

Distributed Biological Observatory (DBO)

Linking Physics & Biology in the Arctic

The Distributed Biological Observatory (DBO): 2015 Updates of Activities and 2016 Data Workshop

Jacqueline M. Grebmeier

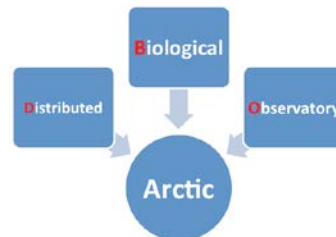
Chesapeake Biological Laboratory

University of Maryland Center for Environmental Science, Solomons, MD, USA

Pacific Arctic Group Fall Meeting

October 28-29, 2015

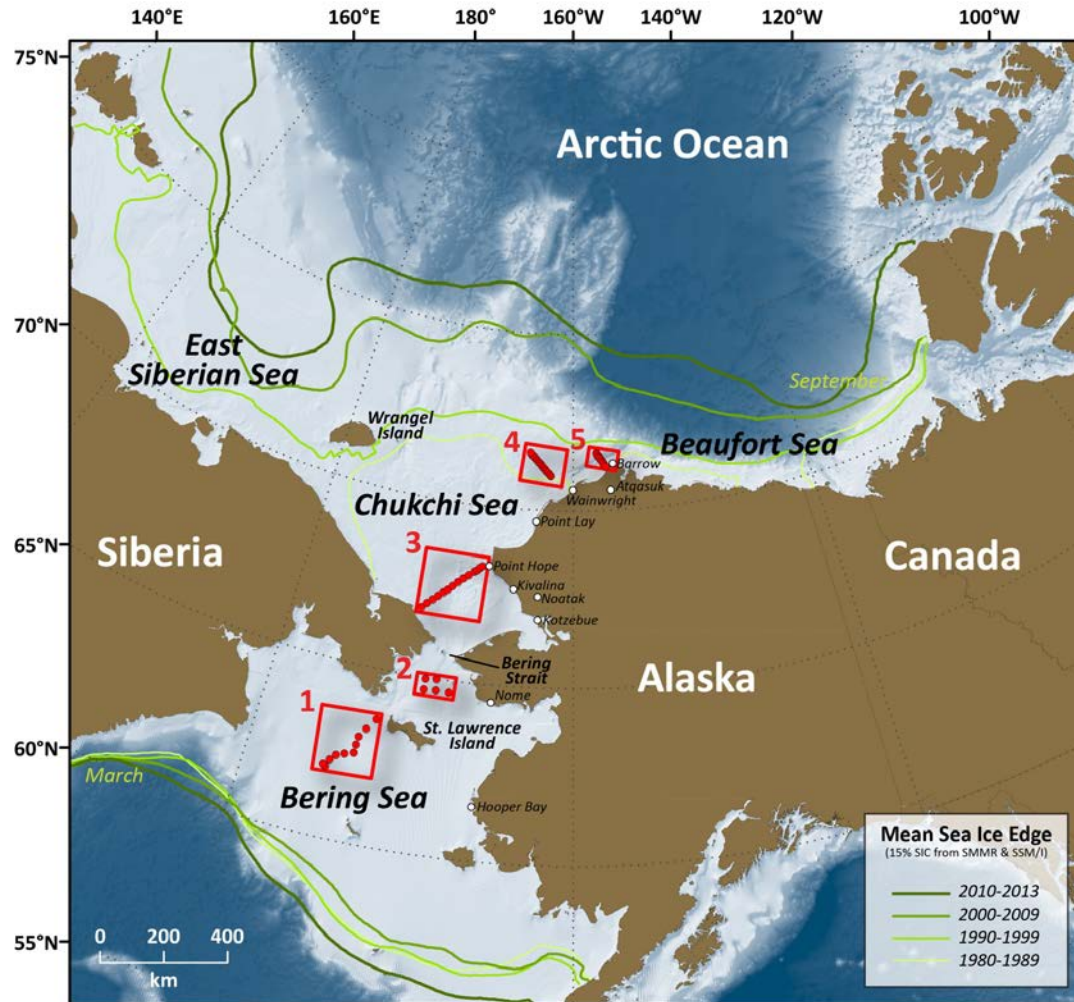
Incheon, South Korea



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



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



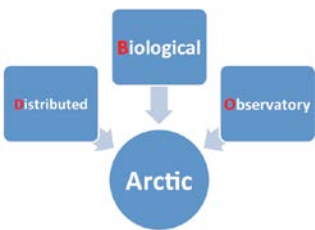
- DBO sites (red boxes) are regional “hotspot” transect lines and stations located along a latitudinal gradient
- DBO sites exhibit high productivity, biodiversity, and/or overall rates of change
- DBO sites serve as a change detection array for consistent monitoring of biophysical responses
- Sites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

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



2015 PAG and DBO Field Season: Sampling Contributors. Projects Key: AON=US Arctic Observing Network; ARCWEST=Arctic Whale Ecology Study; C30=Canada's Three Oceans; JAMSTEC= Japan Agency for Marine-Earth Science and Technology; KOPRI = Korea Polar Research Institute. **DBO Region Key:** DBO1=So. St. Lawrence Is., DBO2=Chirikov Basin, DBO3=So Chukchi Sea, DBO4=NE Chukchi Sea, DBO5=Barrow Canyon, DBO6=East Beaufort Sea, DBO7-Central Beaufort Sea, DBO8=Bathurst Polynya region

Dates (Port calls)	Ship	DBO Region	Projects	PAG contact	Chief Scientist
July 2-8 (Nome-Nome)	Norseman II	3	Bering Strait Mooring Project/AON	Rebecca Woodgate woodgate@apl.washington.edu	Rebecca Woodgate woodgate@apl.washington.edu
July 11-22 (Nome-Nome)	Norseman II	2,3,4	USGS	Jackie Grebmeier jgrebmei@umces.edu	Chad Jay cjay@uscg.gov
July 4-25 (Victoria, BC-Barrow)	Sir Wilfrid Laurier	1,2,3,4,5	C30/DBO	Jackie Grebmeier jgrebmei@umces.edu	Svein Vagle Svein.Vagle@dfo-mpo.gc.ca
July 27-14 Aug	Fairweather	2, 3	CTD sampling	Sue Moore sue.moore@noaa.gov	Noaa.Ship.Fairweather@noaa.gov
July 30-Aug 5 (Prudhoe-Prudhoe)	Norseman II	DBO6,7	ANIMIDA	Jackie Grebmeier jgrebmei@umces.edu	Jeremy Kasper jkasper@alaska.edu
August-Sept (Dutch-Barrow)	Healy	-	GEOTRACES	Jackie Grebmeier jgrebmei@umces.edu	David Kadko dkadko@fiu.edu
Aug 6-Sept 2	Araon	3	Korean Expedition (KOPRI)	Sung-Ho Khang shkang@kopri.re.kr	Eun Jin Yang ejyang@kopri.re.kr
Aug 9-Sept 2 (Prudhoe-Wainwright)	Norseman II	3, 4	AMBON	Jackie Grebmeier jgrebmei@umces.edu	Katrin Iken iken@alaska.edu
Aug 18-Sept 7 (Barrow-Barrow)	Annika Marie	5	AON	Carin Ashjian cashjian@whoi.edu	Carin Ashjian cashjian@whoi.edu
Aug 6-Sept 4 (Kodiak-Dutch Harbor)	Brown	3,4,5	NOAA/PMEL	Phyllis Stabeno Phyllis.Stabeno@noaa.gov	Nancy Kachel Nancy.Kachel@noaa.gov
Aug 25-Oct 6 (Hachinohe, Japan-Dutch Harbor)	Mirai	3,5	JAMSTEC; DBO moorings 3 and 5	Takashi Kikuchi takashik@jamstec.go.jp	Shigeto Nishino nishinos@jamstec.go.jp
mid-October (Anadyr-Anadyr)	Viktor Buynitsky	3	RUSALCA Bering Strait mooring	Kathy Crane Kathy.Crane@noaa.gov Phyllis.Stabeno@noaa.gov	Kathy.Crane@noaa.gov
Sept 4-12 (Wainwright-Wainwright)	Norseman II	4	Winsor gliders	Jackie Grebmeier jgrebmei@umces.edu	Peter Winsor pwinsor@alaska.edu
Sept-Oct	Louis S St-Laurent	-	JOIS	Bill Williams Bill.Williams@dfo-mpo.gc.ca	Bill Williams Bill.Williams@dfo-mpo.gc.ca
Sept-Oct	Sir Wilfrid Laurier	4, 8	C30/DBO	Bill Williams Bill.Williams@dfo-mpo.gc.ca	Humfrey Melling Humfrey.Melling@dfo-mpo.gc.ca
Oct	USCG ship	-	MARES	Robert Pickart rpickart@whoi.edu	Robert Pickart rpickart@whoi.edu



