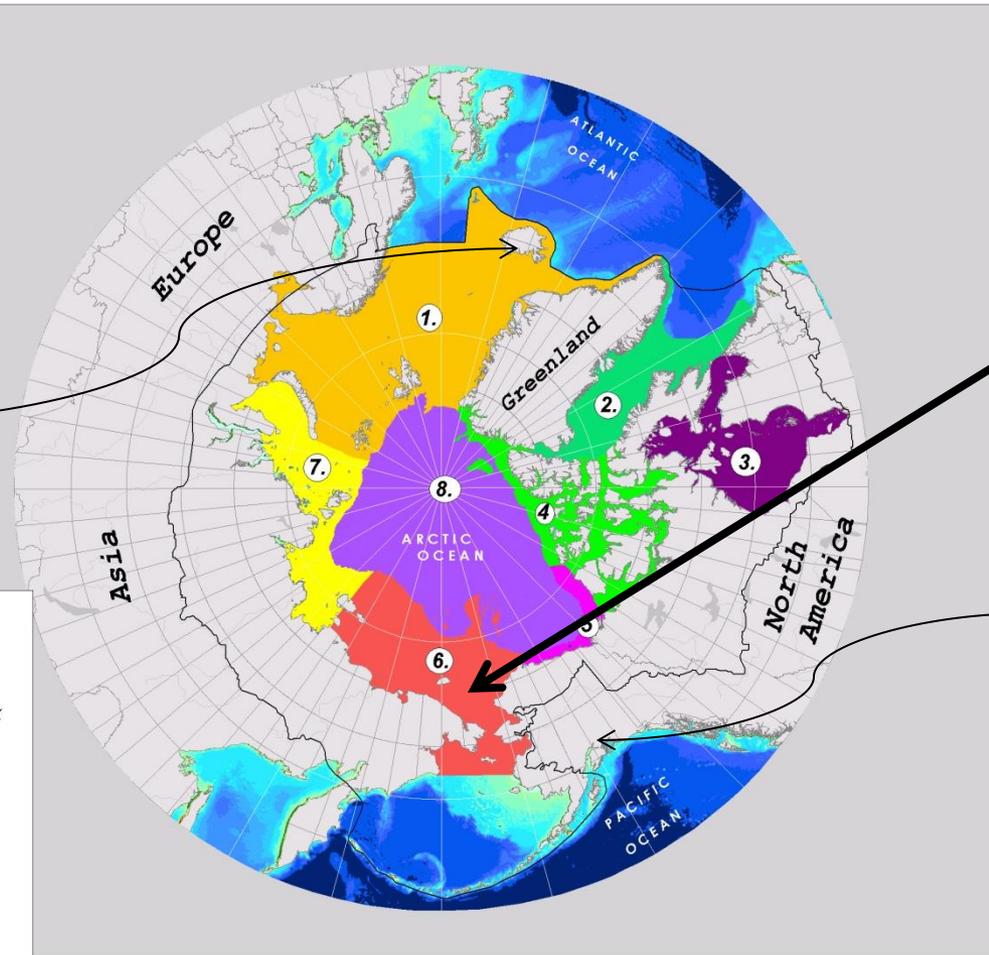
- Marine Monitoring Plan
- Polar Bear Discussion
- Arctic Biodiversity Trends 2010

Borgir, Nordurslod - 600 Akureyri - Iceland  
email: caff@caff.is - Tel: +354 462 3350

# ARCTIC COUNCIL'S CAFF WORKING GROUP'S ARCTIC MARINE AREAS

**CBMP  
PAN-ARCTIC  
DATA NODE-  
ICELAND**

1. Atlantic Arctic
2. Davis-Baffin
3. Hudson Complex
4. Arctic Archipelago
5. Beaufort
6. Pacific-Arctic
7. Kara-Laptev
8. Arctic Basin

