

Distributed Biological Observatory: A Change Detection Array in the Pacific Arctic-Session Introduction and US DBO Updates

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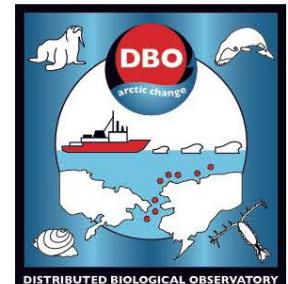
3-2 Distributed Biological Observatory (DBO)

- ❖ Brief updates of recent activities and results of DBO
 - USA DBO results (Jackie Grebmeier)-10 min
 - Japan DBO results (Shigeto Nishino)
 - Korean DBO results (Eun-Jin Yang)

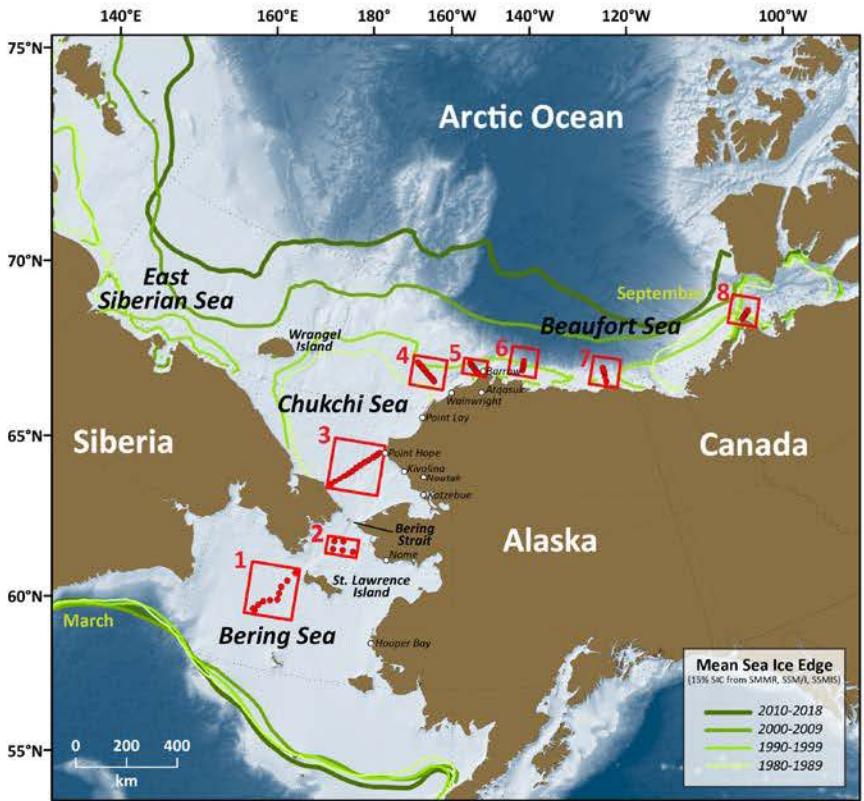
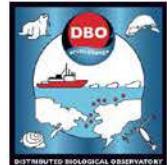


Pacific Arctic Group
Arkhangelsk, Russia

May 23, 2019



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



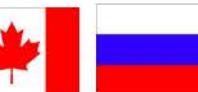
[updated from Moore and Grebmeier 2018]

- **Ship-based sampling:**
 - CTD and ADCP
 - Chlorophyll, nutrients, carbon products
 - Plankton (size, biomass and composition)
 - Benthos (size, biomass and composition)
 - Seabird and marine mammal surveys
 - Fishery acoustics
 - Bottom trawling (every 3-5 years)
- **Autonomous sensor sampling:**
 - Gliders, moorings, saildrone
 - Satellite observations
- **DBO lines also embedded in process cruises**

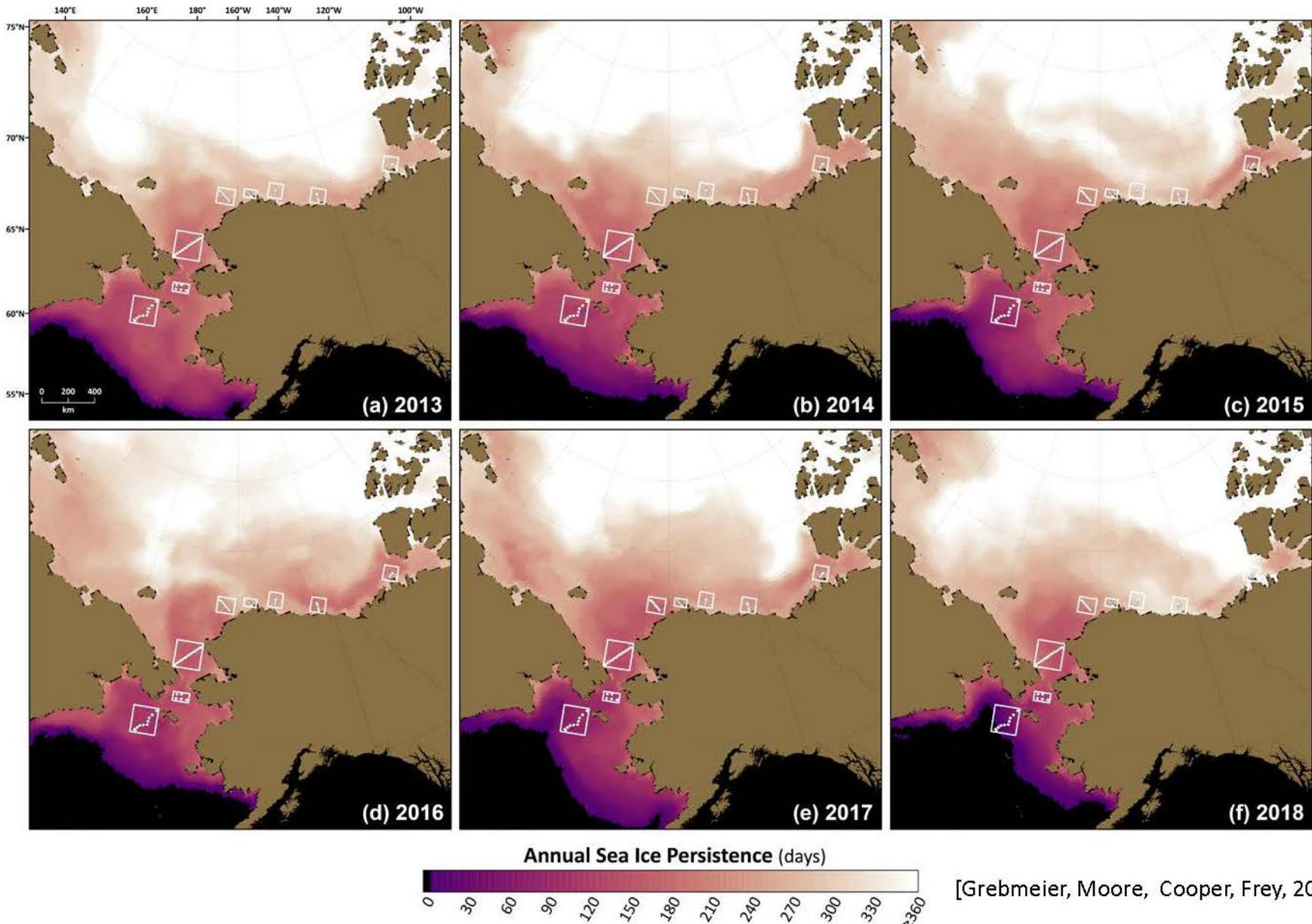
- DBO sites (**red boxes**) are **regional “hotspot”** transect lines and stations, based on high productivity, biodiversity, and/or overall **rates of change**
- DBO serves as a **change detection array** for consistent monitoring of biophysical responses
- Sites occupied by **national and international entities** with shared data plan