2nd DBO DATA WORKSHOP - FINAL AGENDA

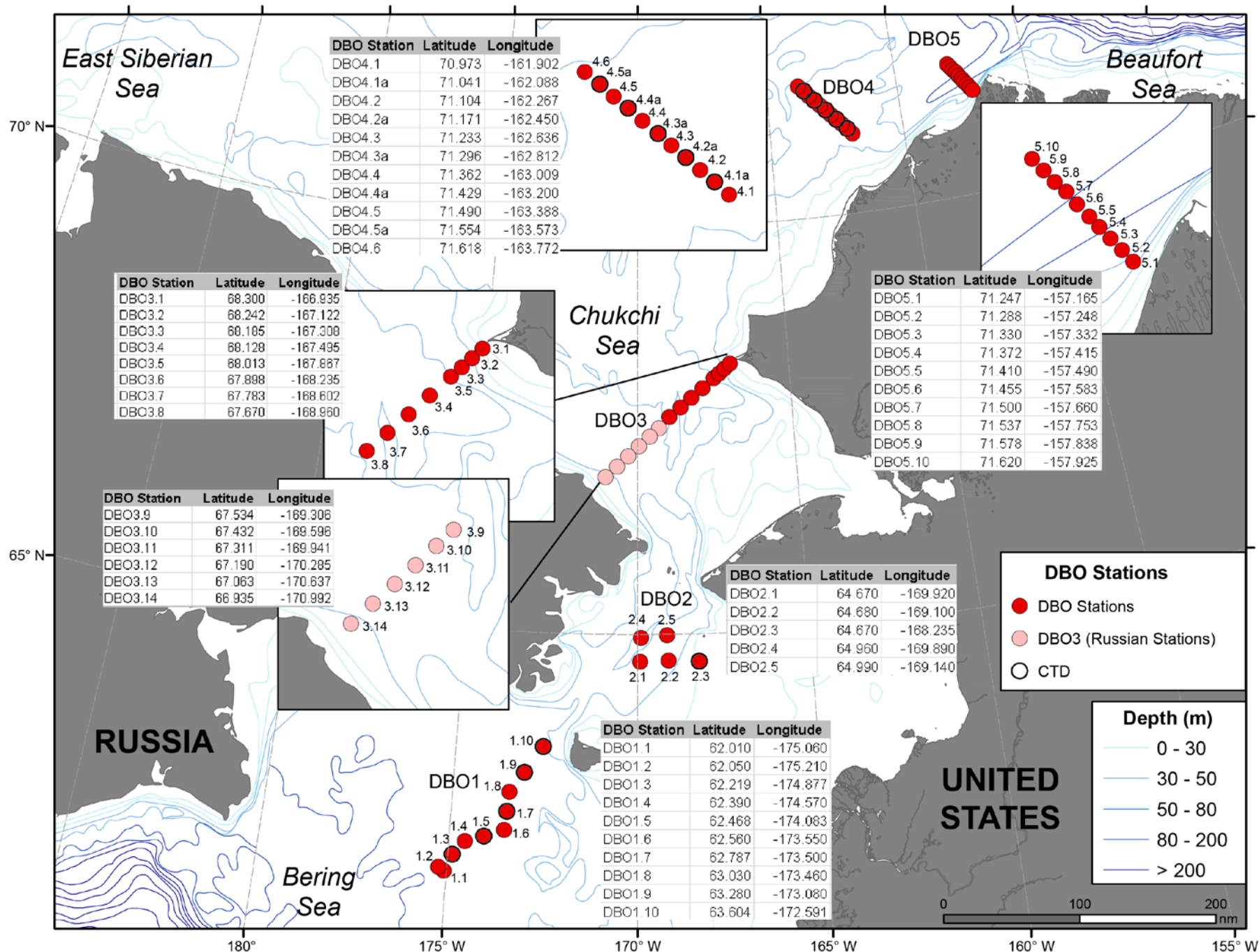
October 29-31, 2014

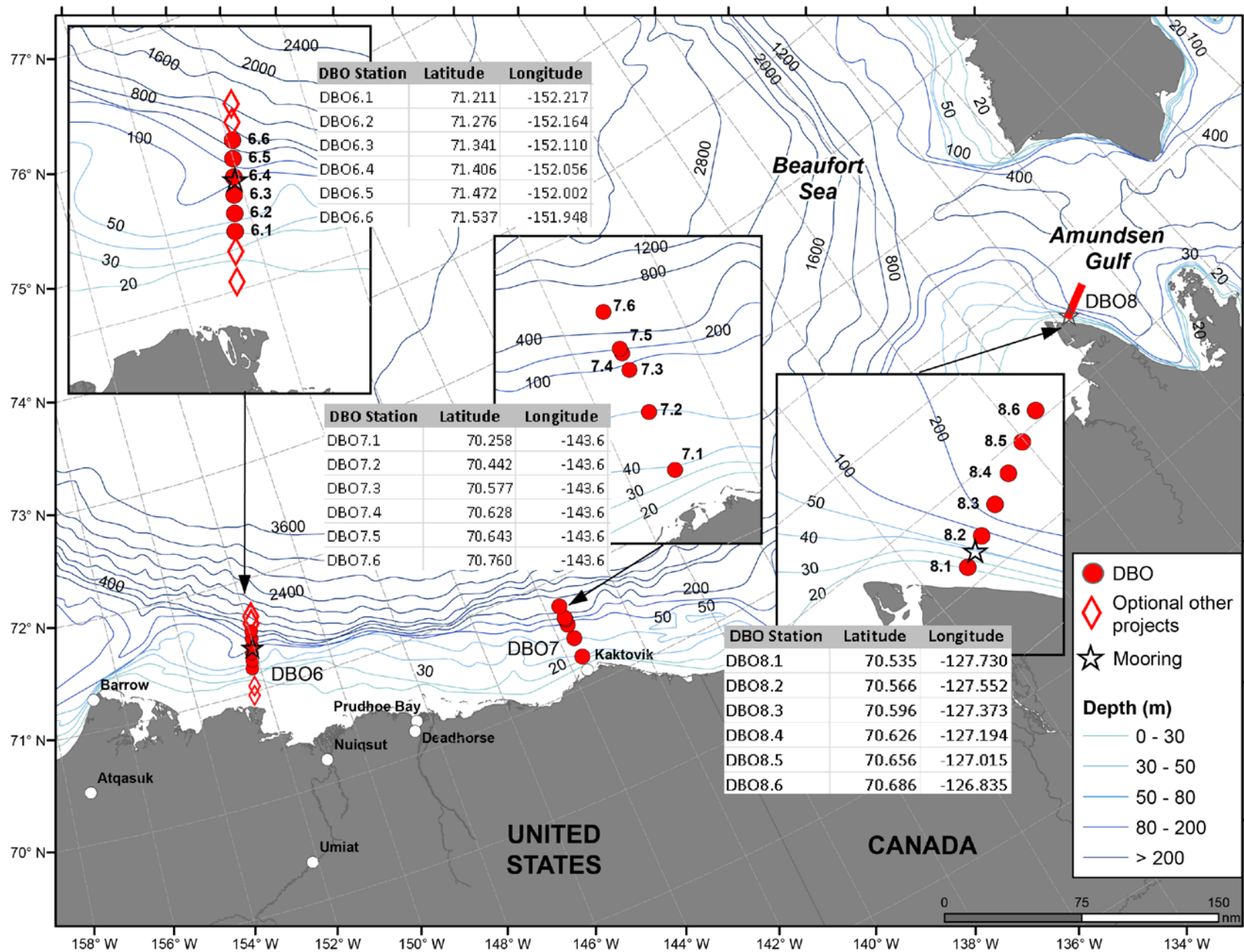


52 participants, 7 countries, all levels of scientists, including early career participants