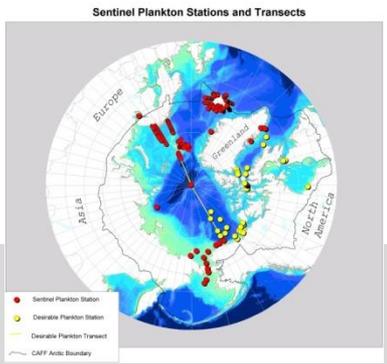
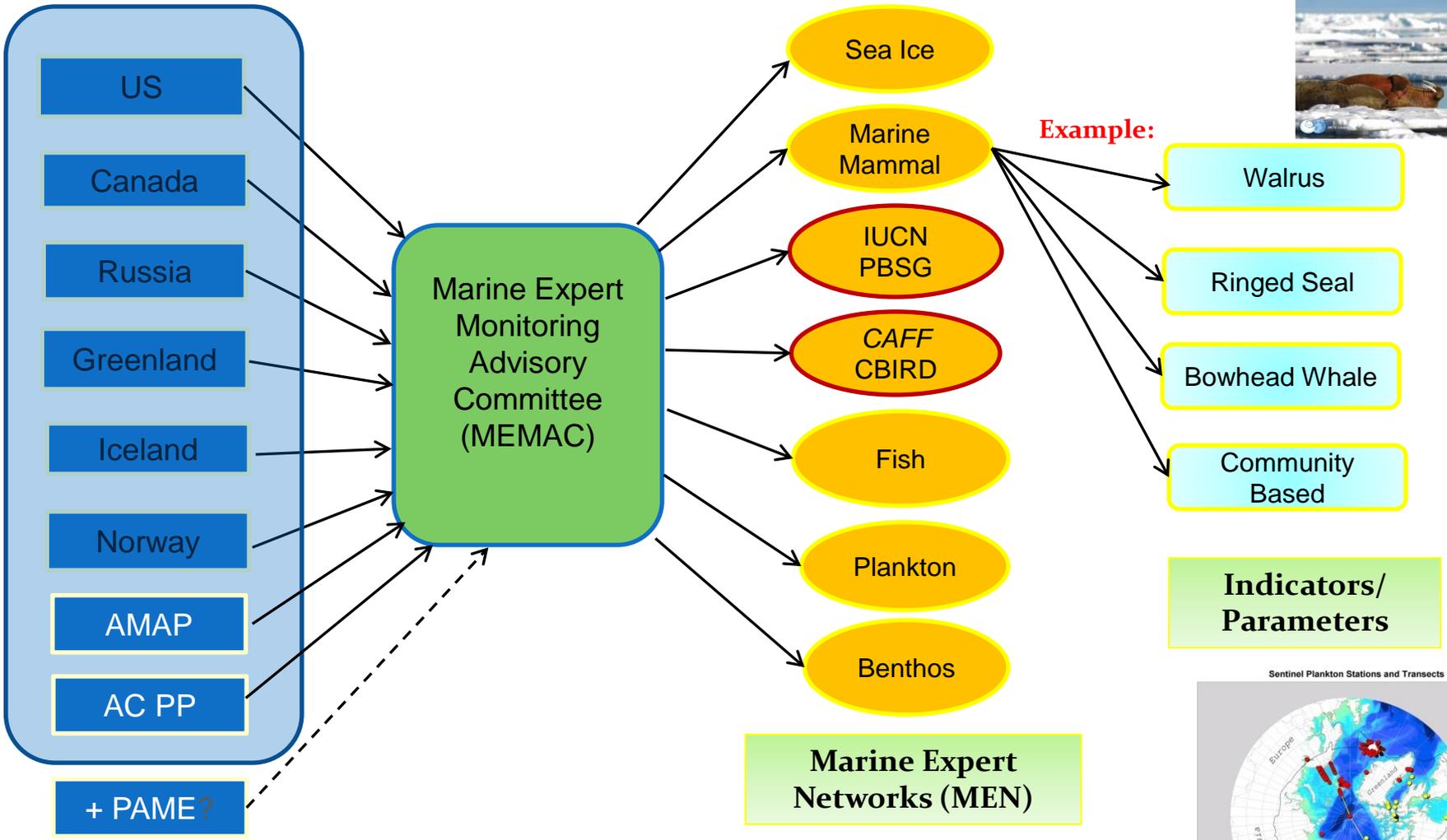