BOEM
Bureau of Ocean Energy Management



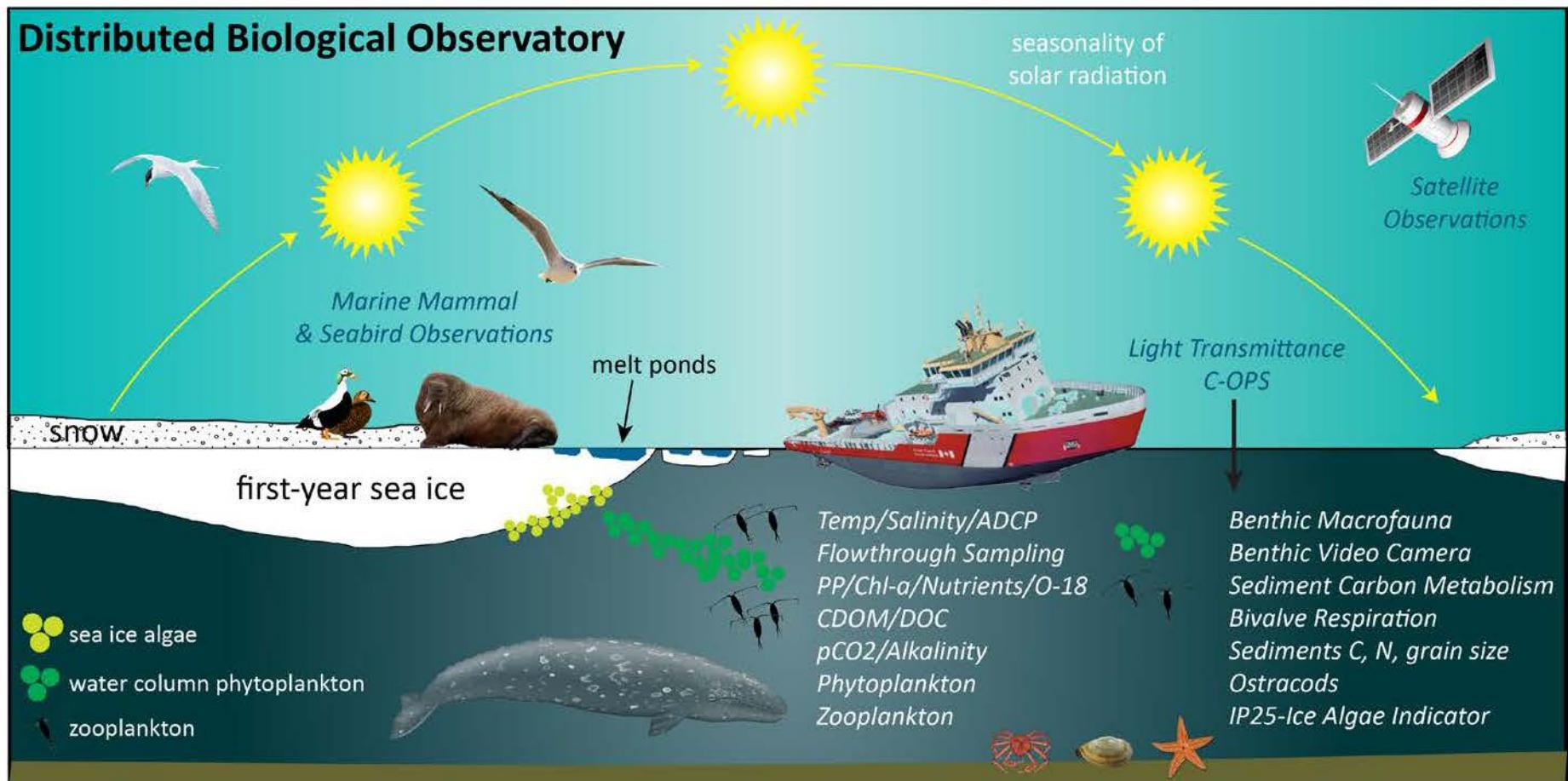
Annual sea ice persistence (# of days/year of sea ice presence) across the DBO1–8 regions in the Pacific Arctic from 2013–2018



[Grebmeier, Moore, Cooper, Frey, 2019]

Sampling Components of the Distributed Biological Observatory

[Grebmeier, Moore, Cooper, Frey, 2019]



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

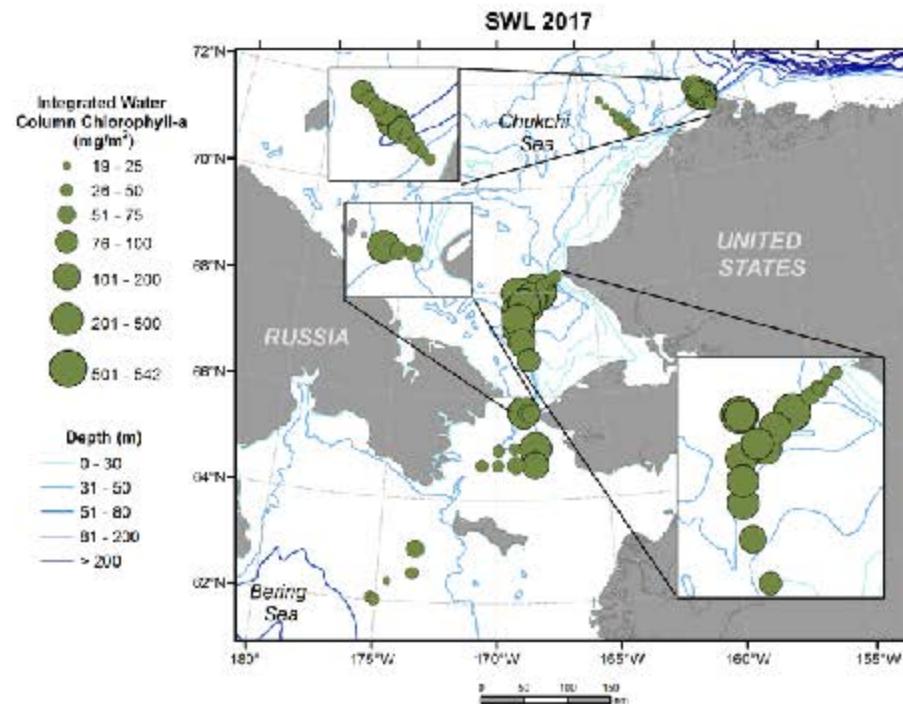
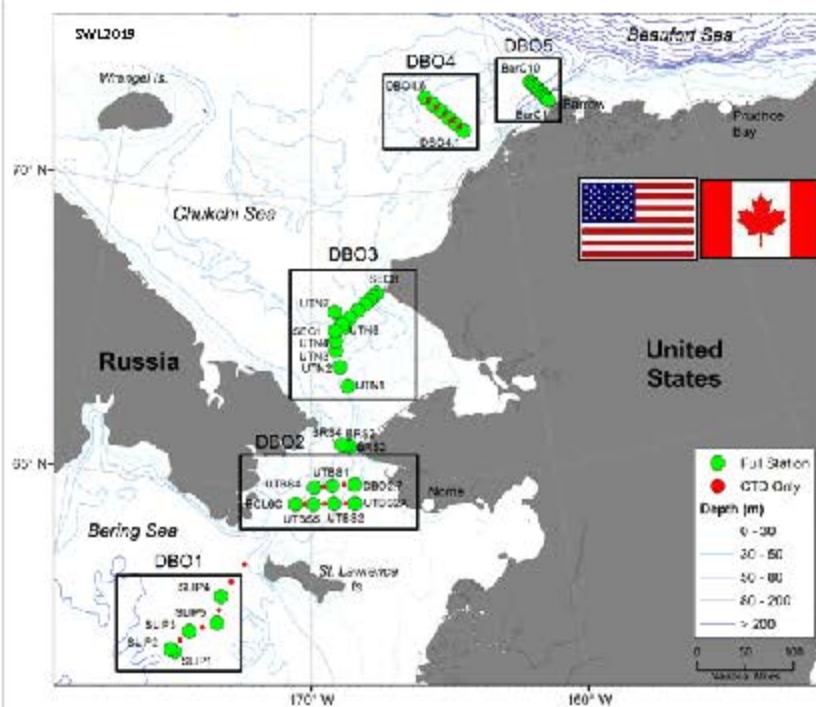
Key: C-OPS=Compact-Optical Profiling System, Temp= Temperature, ADCP= Acoustic Doppler Current Profiler, C=Carbon, CDOM=Chromophoric Dissolved Organic Matter, Chl-a=Chlorophyll a, DOC=Dissolved Organic Carbon, IP-25=Ice proxy with 25 C atoms, N=Nitrogen, O-18=Oxygen-18 ratios, PP=Primary Production. All lower taxa analyses include composition, abundance and biomass data.



