

# Update on Distributed Biological Observatory (DBO) activities

**Jacqueline Grebmeier**

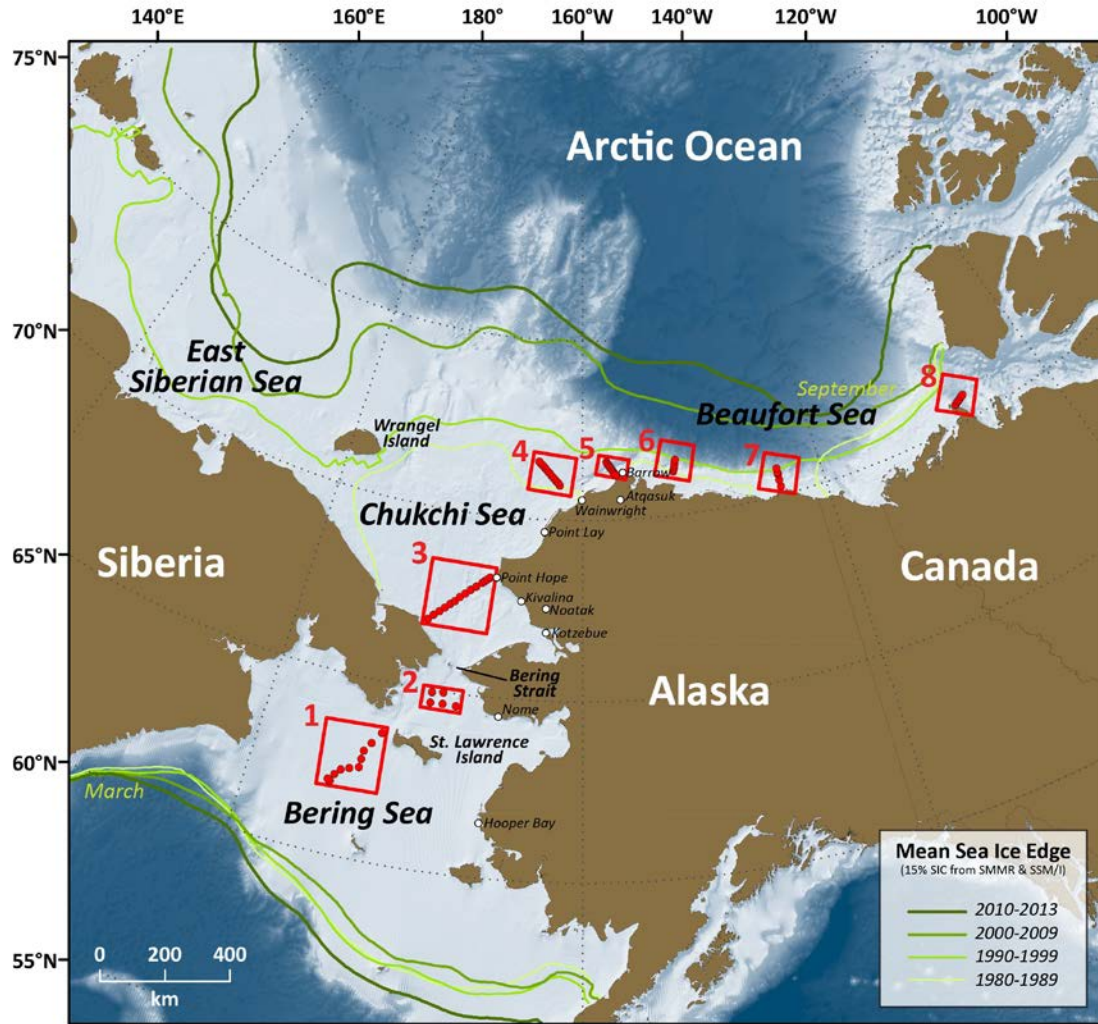
Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science,  
Solomons, Maryland, USA

Pacific Arctic Group Meeting  
April 2, 2017  
Arctic Science Summit Week 2017  
Prague, Czech Republic



<http://pag.arcticportal.org/>

# Linking Physics to Biology: the Distributed Biological Observatory (DBO)



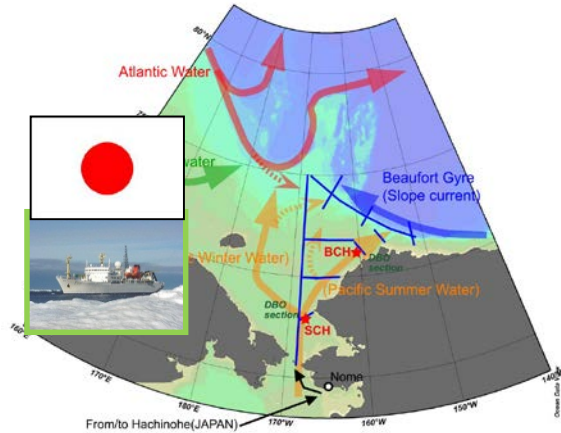
[updated by Karen Frey from Grebmeier et al. 2010, EOS 91]