**PACIFIC ARCTIC  
REGION**

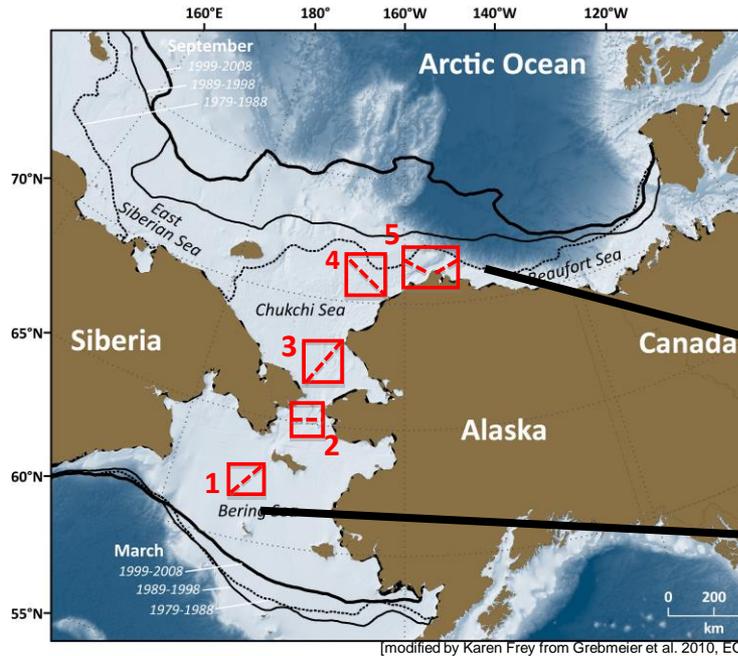
**PACIFIC ARCTIC  
DATA NODE-  
AOS**



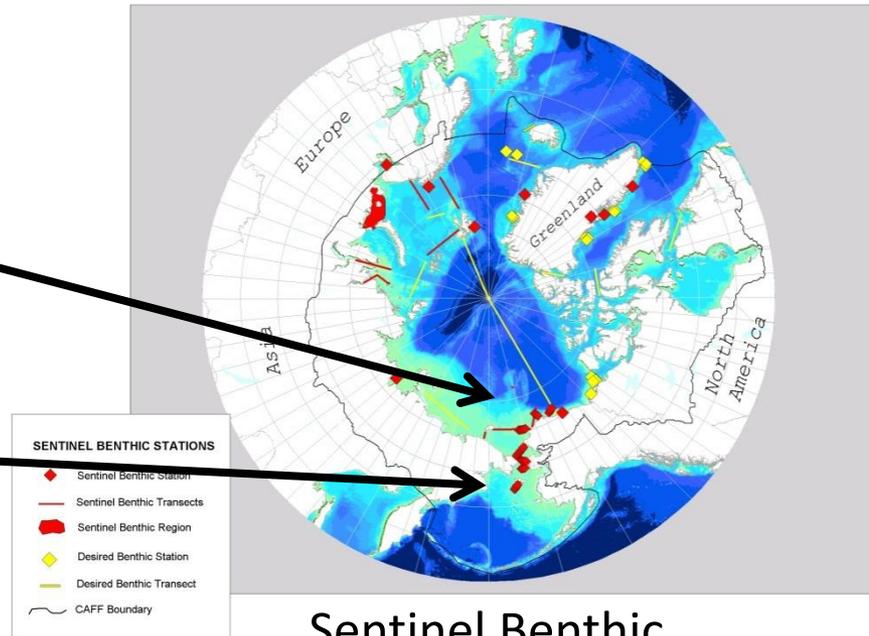
# The ARCTIC COUNCIL's Arctic Marine Biodiversity Monitoring Plan