Canada's Three Oceans (C30) and the DBO: CCGS Sir Wilfrid Laurier, July 11-23, 2019



Focus: sampling along latitudinal transect lines developed as a “change detection array” for consistent monitoring of biophysical responses to changing environmental conditions

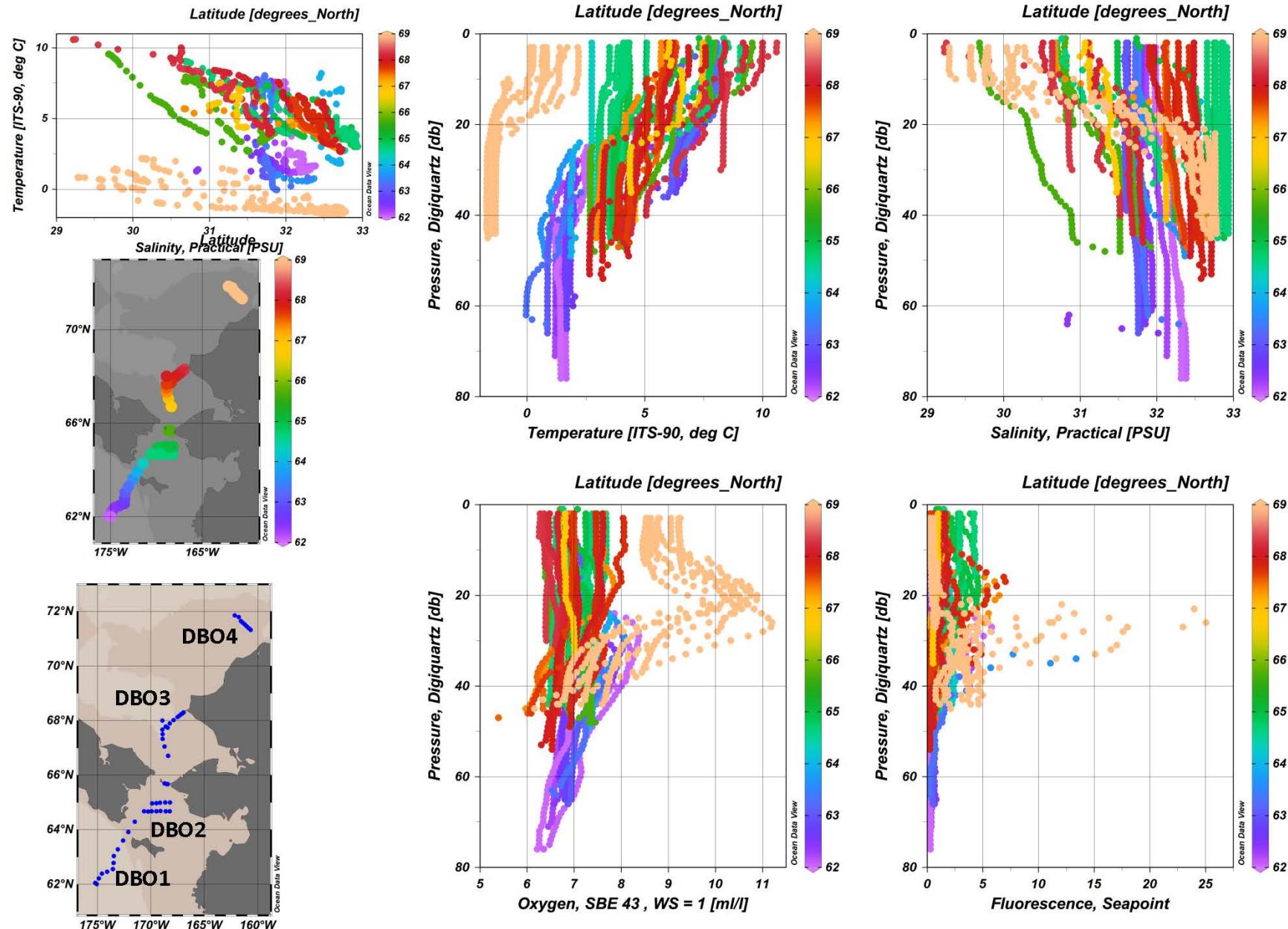


Contacts: John Nelson
John.Nelson@dfo-mpo.gc.ca and
Jackie Grebmeier
jgrebmei@umces.edu