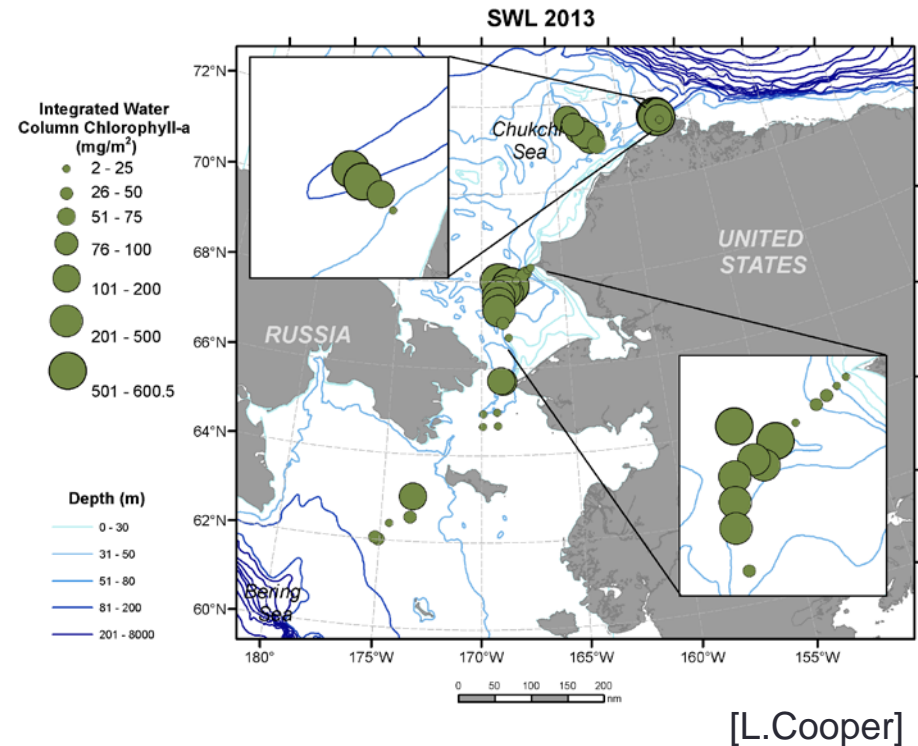
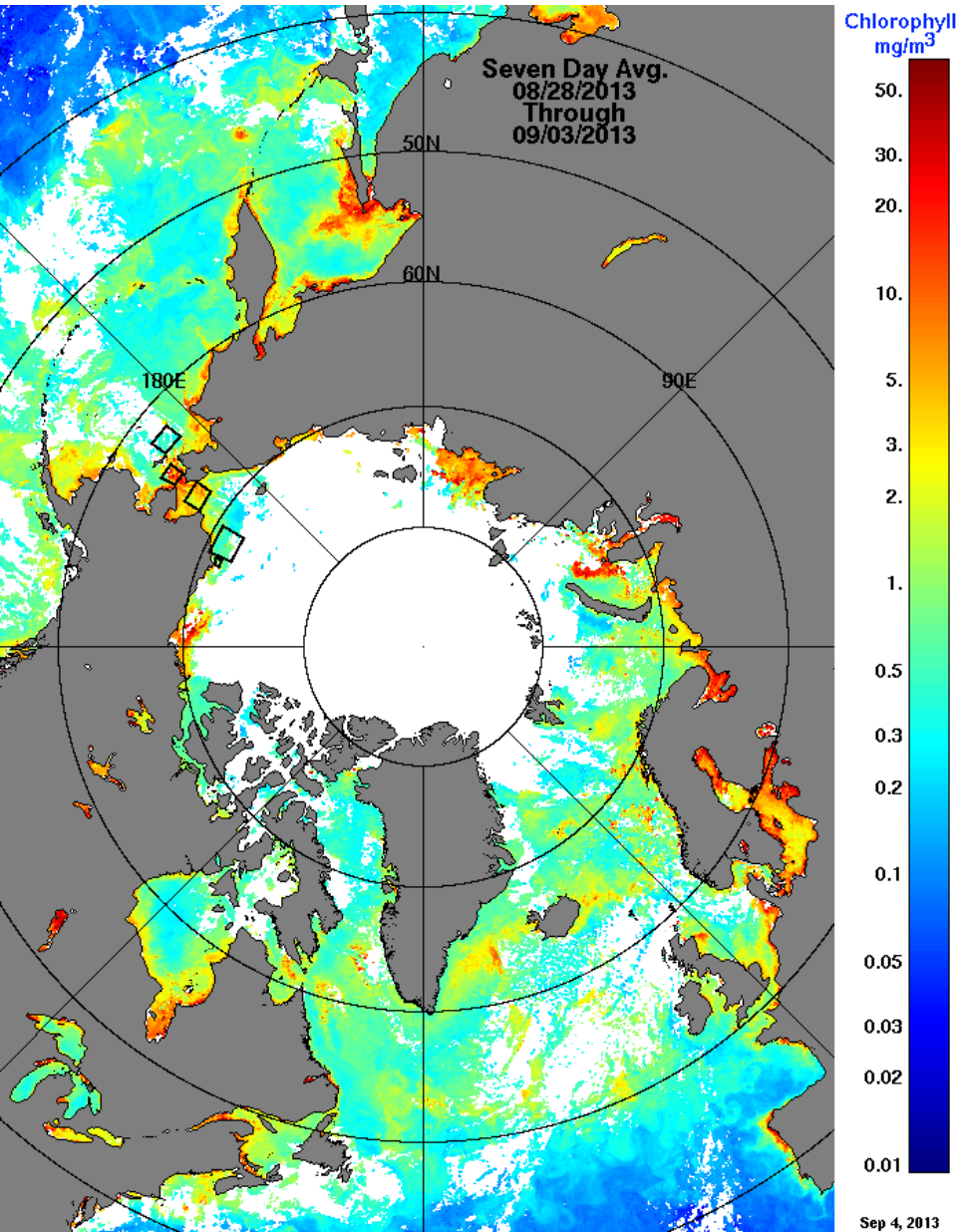
Workshop Overview: We have 4 objectives for this workshop:

- Present results from the 2010-2014 DBO field program and determine a basis for multidisciplinary papers to showcase results of the DBO international effort,
- Evaluate the DBO data submission effort through the AOOS-DBO data workspace, EOL open data site, and discuss linkage to national archives,
- Determine the location of new DBO transect lines in the Beaufort Sea, western Chukchi Sea, and possibly other international lines, such as in the northern Barents Sea, and
- Discuss a plan for full implementation for the DBO.