# NOAA's ROLE IN MONITORING THE PACIFIC ARCTIC FOR CBMP.



Sentinel Benthic Regions, Stations and Transects



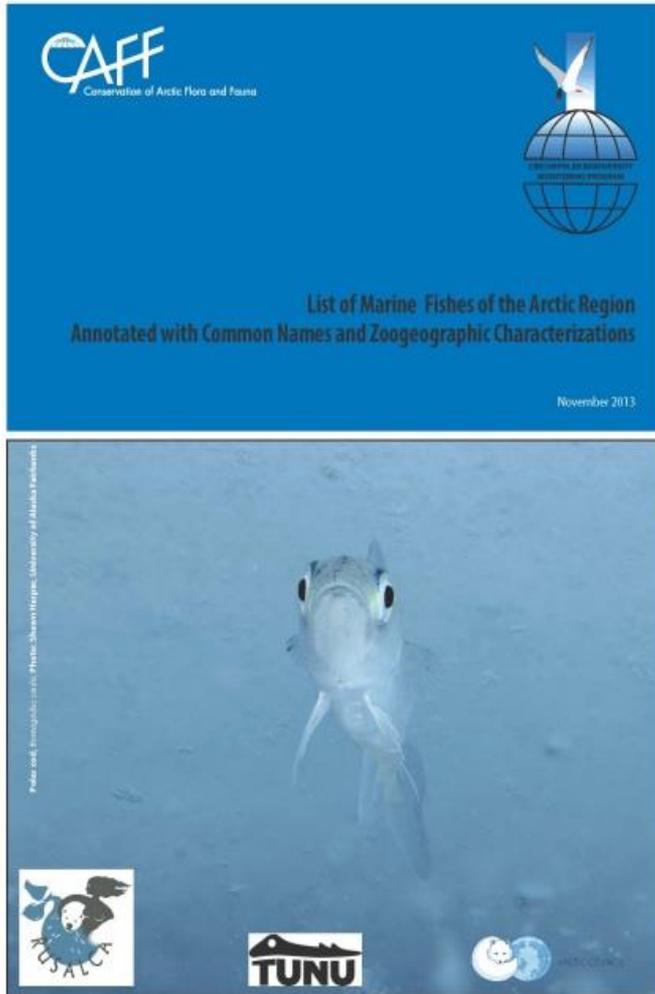
The Distributed Biological Observatory  
 Linking Physics and Biology under  
 conditions of sea ice loss.

Sentinel Benthic  
 Stations (Arctic Council)

Increase ability to monitor and assess environmental  
 conditions under changing climate scenarios through  
 new collaborations and partnerships

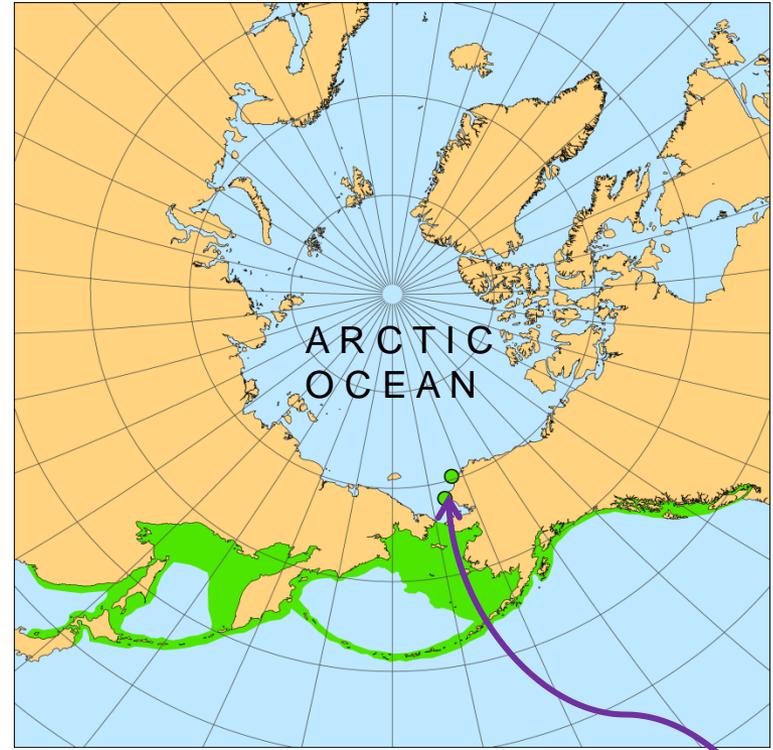


*Baseline map of Arctic-Polar Cod. Changes in habitats of Arctic and Boreal species will be tracked relative to these boundaries. CBMP Fish Expert Network*





*Hemilepidotus jordani* (Yellow Irish Lord), a boreal species moving to the Bering Strait in 2006.