DBO data collections

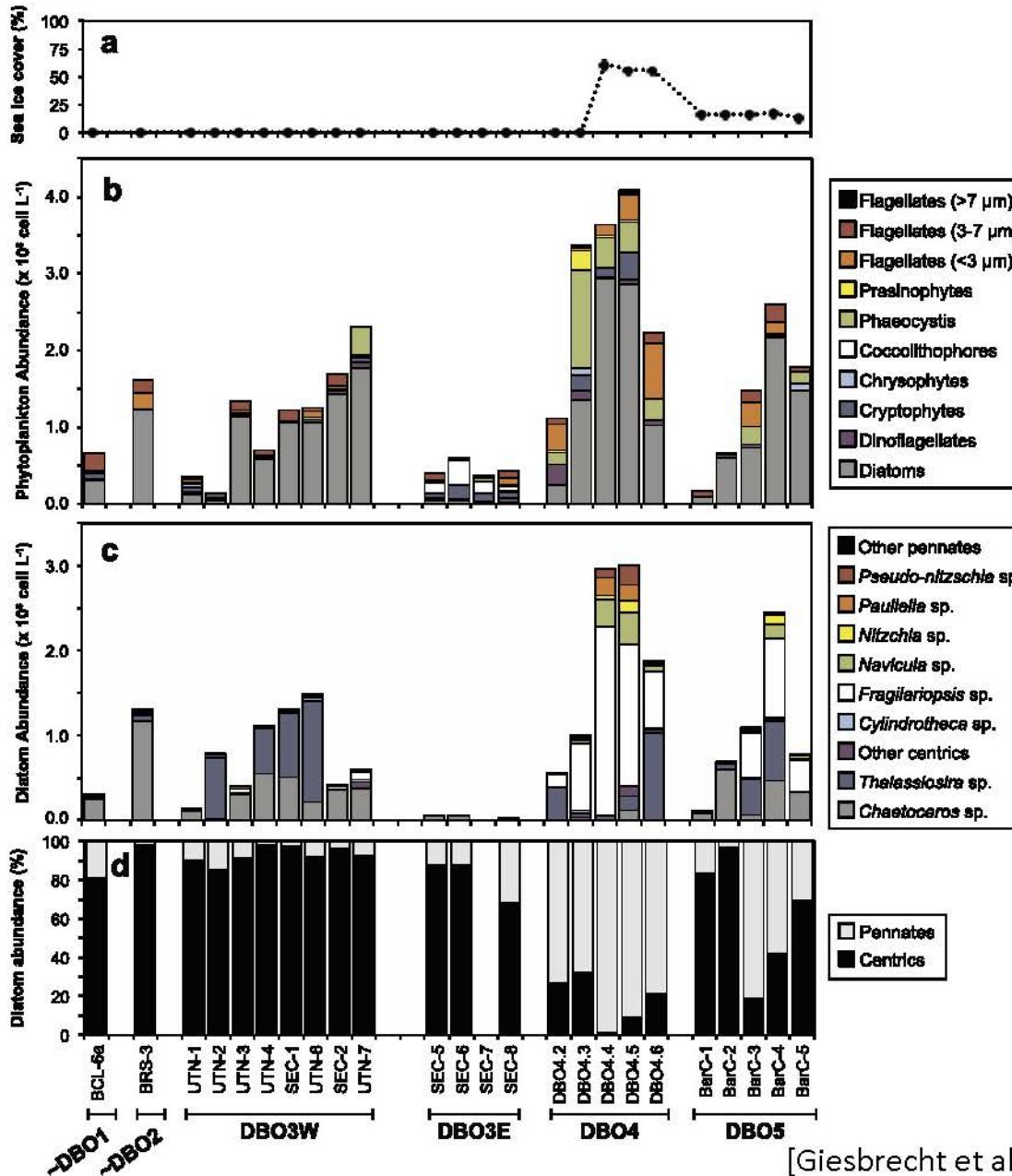
- Seawater temperature and salinity; velocity measurements
- Nutrients, chlorophyll, carbon products, CDOM
- Phytoplankton, zooplankton and macrobenthic abundance, biomass, community structure
- Marine mammal and seabird surveys

DBO-C30 SWL July 2018, All Stations, DBO 1 to 4



[SWL18 figures made using Ocean Data View software, courtesy S. Zimmermann, DFO]

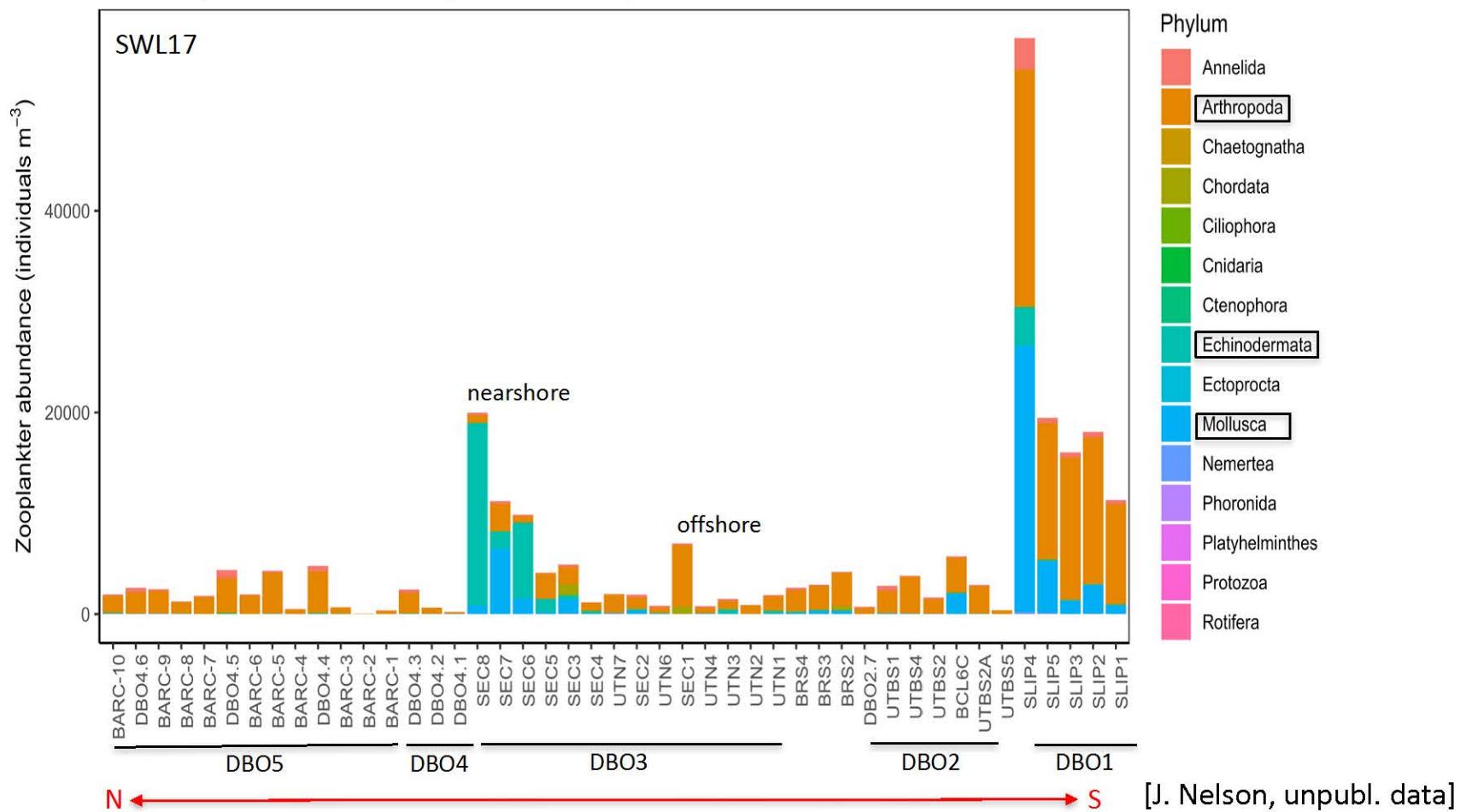
Sea Ice cover and Phytoplankton Type



- Highest sea ice algae in NE Chukchi Sea where sea ice remaining in July (DBO4)
- Phytoplankton abundance greatest in offshore nutrient-rich Bering Sea-Anadyr water
- Centric diatoms dominate in southern sites (DBO1-3), changing to dominance of pennate diatoms in the NE Chukchi Sea (DBO4-5) where most recent ice observed