- DBO sites (red boxes) are regional “hotspot” transect lines and stations located along a latitudinal gradient
- DBO sites are considered to exhibit high productivity, biodiversity, and overall rates of change
- DBO sites serve as a change detection array for the identification and consistent monitoring of biophysical responses
- Sites occupied by national and international entities with shared data plan

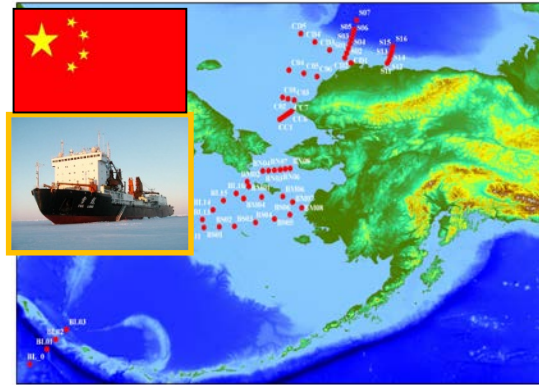


# PAG research cruises in the Pacific Arctic Region with DBO sampling efforts

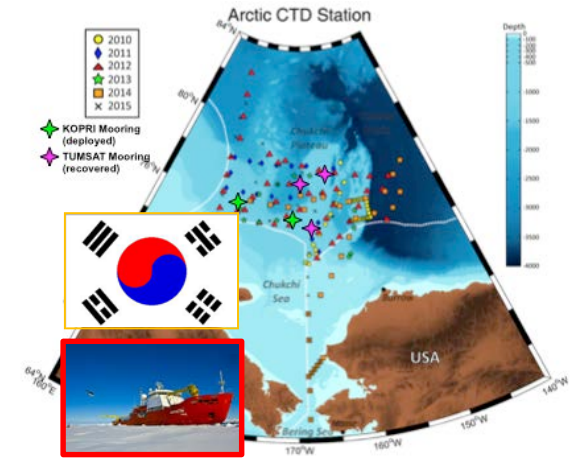
## Japan: RV Mirai



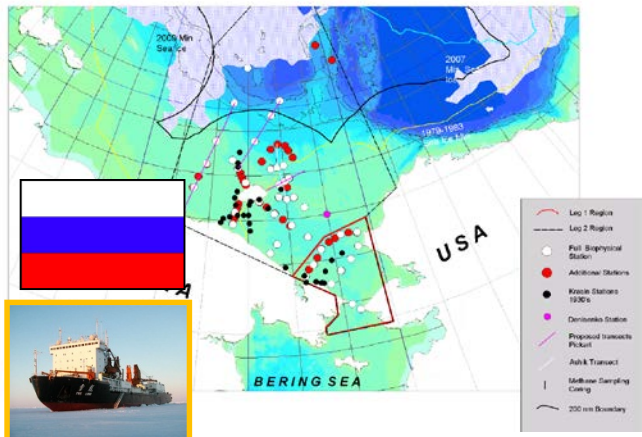
## China: RV Xuelong



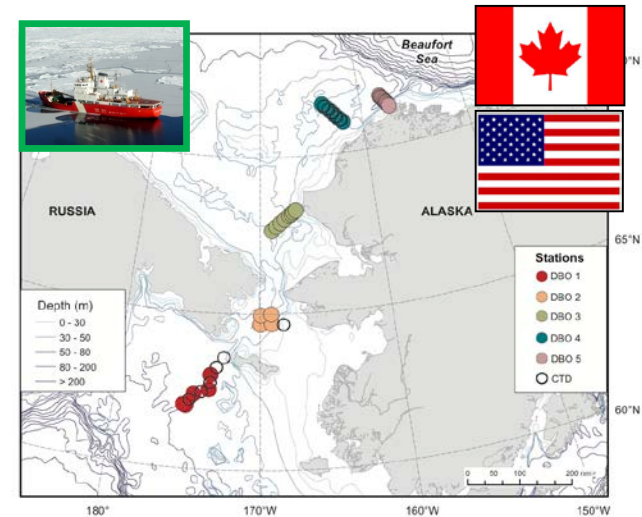
## Korea: RV Araon



## Russia-USA: RV Khromov



## Canada: CCGS Sir Wilfrid Laurier, Louis St. Laurent



## USA: Healy, RV Aquila, Brown etc.



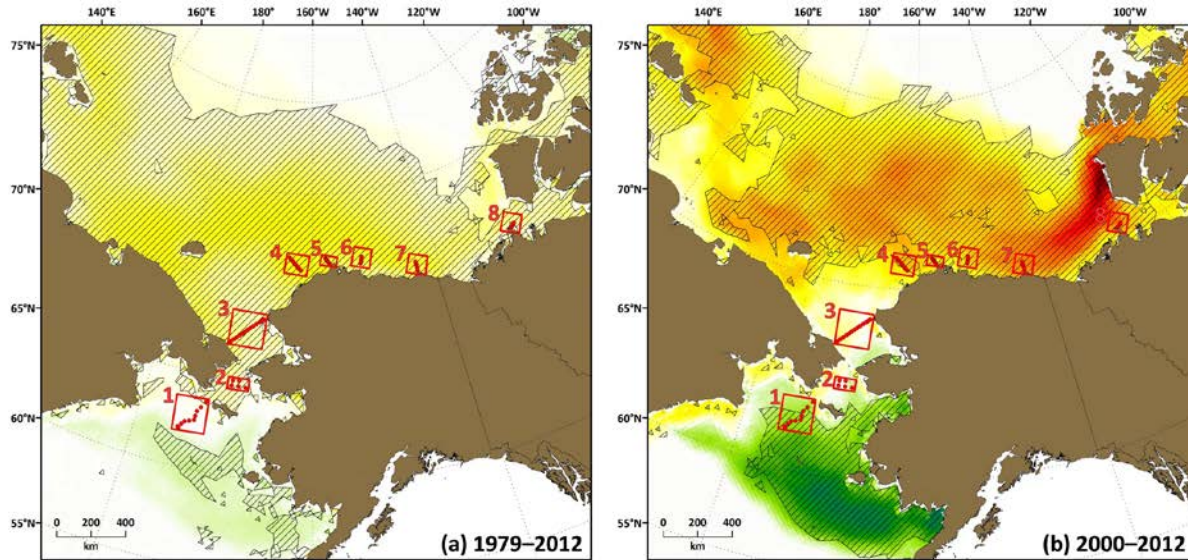
# Distributed Biological Observatory Standardized Sampling Protocols

- Conductivity, Temperature, Depth (CTD), Acoustic Doppler Current Profiler (ADCP) data