*Myoxocephalus polyacanthocephalus* (Great Sculpin) has been moving northwards into the Eastern Chukchi Sea Sampled during RUSALCA

**KEEP MONITORING THE MIGRATIONS OF BOREAL SPECIES**

# Arctic Marine Biodiversity Monitoring Plan USA, 2013 Implementation



The **Arctic Marine Biodiversity Monitoring Plan** (CBMP-Marine Plan) is the first of four pan-Arctic, long-term, integrated biodiversity monitoring plans produced by the Conservation of Arctic Flora and Fauna (CAFF)'s Circumpolar Biodiversity Monitoring Program. Approved by the Arctic Council in 2011, the Marine Plan integrates existing circumpolar monitoring datasets and models to improve the detection and understanding of changes in Arctic marine biodiversity, and informs policy and management responses to these changes.

Development of the plan was co-led by Norway and the United States and was the result of extensive discussions and consultations involving experts from Arctic coastal nations, Permanent Participants and other Arctic Council working groups. The plan identifies eight Arctic Marine Areas (AMAs) and Focal Ecosystem Components (FECs) to monitor at various trophic levels using specific methodologies, parameters, indicators and sampling designs drawn from existing monitoring capacity (programs), best practices and data.

The CBMP-Marine Plan is designed to provide comprehensive and timely circumpolar information on Arctic marine biodiversity to decision makers. Its implementation is currently co-led by Greenland and Norway.



Sampling benthic ecosystem in the Chukchi Sea during a RUSALCA Expedition. Photo: Bodil Bluhm

## Top CBMP Marine Priorities in 2013

- Continue collecting, discovering, rescuing, aggregating and integrating existing Arctic marine biodiversity datasets to establish baselines; and contribute to the [Arctic Biodiversity Data Service \(ABDS\)](#)
- Continue to identify and begin reporting on the best indicators of change building on existing monitoring and observation programs
- Continue to explore ways to utilize Traditional Ecological Knowledge
- Encourage participating states to follow up on the CBMP Marine plan by contributing to the monitoring of the plan's focal ecosystem components, indicators, and the analyzing of existing datasets
- Continue to contribute to international and national initiatives, e.g., the annual NOAA Arctic Report Card, Convention on Biological Diversity, Global Biodiversity Outlook, Group on Earth Observations Biodiversity Observing Network, and others.
- Improve and stabilize funding for full participation by all Arctic Council coastal states and Permanent Participants
- Promote the relevance and importance of the CBMP-Marine Plan

## Links with National Priorities

The [United States Interagency Arctic Research Policy Committee \(IARPC\)](#) is charged with developing five-year plans for U.S. government funded research in the region.

For the years 2013-2017 The IARPC objectives that match those of the CBMP Marine Plan are:

- Sea ice and marine ecosystem studies
- Observing systems

The U.S.A. will pursue four activities that contribute to the CBMP Marine Plan. They are:

1. Develop a framework of observations and modeling to support forecasting of sea ice extent
2. Identify and study sites in the Beaufort and Chukchi Seas and the contiguous Arctic Ocean where climate feedbacks are active
3. Complete deployment of a Distributed Biological Observatory (DBO) in the U.S. and neighboring Arctic Ocean to create long-term data sets on biological physical and chemical variability and ecosystem response
4. Develop integrated ecosystem processes research in the Beaufort, Chukchi and East Siberian Seas as well as parts of the East Siberian and Pacific Arctic Ocean.

[www.caff.is/marine](http://www.caff.is/marine)

## Marine Expert Network Summary of 2013 Achievements

### Benthos

In 2013, field work has been carried out in the Chukchi Sea within the Distributed Biological Observatory (the CBMP sentinel stations in U.S. waters). The U.S. Benthic group is pursuing a joint US-Canada Trans-boundary program in the Beaufort Sea. Dr. Iken of the [Benthic Expert Network](#) contributed to the 2013 [Arctic Report Card](#) and will be a participant in the upcoming [RUSALCA](#) synthesis.

Contact: [Dr. Katrin Iken](#)

### Plankton

In 2013, the Plankton Expert Network consolidated zooplankton data, with data continuing to be consolidated. Maps of species locations were produced. Prediction probability modeling of zooplankton species in the Arctic was initiated. These data will be put into the [AQOS website](#) in preparation for transfer to the [ABDS](#). Meta-zooplankton species list, which is a legacy of CoML maps, are underway and the genetic library is growing. Parallel efforts are underway for the Pacific Arctic AMA by other funding agencies/industry (several students are working in this activity).