Abundance of zooplankton phyla for the SWL 2017 DBO July cruise

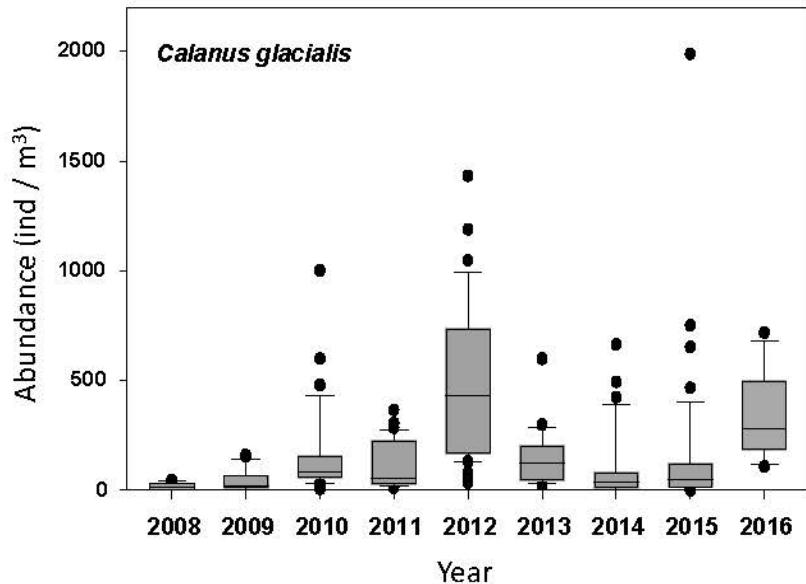
2017 Zooplankton Abundance by Station and Phylum



- High abundances at SEC6-SEC8 (DBO3-east) of echinoderm and molluscan larvae, barnacle cirripedia and small copepods (*Oithonia*), larger calanoid copepods
- High abundance of molluscan and echinoderm larvae at the DBO1 SLIP stations, with pelagic zooplankton dominated by small cyclopoid and calanoid copepods, *Calanus glacialis*

DBO3-Adding to long-term time series

Zooplankton



Relate copepod abundance to hydrographic conditions

= warm years dominated by small *Pseudocalanus*

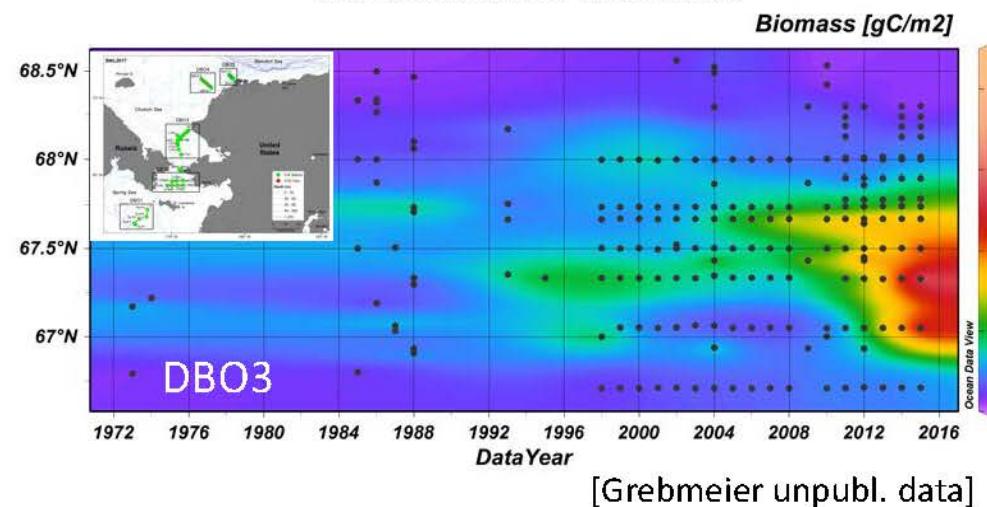


= lipid-rich *Calanus* more abundant in cold years



[R. Hopcroft]

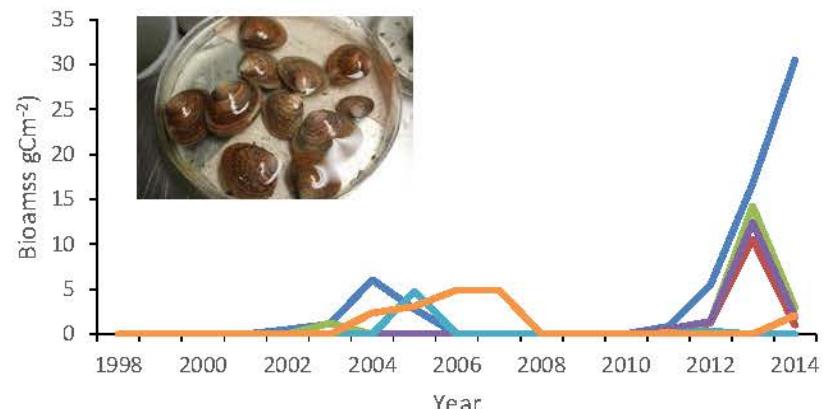
Macrofaunal Biomass



Example Data

Biomass of *Serripes groenlandicus* in DBO 3

— UTN 2 — UTN 3 — UTN 4 — UTN 5 — UTN 6 — UTN 7



[Goethel unpubl. data]

Distributed Biological Observatory Sea-floor Videos

Untitled — Edited

Inbox (332) - cooper@umces.edu X Cambridge Bay - Google Drive X Inbox (1,424) - leewcooper@gmail.com X distributed biological observatory X

Most Visited Sign Out DBO Collaboration T... Google Accounts Google News DirectionsAce Mozilla Firefox Start... OnlineMapFinder Getting Started UMCES-CBL Next WoRMS - World Re...

YouTube distributed biological observatory

About 104 results

Distributed Biological Observatory (DBO) Sir Wilfrid Laurier 2017 cruise
Lee Cooper • 21 views • 3 months ago
Underwater video from Distributed Biological Observatory (DBO) stations in the northern Bering and Chukchi seas. The DBO is a

Distributed Biological Observatory Update
IARPC Collaborations • 4 views • 1 year ago
This video is about Distributed Biological Observatory Update.

Jackie Grebmeier - The Distributed Biological Observatory
PAME Secretariat • 19 views • 1 year ago
Full title: The Distributed Biological Observatory: A Marine Change Detection Array in the Pacific Arctic Recording from the Arctic.