- Bottle data for chlorophyll and nutrients
- Abundance, biomass and composition of ice algae, phytoplankton, zooplankton, benthic fauna (both infauna and epifauna), and fish
- Sediment parameters (grain size, organic carbon content, chlorophyll *a* content)
- Seabird and marine mammal surveys
- Mooring data (temperature (T), salinity (S), currents, fluorescence, nutrients, sediment traps)
- Satellite data (data presented are weekly averages of most recent data on: (1) chlorophyll pigment concentration; (2) sea surface temperature (SST); (3) sea ice concentration; (4) cloud fraction, and (5) winds and sea level pressure)

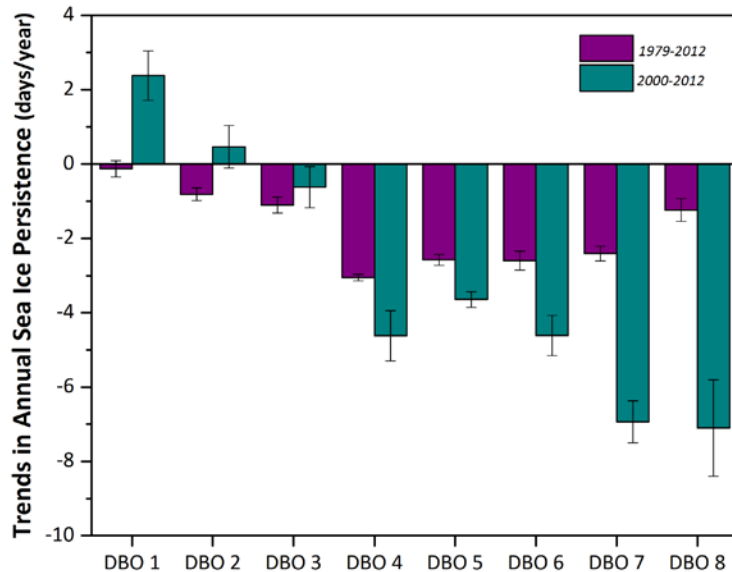
# Trends in Annual Sea Ice Persistence (DBO 1–8)

*Hatching indicates statistically significant trends (Mann-Kendall  $p < 0.1$ )*

*Trends in annual sea ice persistence have accelerated since 2000*



Trends in Annual Sea Ice Persistence (days/year)