Contact: [Dr. Russell Hopcroft](#)

### Sea Ice Biota

At present, no sea ice biota monitoring is taking place in the U.S. high Arctic. Accumulation of sympagic macrofauna data has progressed considerably. A comprehensive list based on published and unpublished data will be available. The U.S. representative to the [Sea Ice Biota Expert Network](#) has started a compilation of sea ice meiofauna data. Metadata and raw data reside in a single data base at present. In the future the data will be linked to regions of fast ice, drift ice, multi-year ice and annual ice. A goal will be to gather data from gaps in the high Arctic, and a standardization of monitoring approaches is being pursued. In 2013 sampling campaigns off of Barrow, Alaska, U.S.A. collected sea ice biota data which will be analysed. Dr. Bluhm contributed sea ice biota information to the 2013 [Arctic Report Card](#). In addition, University of Alaska student projects on components of ice biota were funded. Various proposals on sea ice biota diversity and time series are pending as are publications on ice biota-related questions.

Contact: [Dr. Bodil Bluhm](#)

### Fish

The U.S. continued as a co-lead of the [Fish Expert Network](#). Species composition and distribution data were collected and baseline distributions were determined for the first 100 species out of approximately 245. Data sharing agreements were established. Dr. Mecklenburg published the [pan-Arctic species list of marine and diadromous fishes](#) and contributed to the 2013 [Arctic Report Card](#). Information from traditional knowledge on marine fishes is being gathered. Data are being entered into the Pacific Arctic data Node ([RUSALCA](#)) on the [AQOS website](#) for future CBMP-Marine use.

Contact: [Dr. Catherine Mecklenburg](#)

### Seabird

CAFF's [CBird Expert Group](#) acts as the CBMP Marine Seabird Network. Work is ongoing to develop several research projects and strategies to better understand changes in seabird populations.

Contact: [Dr. David Irons](#)

### Marine Mammals

Work in 2013 focused on tracking marine mammal information from NOAA, FWS, Alaska State Fish and Game and native communities. In addition abundance estimates are being assessed. Future parameters include harvest, body condition and health information. [Additional information found here](#) and on the [Marine Mammal Expert Network](#) site.

Contact: [Dr. Rosa Meehan](#) and [Dr. Peter Thomas](#)

### General

- NOAA will continue to lead the U.S. delegation to the CBMP-Marine Plan in 2014
- NOAA and the Marine Mammal Commission will continue to fund U.S. experts to attend CBMP working group meetings and to process data.
- Baseline distributions of species within each network will be refined.
- The U.S. will continue to fund data management and aggregation for submission to the [ABDS](#).
- The U.S. will continue to coordinate U.S. activities to work with other Arctic country scientists from the expert networks.
- The U.S. will work towards development a Pan-Arctic Atlas of species range extent and changes through space and time.

## For more information

**Kathleen Crane**  
Arctic Research Program  
National Oceanic and Atmospheric Administration (NOAA)  
1100 Wayne Avenue, Silver Spring, MD  
U.S.A. - 20910