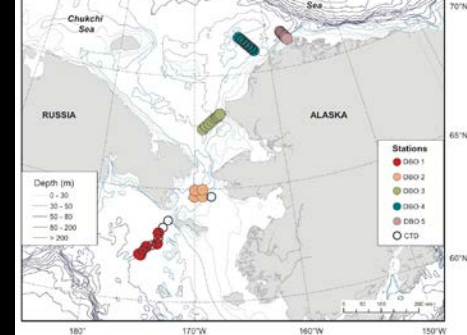


NASA DBO-surface chlorophyll and field collected integrated values



- Highest chl a via satellites and field data in Bering Strait and offshore SE Chukchi Sea DBO3 SE Chukchi Sea hotspot

A Climatology of the DBO Sites



Sea Surface Temperature (AVHRR)

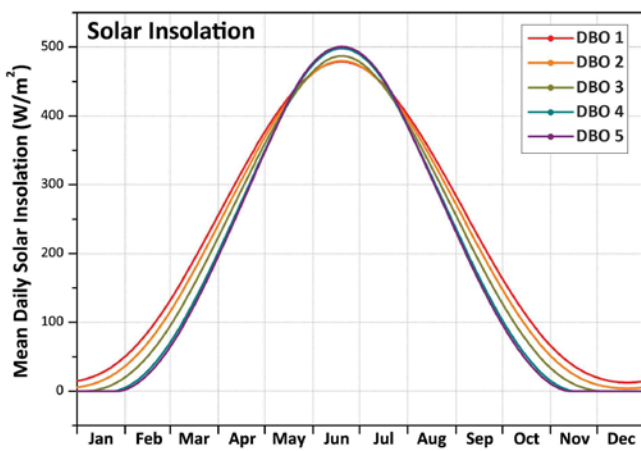
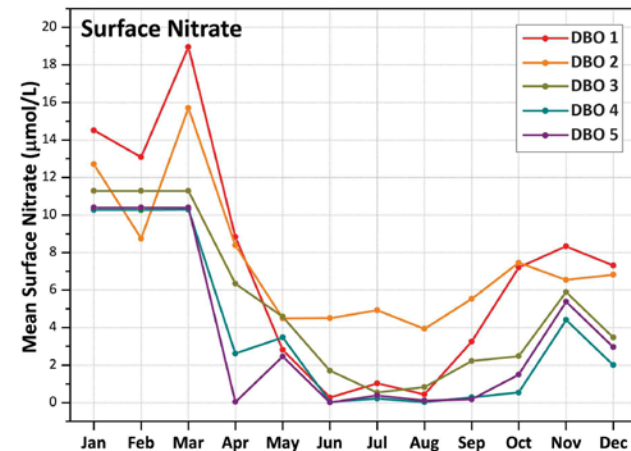
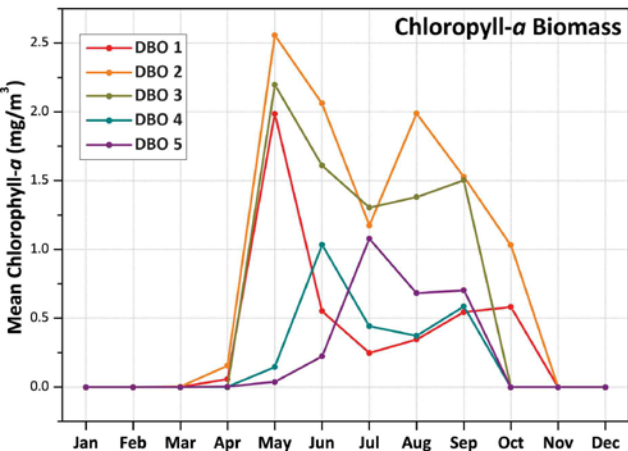
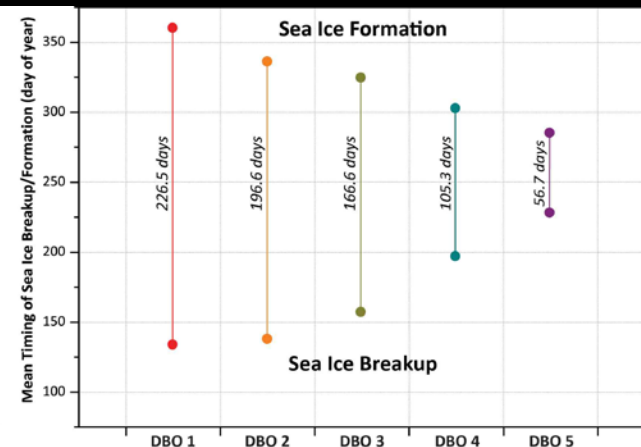
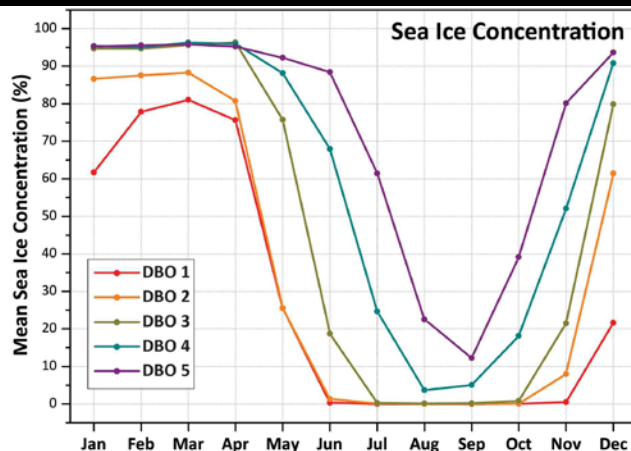
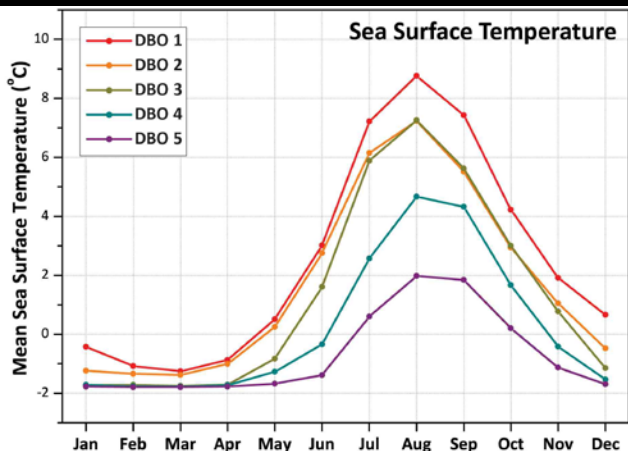
Sea Ice Concentration (SMMR/SSM/I)

Sea Ice Breakup/Formation Timing (SMMR/SSM/I)

Chlorophyll-*a* Biomass (Globcolour)

Surface Nitrate (World Ocean Atlas)

Solar Insolation (NASA)



Distributed Biological Observatory Standardized Sampling Protocols



Core ship-based sampling:

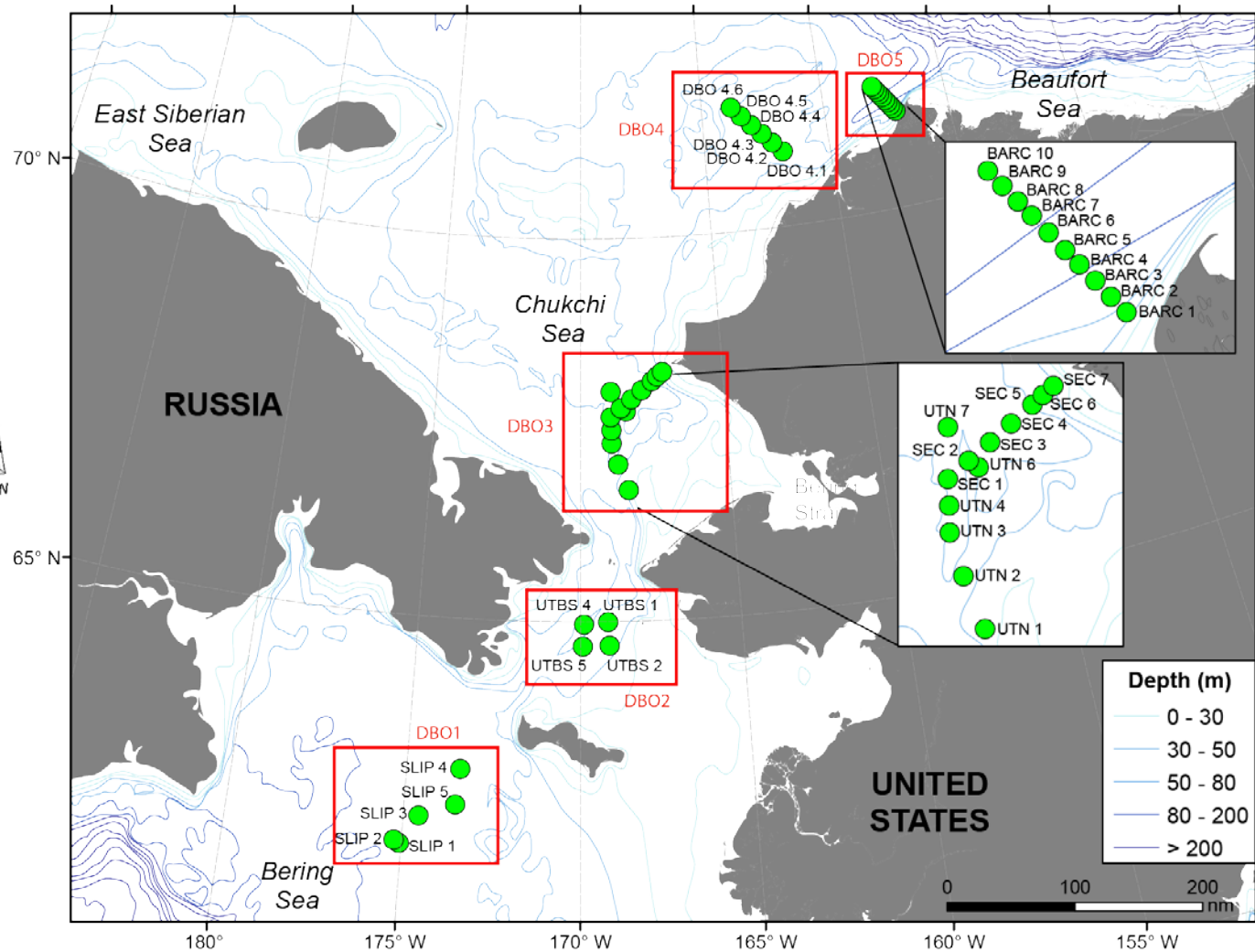
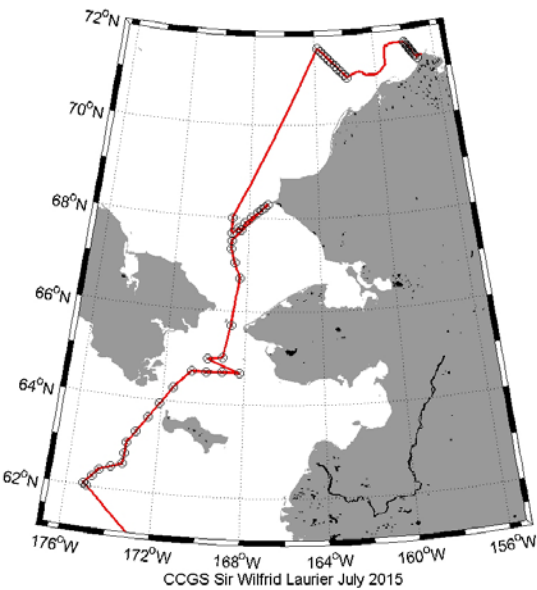
- CTD and ADCP
- Chlorophyll
- Nutrients
- Ice algae/Phytoplankton (size, biomass and composition)
- Zooplankton (size, biomass and composition)
- Benthos (size, biomass and composition)
- Seabird surveys (standard transects)
- Marine mammal surveys (standard transects)

Second tier ship-based sampling:

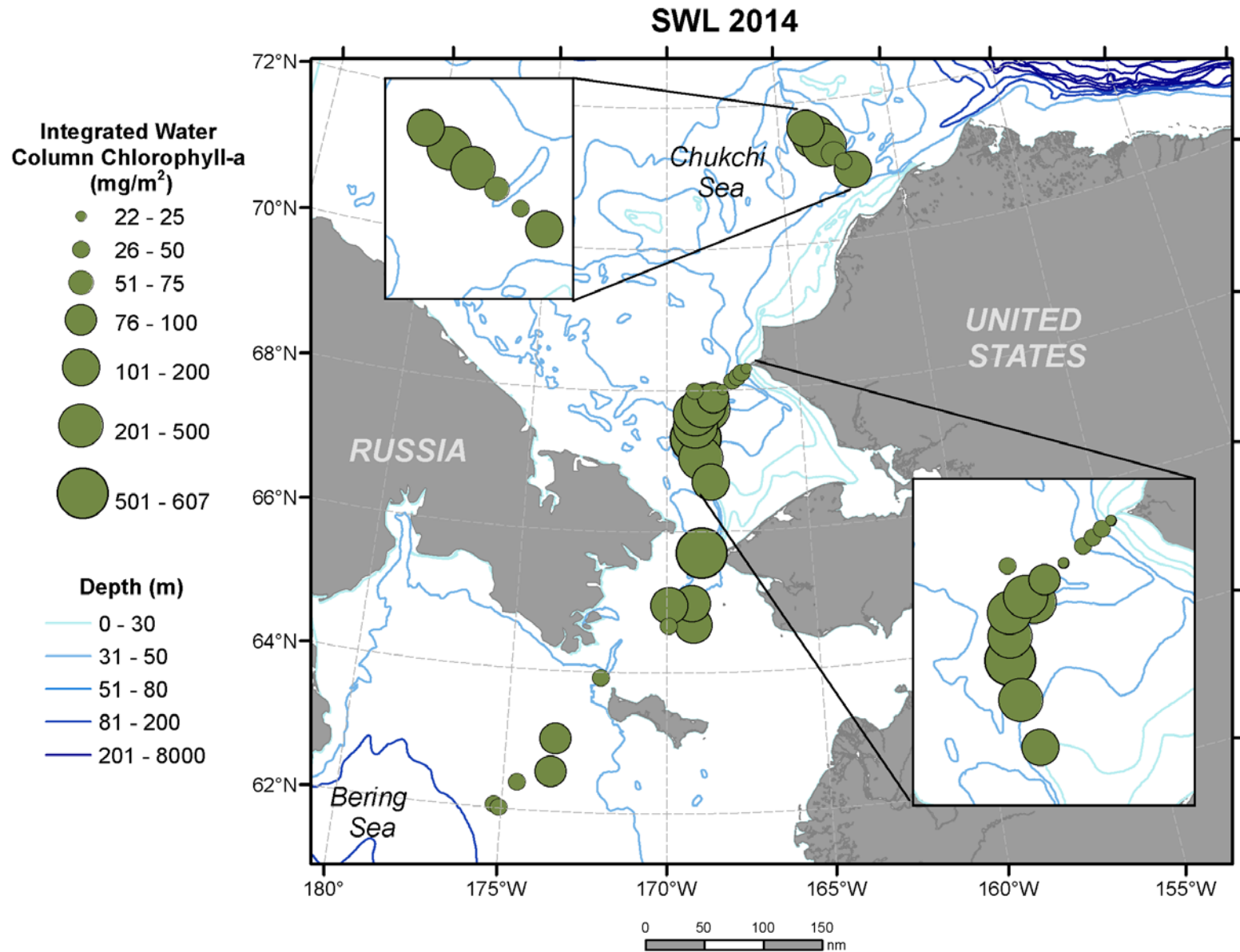
- Fishery acoustics (less effort than standardized bottom trawling)
- Bottom trawling (every 3-5 years)