Satellite Oceanographic Data in the Distributed Biological Observatory - J.C. Comiso, NASA
Jessica Rohde • 13 views • 3 years ago
Learn more about this video and the Interagency Arctic Research Policy Committee (IARPC) at <http://www.iarpcollaborations.org/>

DBO Sir Wilfred Laurier seafloor 2016 lg copy
Lee Cooper • 82 views • 1 year ago
Seafloor video from Distributed Biological Observatory (DBO) stations in the northern Bering and Chukchi seas. Filmed from the

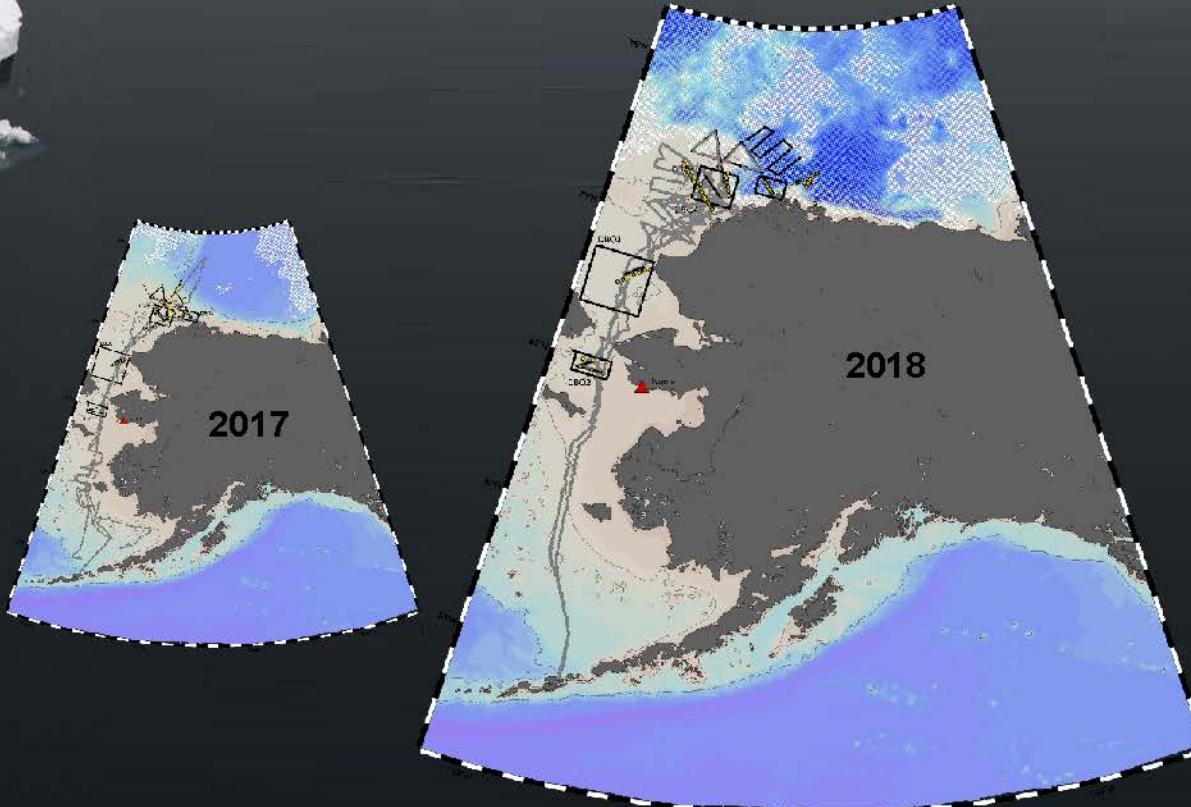
[Cooper et al. DSR in press]

Samples from 10 minute clips at each station are posted on youtube.com at:
<https://www.youtube.com/watch?v=QGvJm1VjGrk&index=15&list=PL47bWgz8o1VnF23-mAnnGdTsEdupDEGei>

Or search at youtube.com for “distributed biological observatory”



ARCTIC DBO-NCIS

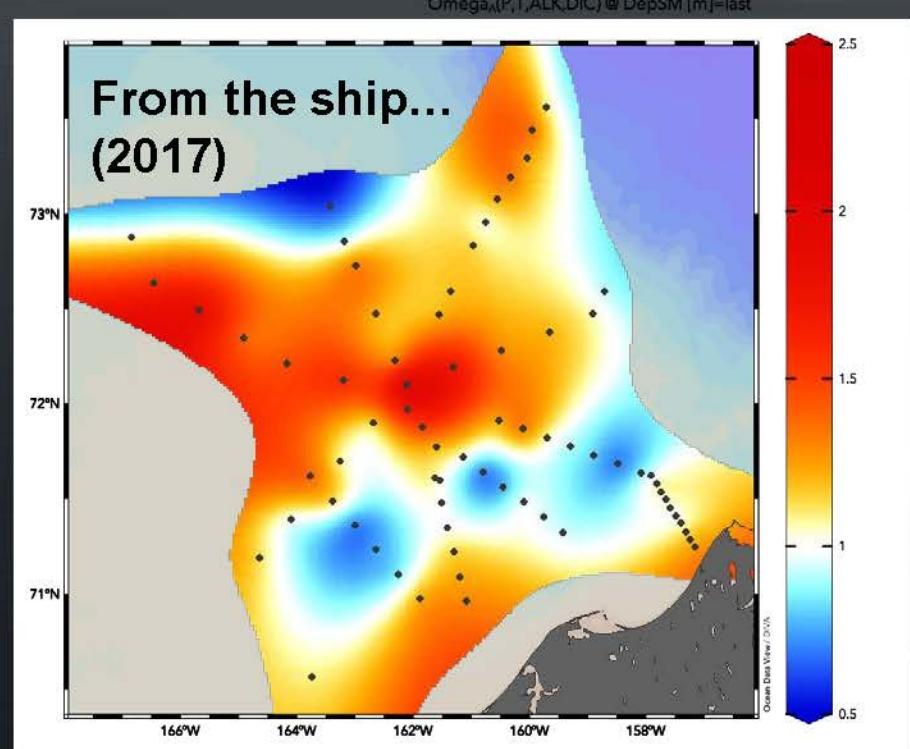


[Jessica Cross, NOAA]



ARCTIC DBO-NCIS

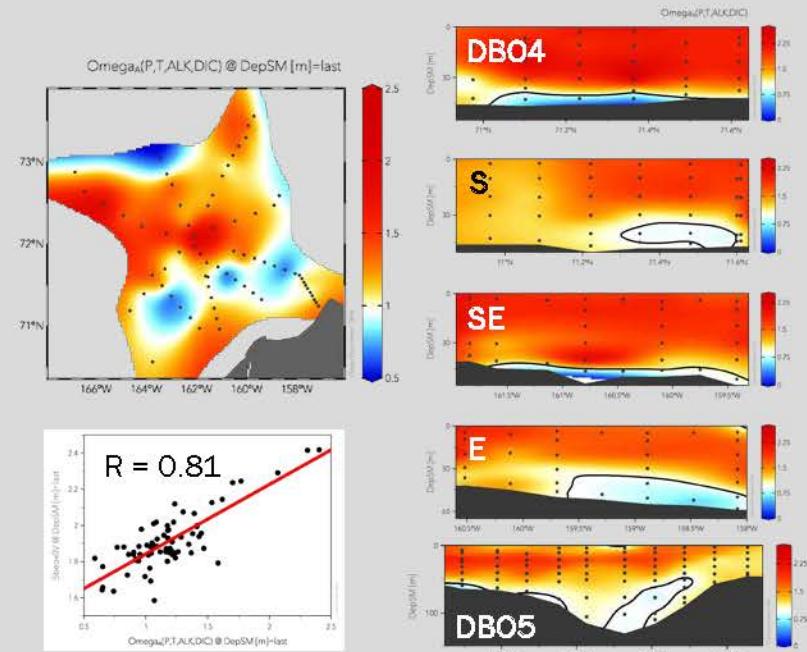
2017



[Jessica Cross, NOAA]