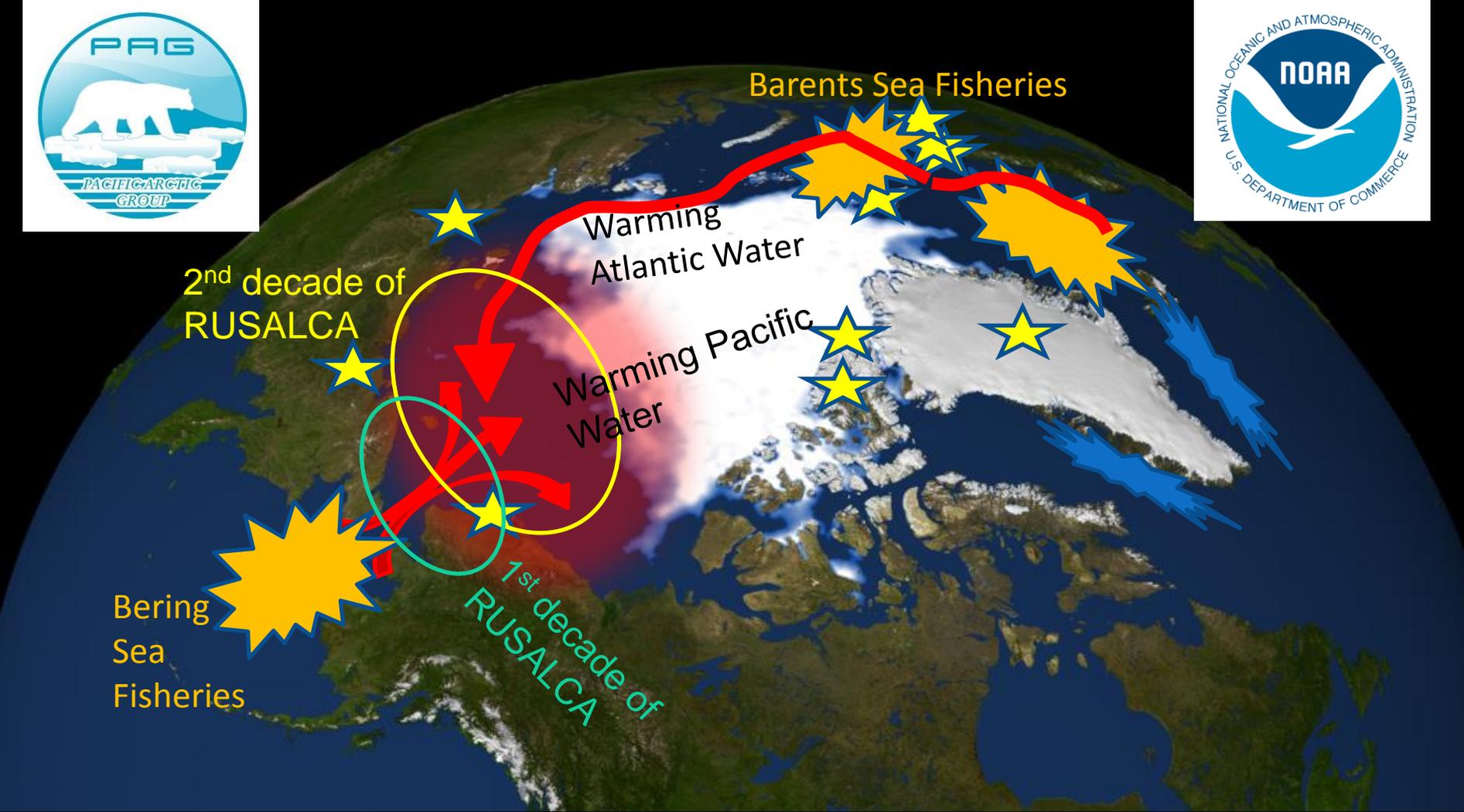
Tel: +1 301-427-2471  
Email: [Kathy.Crane@noaa.gov](mailto:Kathy.Crane@noaa.gov)  
Website: [www.arctic.noaa.gov](http://www.arctic.noaa.gov)