DBO sampling by national & international science programs

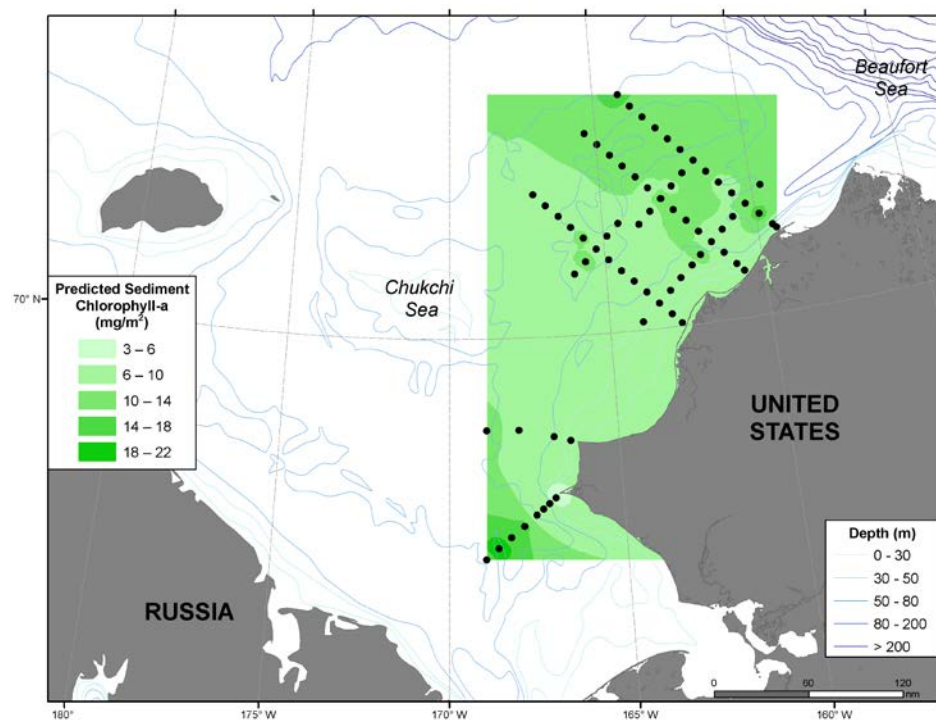
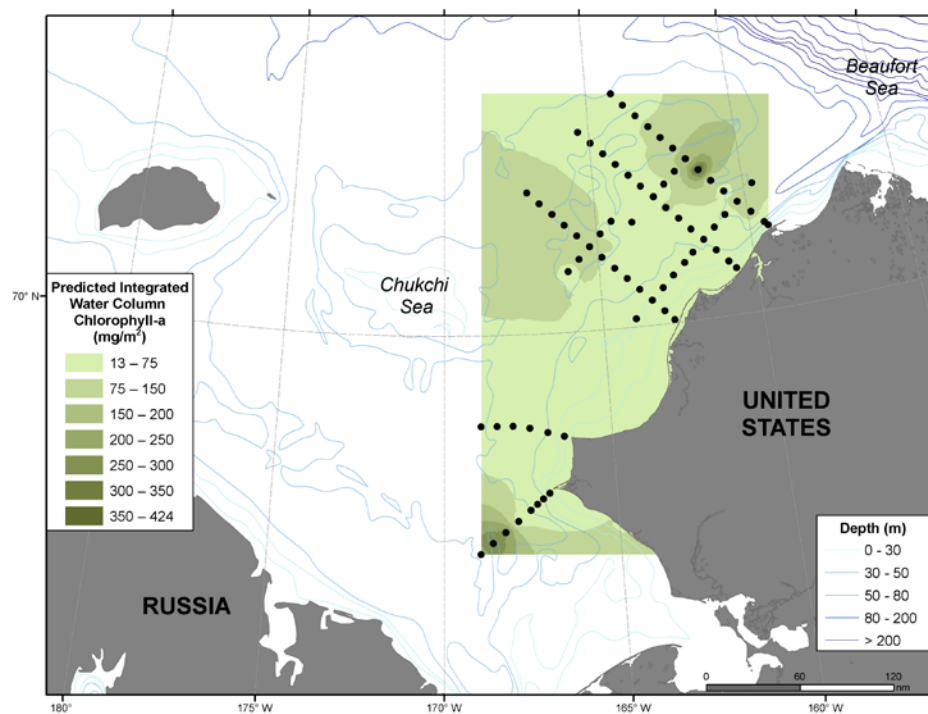
Canada' Three Oceans (C3O) and the Distributed Biological Observatory (DBO)



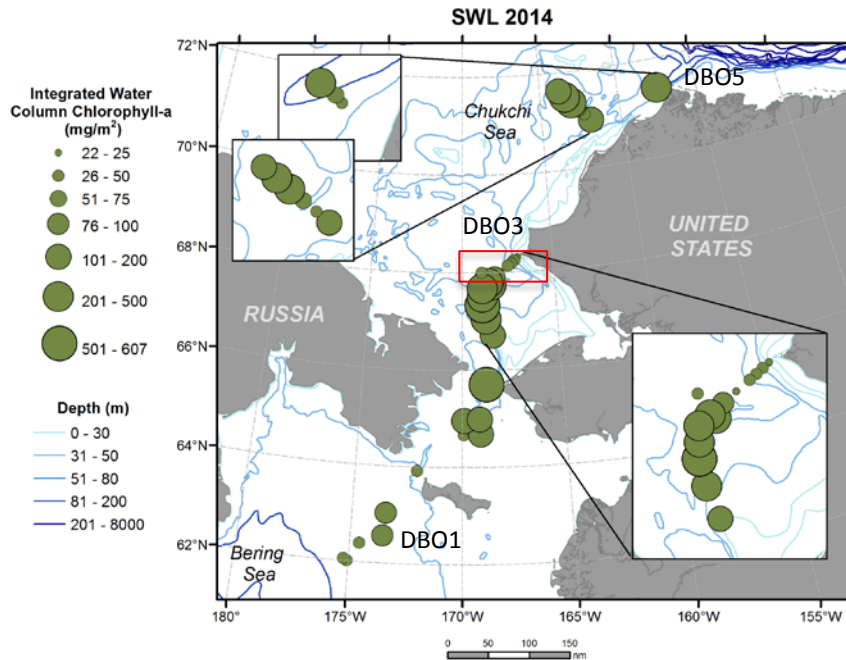
DBO Integrated Chlorophyll a (mg/m²) during July 2014



AMBON2015-Integrated water column chlorophyll a (left) and sediment chlorophyll a (right)



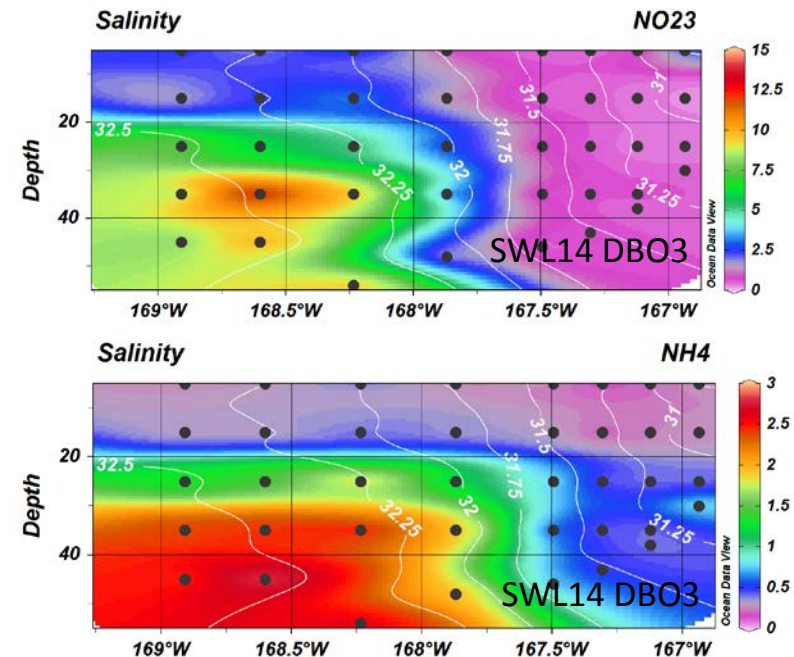
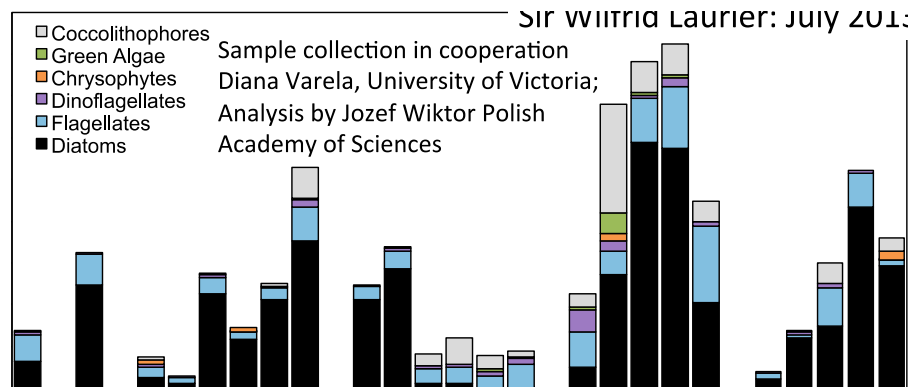
Examples of DBO Data Products