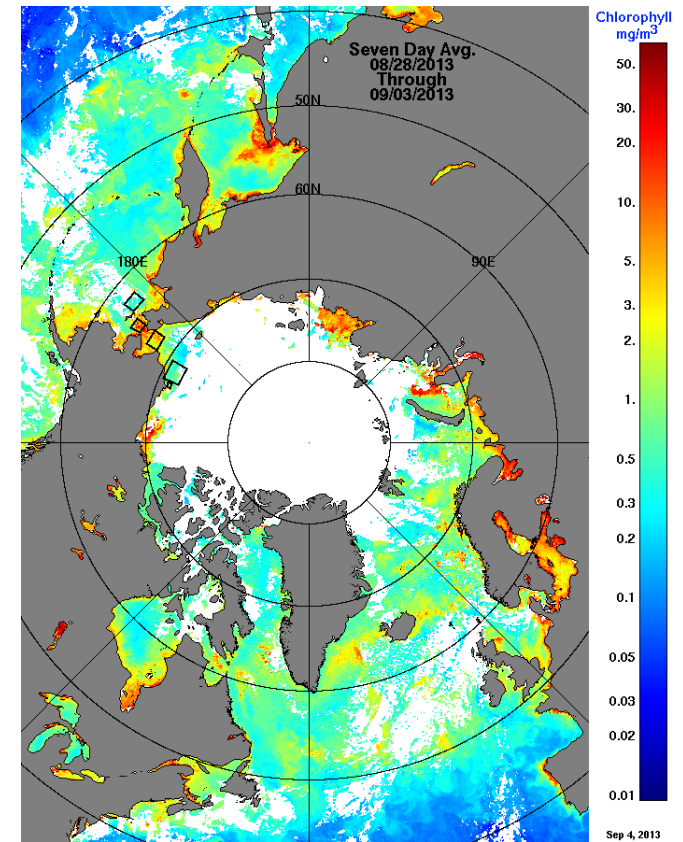
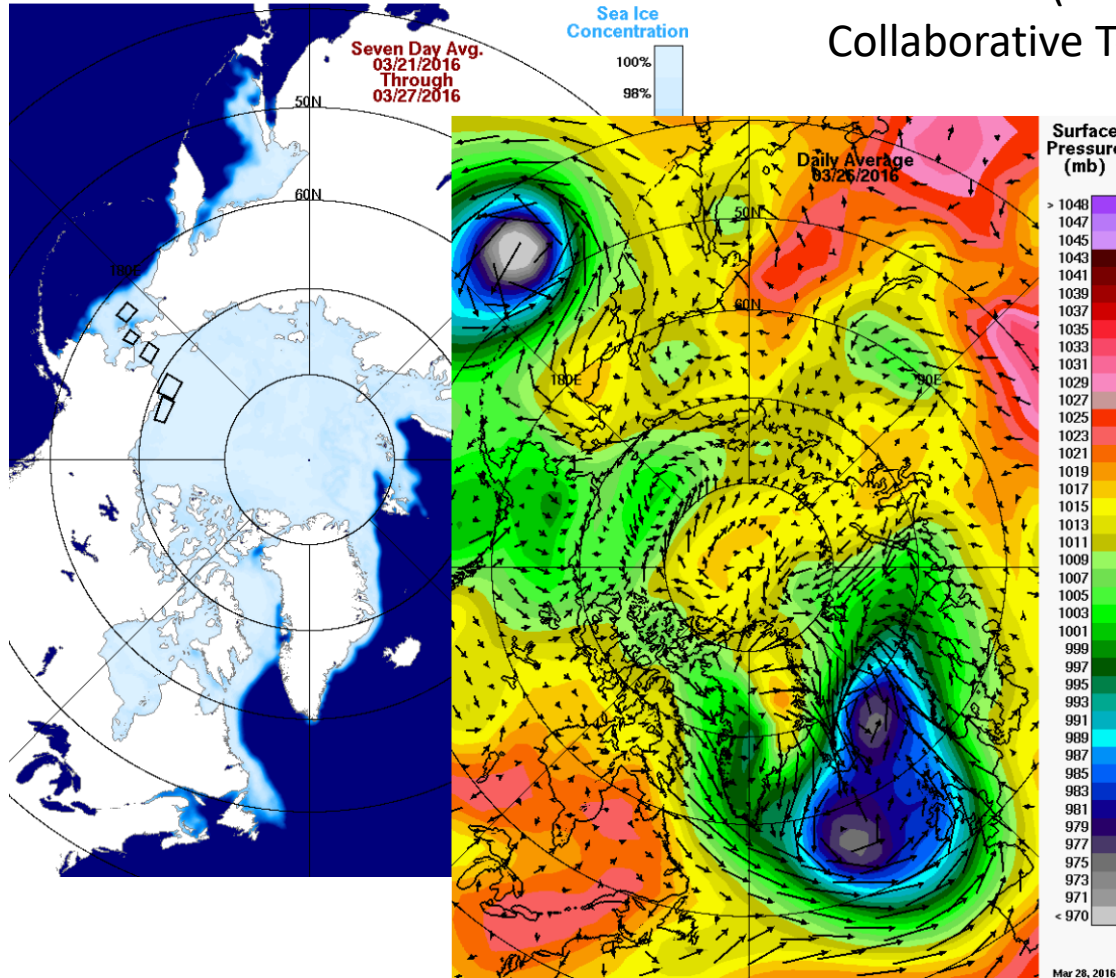
- Trends in annual sea ice persistence have accelerated since 2000
- Recent gains in annual sea ice persistence in the south (DBO 1–2) transition to losses in the north (DBO 3–8)

[Karen Frey, Clark University]