**Conservation of Arctic Flora and Fauna (CAFF)**  
Borgir, Nordurhlod  
600 Akureyri, Iceland

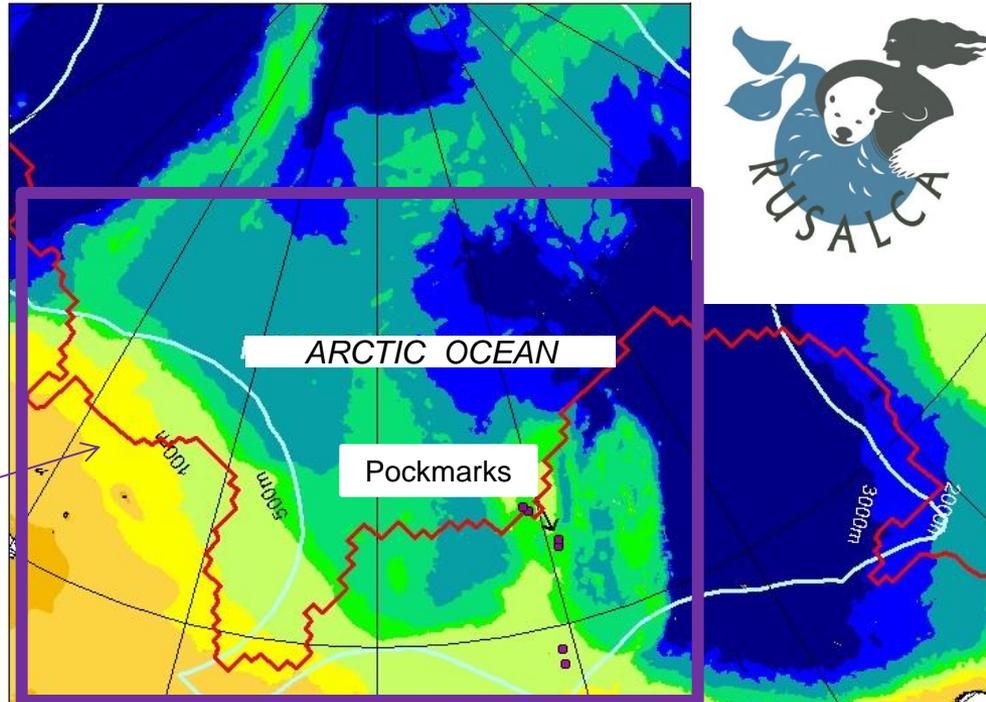
[caff@caff.is](mailto:caff@caff.is)  
[www.caff.is/marine](http://www.caff.is/marine)

Sign up for the CBMP newsletter

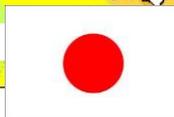
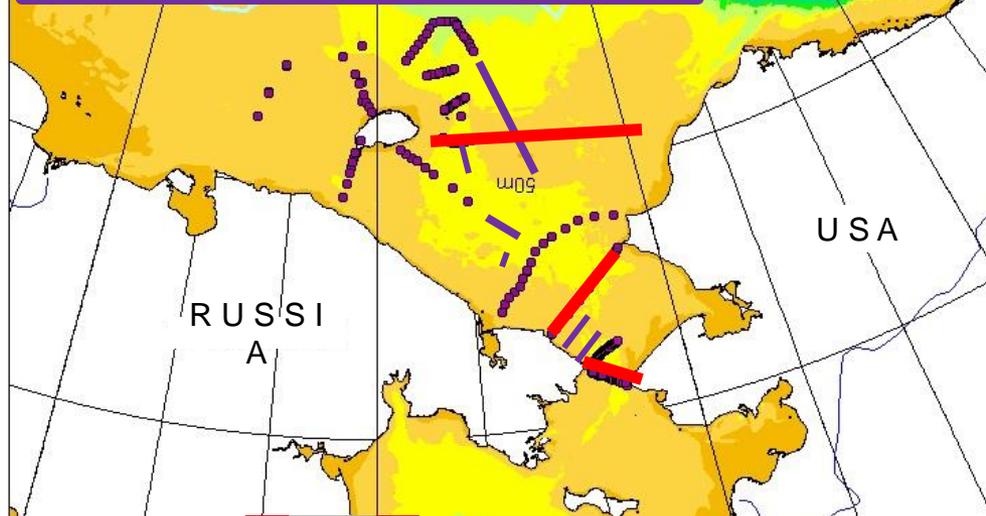
# FROM 2016-2020, RUSALCA WILL MOVE NORTHWARDS TO OBSERVE THE PACIFIC ARCTIC HOT SPOT WITH MEMBERS OF THE PACIFIC ARCTIC GROUP



# RUSALCA 2<sup>ND</sup> DECADE



**RUSALCA-PAG**  
Proposed survey  
area 2016-2020



# GOALS: 2015-2025 ARP ECOSYSTEM OBSERVATIONS



1. Continue repeat sampling of three transects in the Chukchi Sea (Bering Strait, DBO 3 and westward extension of DBO 4)
2. Expand RUSALCA northwards
3. Design and implement Pacific Arctic ocean climate -ecosystem repeat transects with the Pacific Arctic Group
4. Provide data to the Alaska Ocean Observing System and as a U.S. contribution to the Arctic Council's Arctic Biodiversity Data Service for CBMP.