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

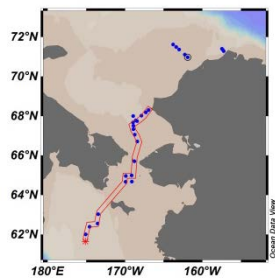
Bottom left: Phytoplankton taxonomy, with dominance by diatoms in western side maintained by nutrient rich Anadyr and Bering Shelf waters

Bottom right: nitrate/nitrite (top panel) and ammonium (bottom panel) (μM)



DBO1, DBO2, BRS, DBO3:

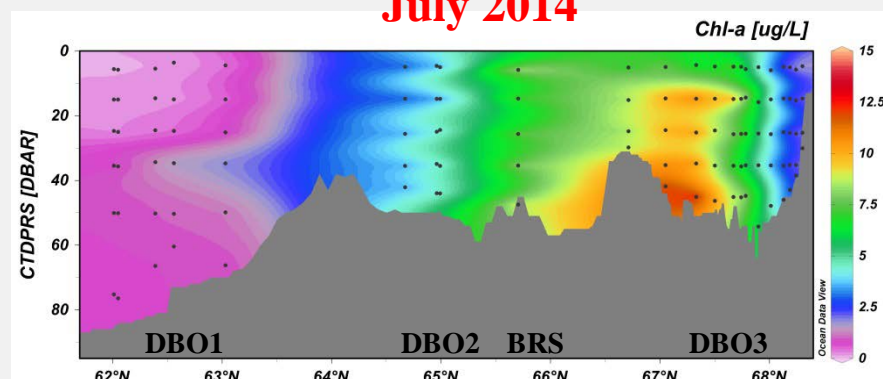
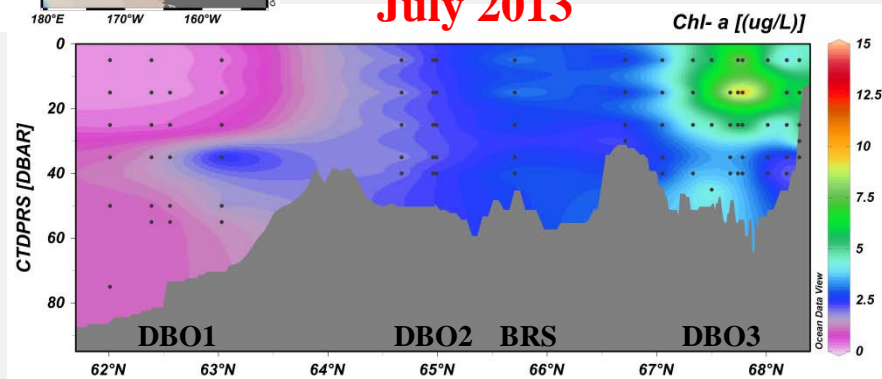
Chlorophyll-a, Pheophytin, Suspended Particulate Matter (SPM)



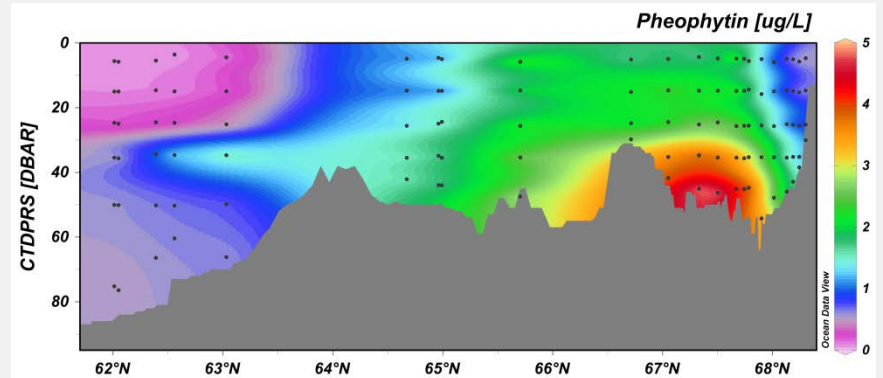
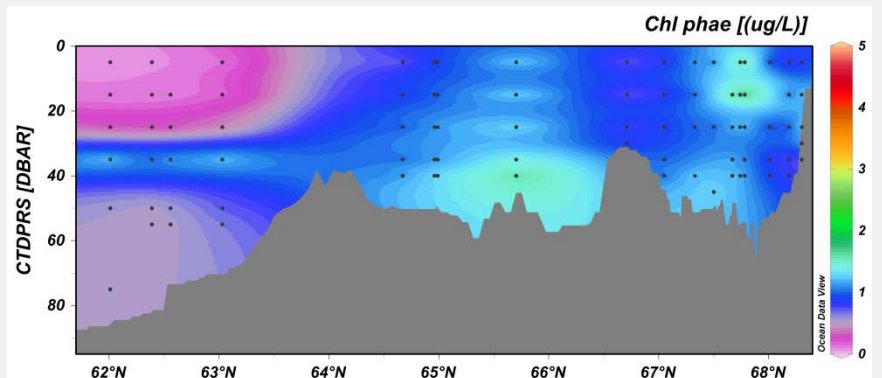
July 2013

July 2014

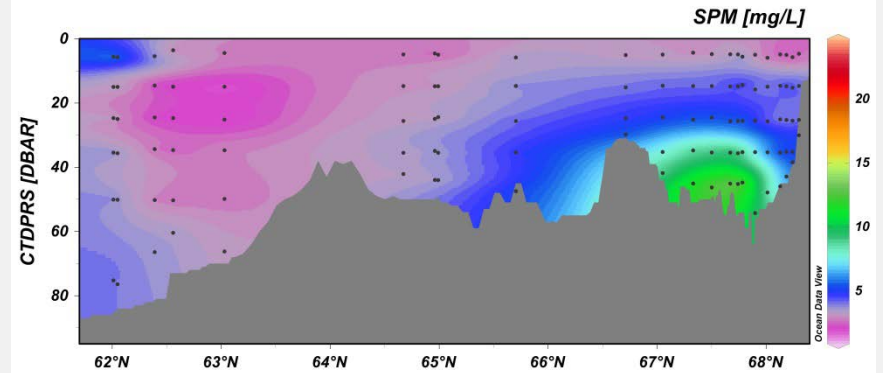
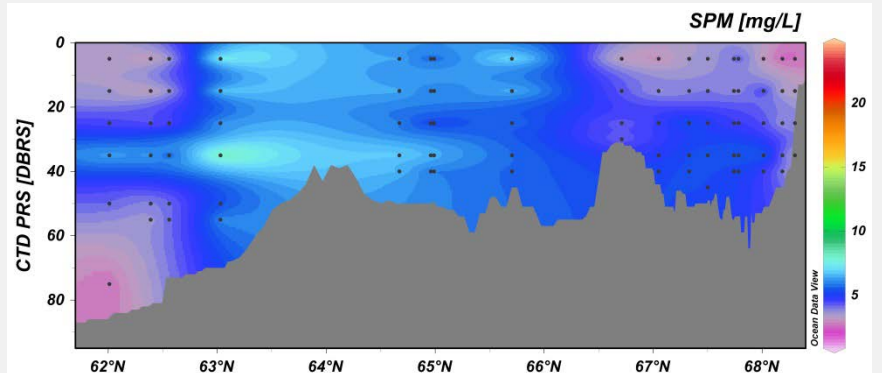
Chlorophyll-a