# Satellite Visualization Data for the Distributed Biological Observatory (DBO)

J. C. Comiso, Karen Frey, L. V. Stock, R. A. Gersten, and H. Mitchell.  
NASA Goddard Space Flight Center

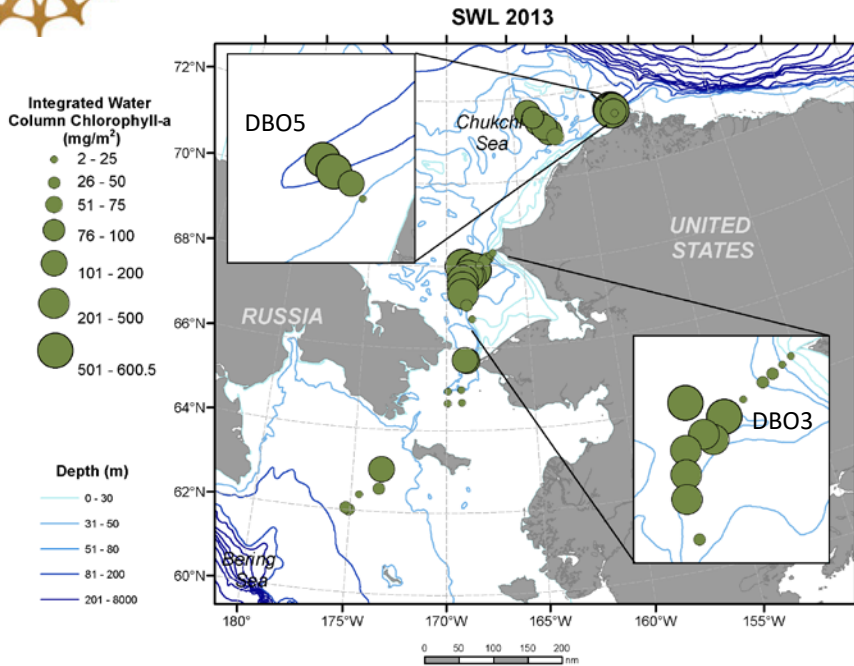
US Interagency Arctic  
Research Policy  
Committee (IARPC) DBO  
Collaborative Team (CT)



<http://neptune.gsfc.nasa.gov/csb/index.php?section=270> (courtesy Joey Comiso)



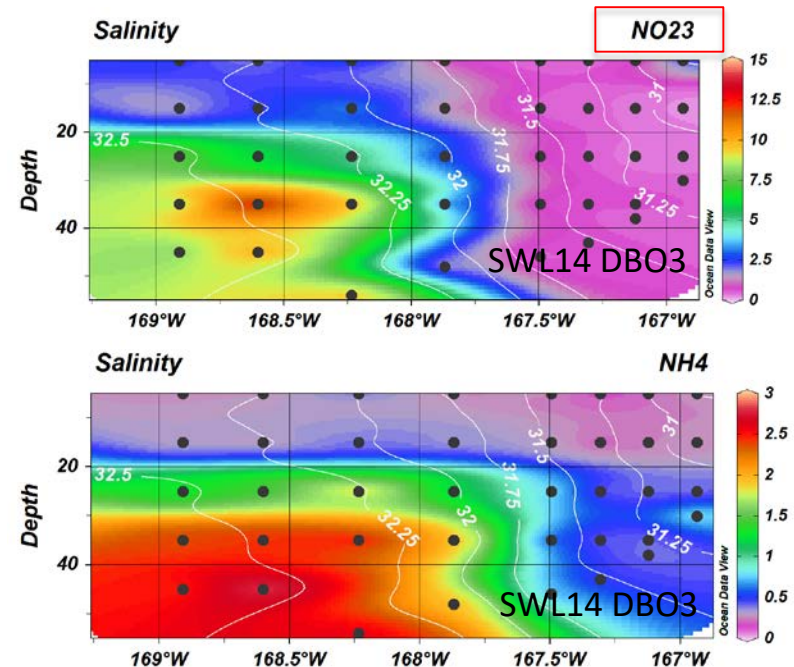
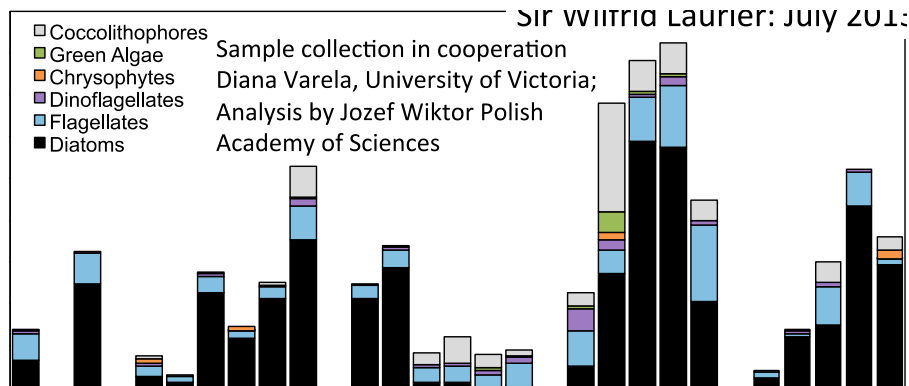
# Examples of DBO Data Products



**Top Left:** Integrated Chlorophyll *a* during annual DBO cruise

**Bottom left:** Phytoplankton taxonomy, with dominance by diatoms in western side maintained by nutrient rich Anadyr and Bering Shelf waters

**Bottom right:** nitrate/nitrite (top panel) and ammonium (bottom panel) ( $\mu\text{M}$ )



# Mooring observations at DBO-5

[Takashi Kikuchi]

● Publication

Itoh et al. (2015, DSR-I)



Water properties, heat and volume  
 Canyon during summer 2010

Motoyo Itoh <sup>a,\*</sup>, Robert S. Pickart <sup>b</sup>, Takashi Kikuchi <sup>c,d</sup>,  
 Daisuke Simizu <sup>c,d</sup>, Kevin R. Arrigo <sup>e</sup>, Svein Val  
 Jeremy T. Mathis <sup>h</sup>, Shigeto Nishino <sup>a</sup>, Carolin