2017 DBO-NCIS

- Corrosive waters prevalent on SE side of Hannah Shoal
- Similar to 5-year synthesis
- How persistent is this feature?
 - Remnant Winter Water (*DBO5*)
- What mechanism drives it?
 - Focused Deposition & Respiration



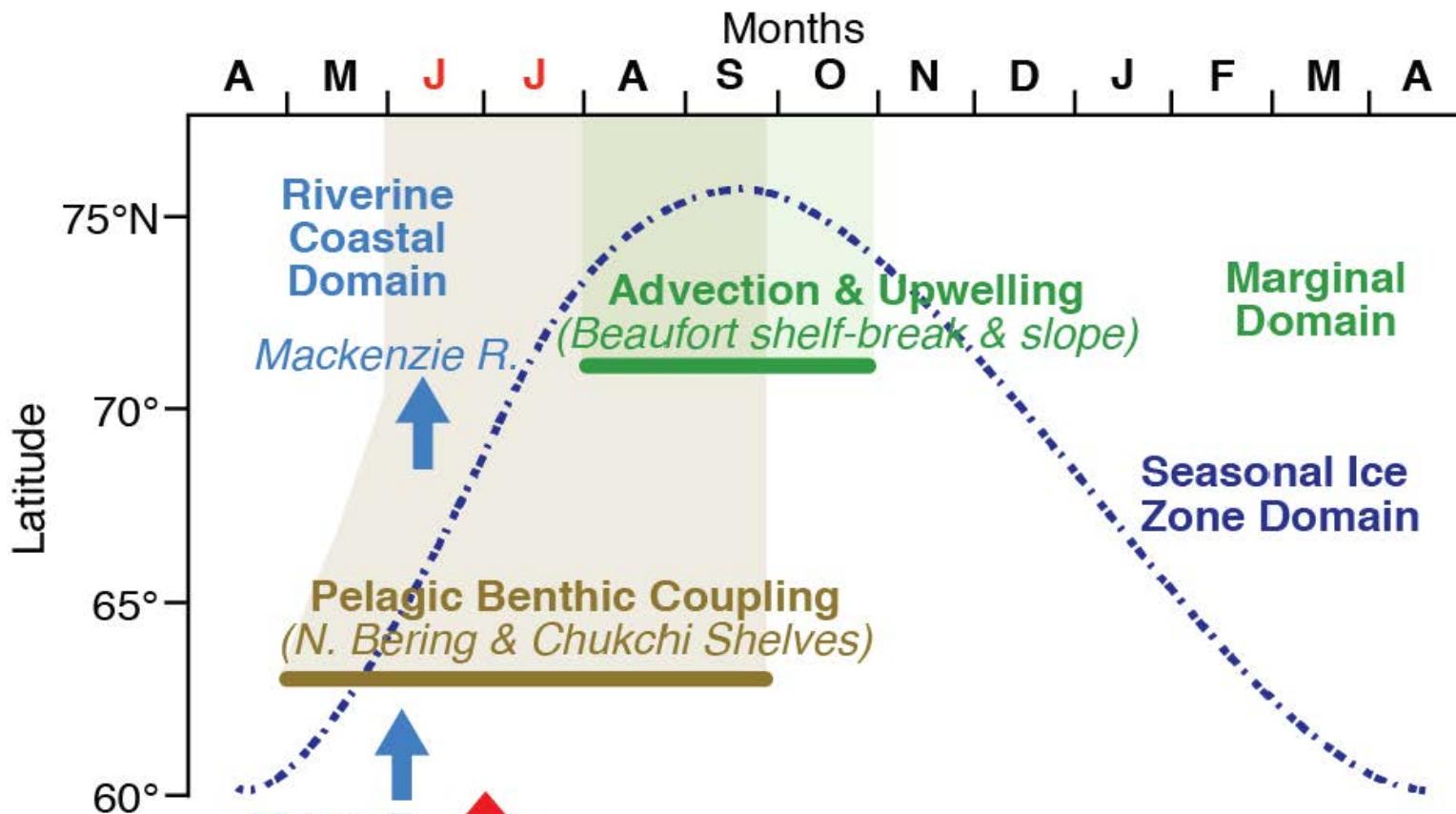
Implications of ocean acidification in the Pacific Arctic: Experimental responses of three Arctic bivalves to decreased pH and food availability

Christina L. Goethel, Jacqueline M. Grebmeier, Lee W. Cooper, Thomas J. Miller

Show more

[Jessica Cross, NOAA]