<sup>a</sup> Japan Agency for Marine-Earth Science and Technology, Yokosuka, Kanagawa  
<sup>b</sup> Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA  
<sup>c</sup> Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan  
<sup>d</sup> National Institute of Polar Research, Tachikawa, Japan  
<sup>e</sup> Department of Environmental Earth System Science, Stanford University, Sta  
<sup>f</sup> Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, British Col  
<sup>g</sup> Polar Research Institute of China, Shanghai, China  
<sup>h</sup> NOAA Pacific Marine Laboratory, Seattle, WA 98115, USA

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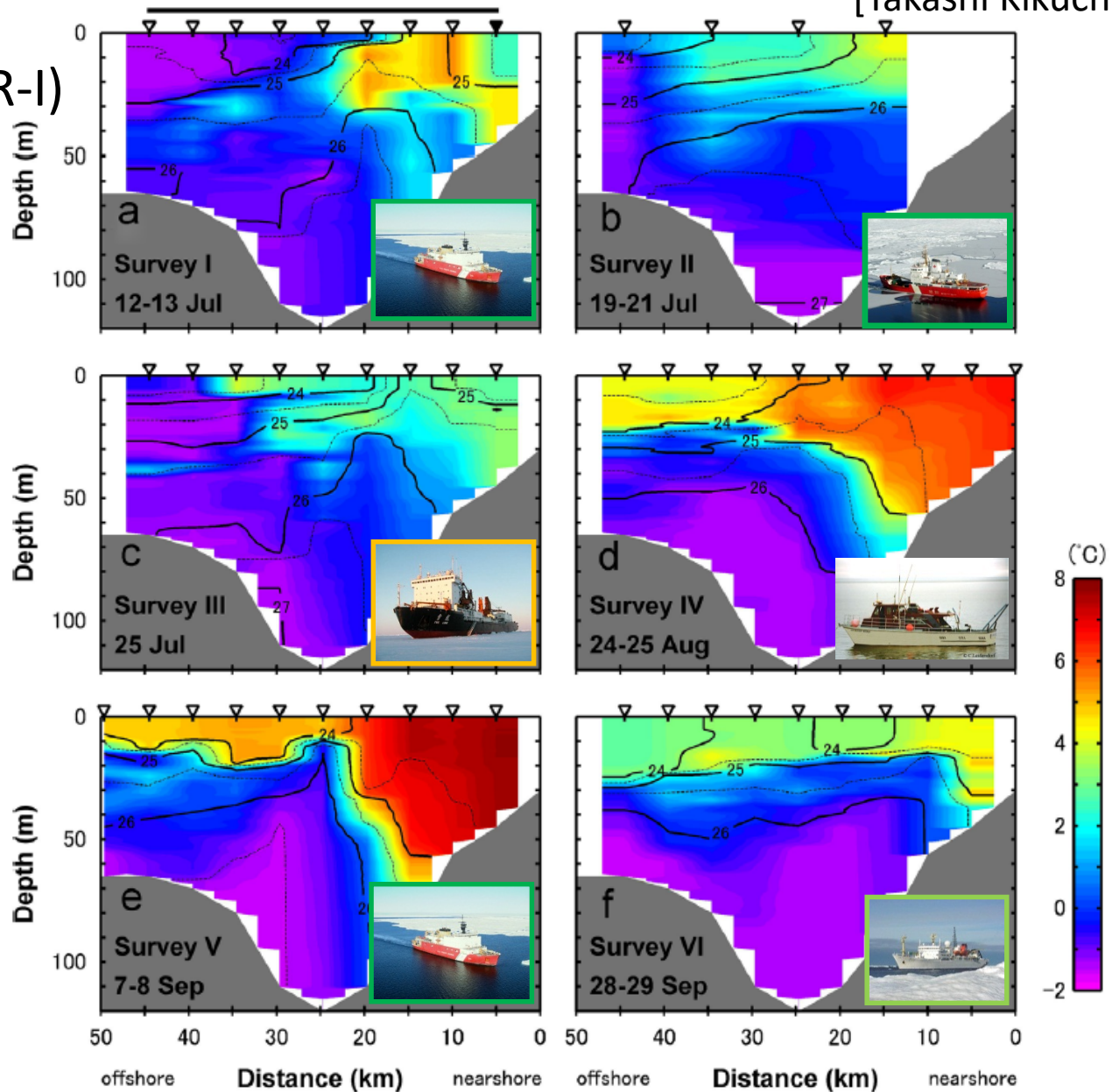
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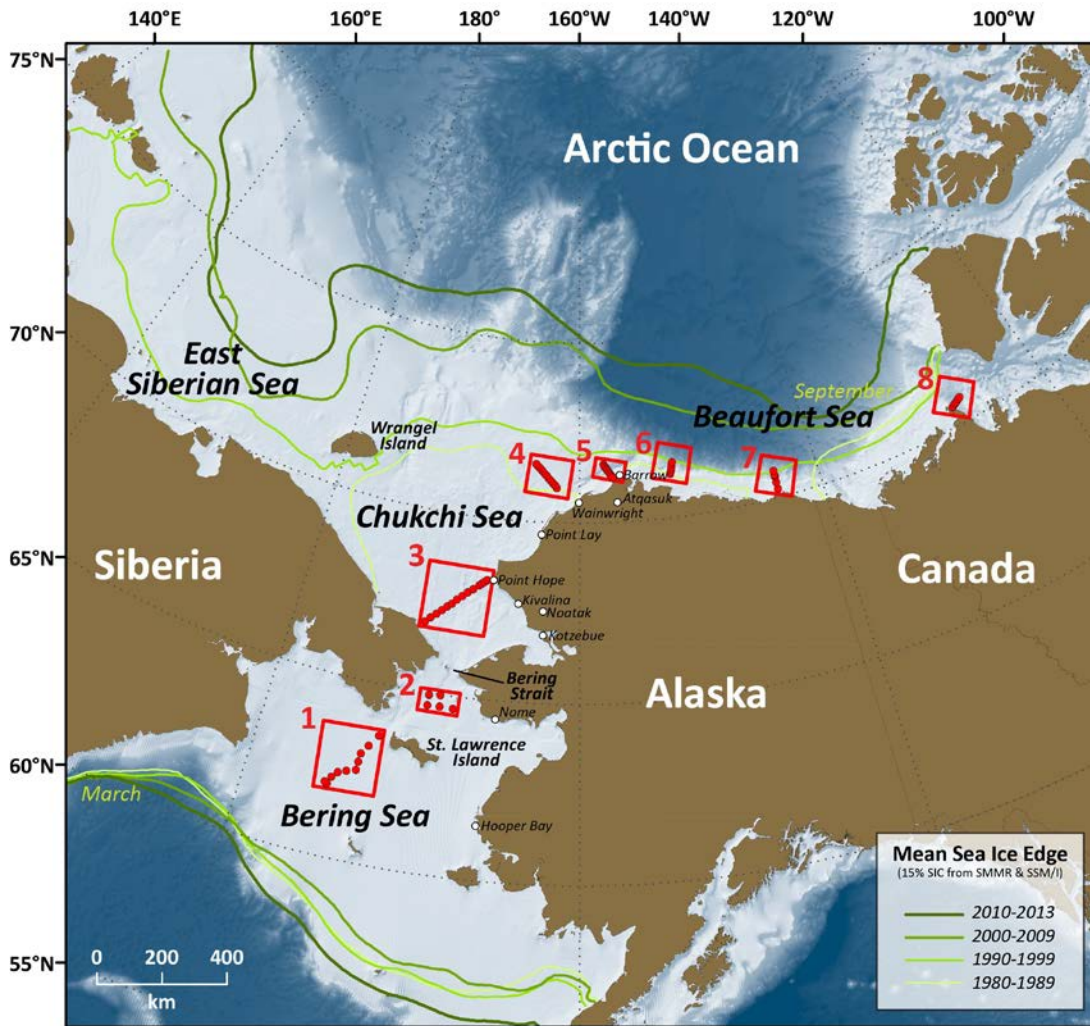
ABSTRACT

Over the past few  
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 Strait. Barrow Cany  
 water enters the  
 hydrographic/velo  
 water masses feed  
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 through the canyo  
 water (ACW and B  
 from 8.56 TW to 2  
 supplemental moc  
 weather station, w  
 period, which is w  
 2010 was estimat  
 amount of heat c  
 summer sea ice re  
 © 2015 The Auth





# DBO Data Sharing Protocols



[modified by Karen Frey from Grebmeier et al. 2010, EOS 91]

- Data Sharing Site Established and Supported Through NSF at Earth Observations Laboratory, UCAR: [dbo.eol.ucar.edu](http://dbo.eol.ucar.edu)
- Data Policy Protocol Approved by International Partners in 2015 [http://dbo.eol.ucar.edu/data\\_policy-dbo.html](http://dbo.eol.ucar.edu/data_policy-dbo.html)
- US Collaboration Team chaired by Sue Moore and Jackie Grebmeier through US IARPC to facilitate US agency DBO <http://www.iarpcollaborations.org/teams/Distributed-Biological-Observatory>



# 4th DBO Workshop:

## Data Updates, Synthesis and 10-year Implementation plan

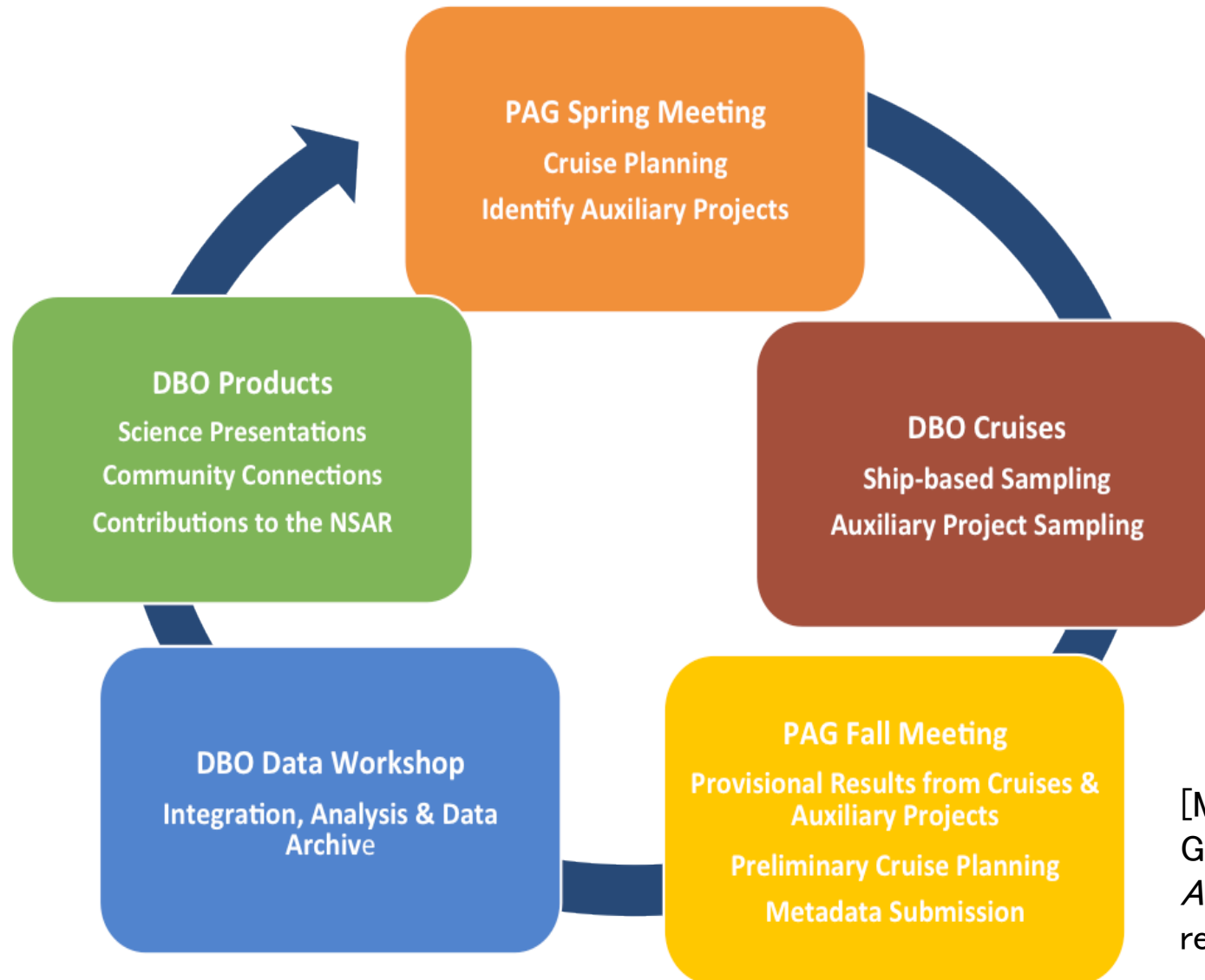
- **3 Objectives**

- Present results from the 2010-2017 DBO field program and commit to multidisciplinary papers to showcase results of the DBO international effort
- Evaluate the DBO data submission effort through the DBO Metadata site and linkage to other national archives
- Updates from the DSR DBO special issue
- Review US-IARPC DBO Implementation Plan + International 10-year future efforts



**March 9-10, 2016 , Pacific Marine Environmental Laboratory, NOAA, Seattle,**

# DBO IMPLEMENTATION PLAN ANNUAL CYCLE



[Moore and Grebmeier 2017, *Arctic*, in revision]

## Recent Efforts

- Continue the DBO1-5 annual sampling efforts
- Expand the DBO to a larger pan-Arctic network in the Beaufort Sea
- Initiation DBO-type lines in the northern Barents Sea through recent IASC support for an Atlantic-focused DBO workshop (next presentation Marit Reisgard)
- Test the developing Arctic Marine Pulses (AMP) conceptual model with seasonal DBO data to track seasonal biophysical 'pulses' across a latitudinal array
- Engage coastal stakeholders in nearshore coastal zone to the DBO via developing community-based networks

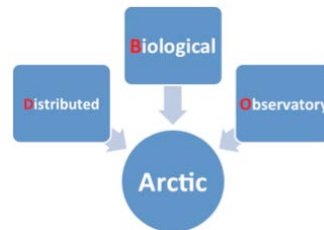
## Summary

- DBO collects and evaluates key information to enable ecosystem approaches to management in the Pacific Arctic region and onwards to pan-Arctic ecosystems
- DBO network is endorsed and facilitated by the Pacific Arctic Group that is providing a process for engaging and organizing the international scientific community in monitoring the Arctic
- DBO effort developed to track biological responses in the context of ongoing ecosystem-based, multidisciplinary studies that are supported by a network of international stakeholders

# Thank you for your attention.

## Questions and comments?

Thank you to all DBO collaborators, field and laboratory technicians over the years for the time series efforts. Financial support for the science provided by the US NSF, NOAA, BOEM, NASA, and ongoing international science partners in the Pacific Arctic Group.



<http://www.arctic.noaa.gov/dbo/>

USA agency support