Arctic Marine Pulses (AMP) Model: the Pacific Arctic Domain

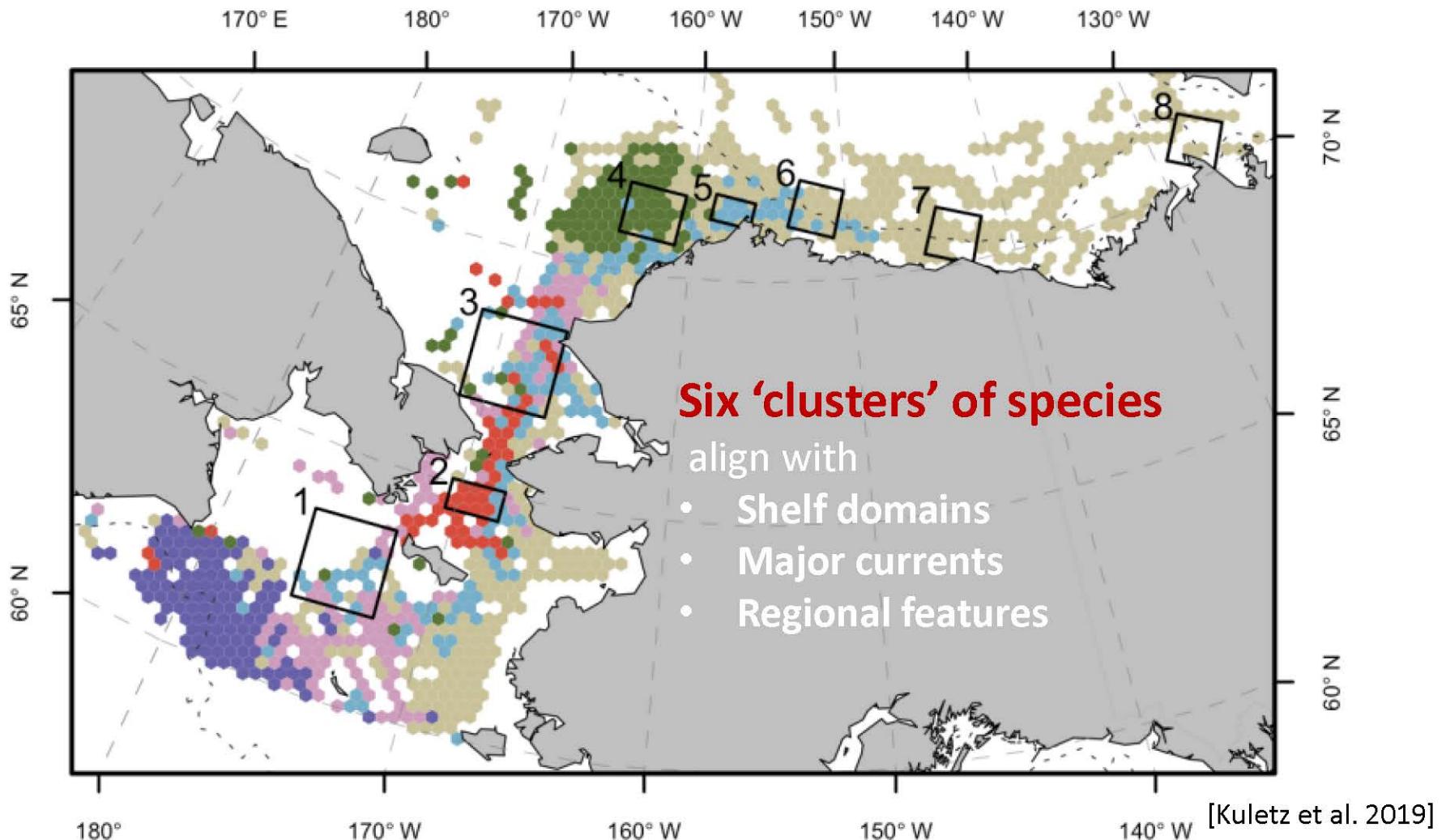


DBO Data and AMP Model

- Pelagic-benthic coupling (P-B): DBO 1-4
- Advection: DBO 1-4 Advection & P-B coupling combined; DBO 5-8 Advection & Upwelling combined, also eddies
- DBO data being used to further develop the AMP model with an aim to predict seasonal variability in ocean processes in the Pacific Arctic over an annual cycle.

Seabird Communities in Pacific Arctic

Cluster Analysis, using at-sea survey data, 2007-2015



Fulmar

Shearwater

TB Murre

Least Auklet

Crested Auklet

Low densities

DBO International Data Policy, approved by partners within PAG in 2015

Distributed
Biological
Observatory

! Group

Group Id: DBO

4 years, 2 months Contributor since
April 17, 2014

1,096 contributions

4,505 downloads

1 members

" ★ Matthew B. Jones
<http://orcid.org/0000-0003-0...>

- DBO data contributions since April 17, 2014
- 1,096 contributions DBO data
- 4,505 downloads of DBO data

DATASETS 11 TO 15 OF 122

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Sort by Most recent

Jacqueline Grebmeier. 2017. Collaborative Research : The Distributed Biological Observatory (DBO)-A Change Detection Array in the Pacific Arctic Region. Arctic Data Center.
urn:uuid:e09c44d9-96b3-4dac-a340-f757e69f3118.

\$ (https://arcticdata.io/metacat/d1/mn/v2/object/resource_map_urn:uuid:e09c44d9-96b3-4dac-a340-f757e69f3118)
23 % & 

Jacqueline Grebmeier. 2017. The Distributed Biological Observatory (DBO) Conductivity-Temperature-Depth (CTD) data from 2010. Arctic Data Center. doi:10.18739/A2Q24W.

\$ (https://arcticdata.io/metacat/d1/mn/v2/object/resource_map_doi:10.18739/A2Q24W) 18 % & 

Carin Ashjian. 2017. Distributed Biological Observatory (DBO), Conductivity-Temperature-Depth (CTD) data along DB05, from 2010 BOW FEST on R/V Annika Marie. Arctic Data Center.
doi:10.18739/A2TV6H.

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Robert Pickart. 2017. Distributed Biological Observatory (DBO), Conductivity-Temperature-Depth (CTD) data along DB05, from 2010 ICESCAPE on the USCGC Healy (HY1001). Arctic Data Center
doi:10.18739/A2ZZJ9S.

\$ (https://arcticdata.io/metacat/d1/mn/v2/object/resource_map_doi:10.18739/A2ZZJ9S) 18 % & 

Kevin Arrigo. 2017. Distributed Biological Observatory (DBO), Conductivity-Temperature-Depth (CTD) data along DB03, from 2010 ICESCAPE on the USCGC Healy (HY1001). Arctic Data Center
doi:10.18739/A23C2N.

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Working Towards an International Pan-Arctic DBO

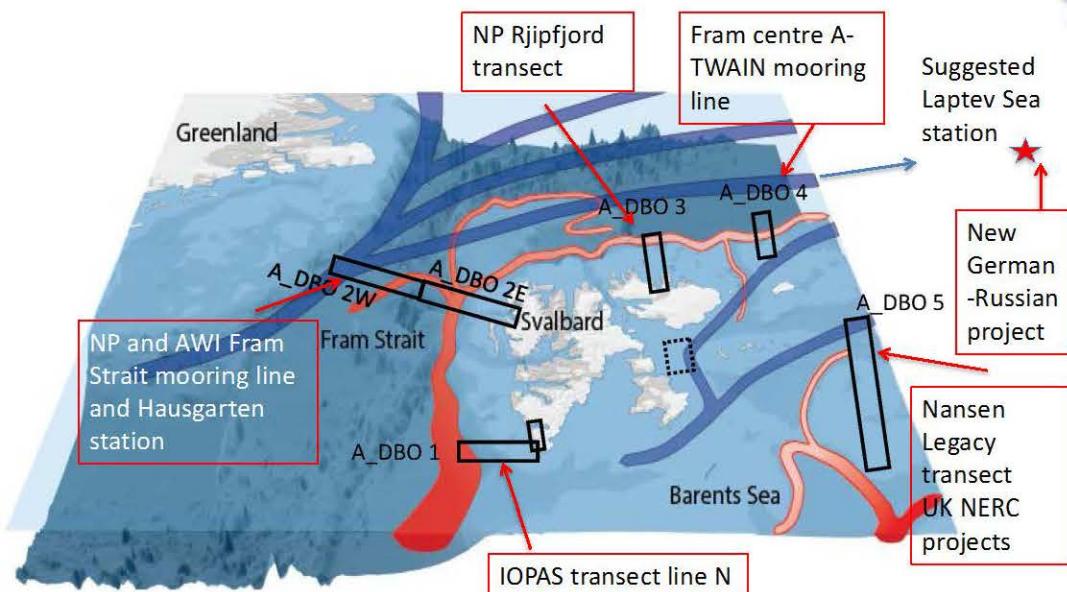
Ex. Atlantic DBO Workshop, November 2016



The Research Council
of Norway

- Norway, Germany, Poland, UK, France, USA
- Physical oceanography, plankton, benthos, vertical flux, molecular studies
- moorings, time series, coordinating initiatives, planned initiatives
- Updated at the 2017 4th DBO data workshop

Suggest five A-DBO transect lines



In addition to moorings in Kongsfjord and Rjipfjord operated by SAMS/UiT

Pending Baffin Bay-Davis Strait DBO area (C. Lee)

Potential Laptev Sea DBO line: Germany and Russia (H Kassens)

Revised location potentially part of NL core transect line

Further information contact:
marit.reigstad@uit.no

Thank you for your attention.

Questions and comments?

Thank you to all Pacific Arctic Region science colleagues and 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/>

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