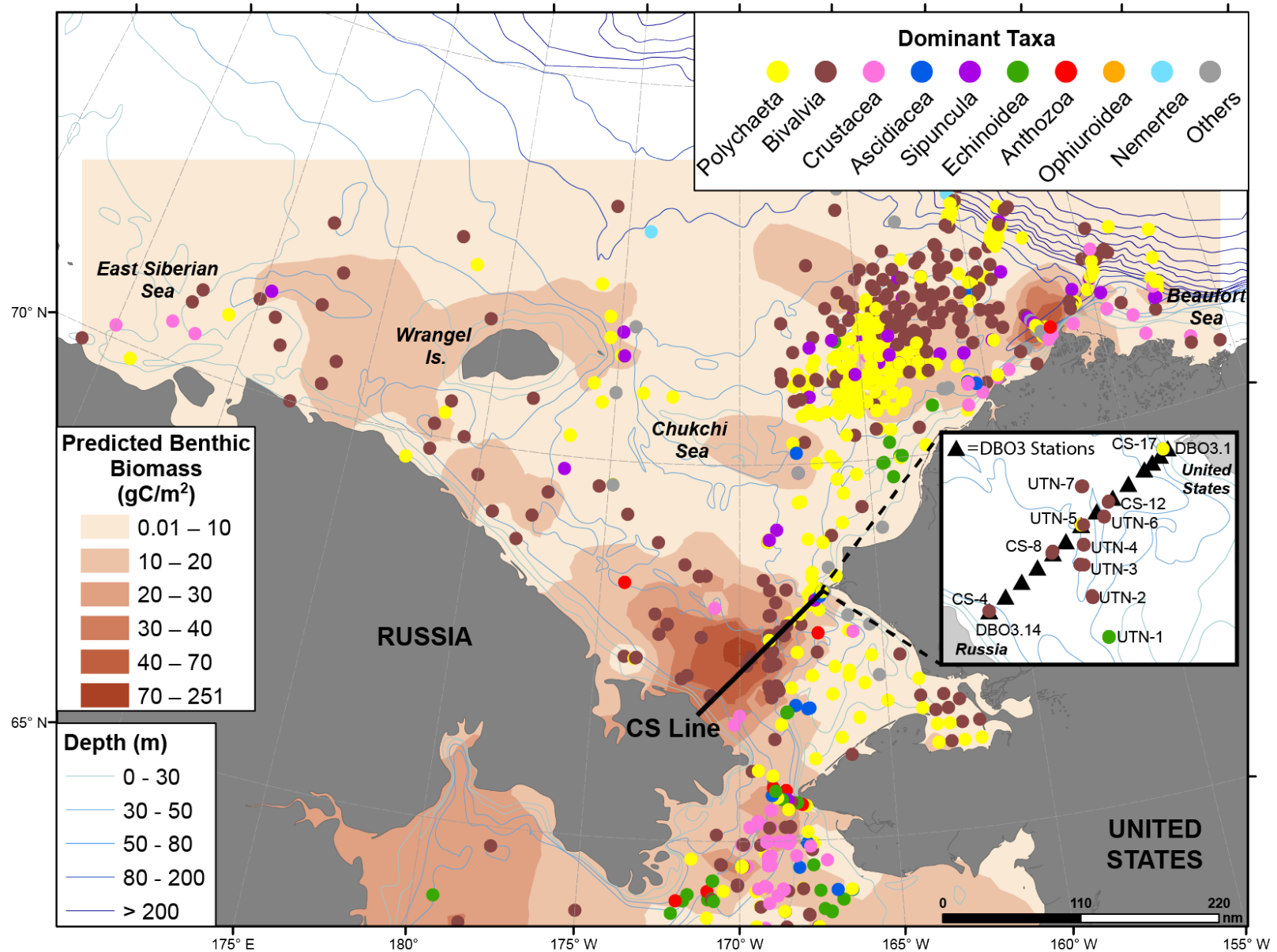
Pheophytin



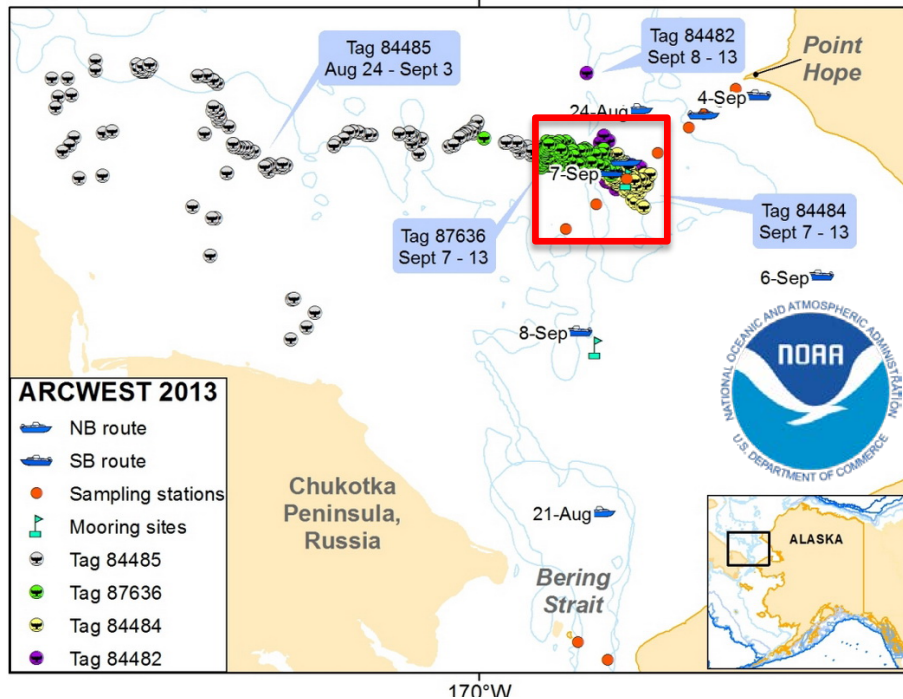
Suspended Particulate Matter (SPM)



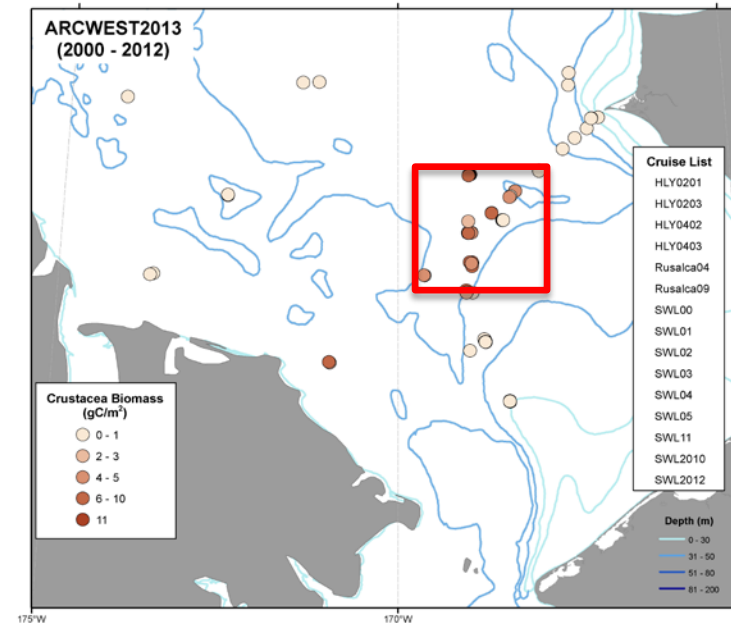
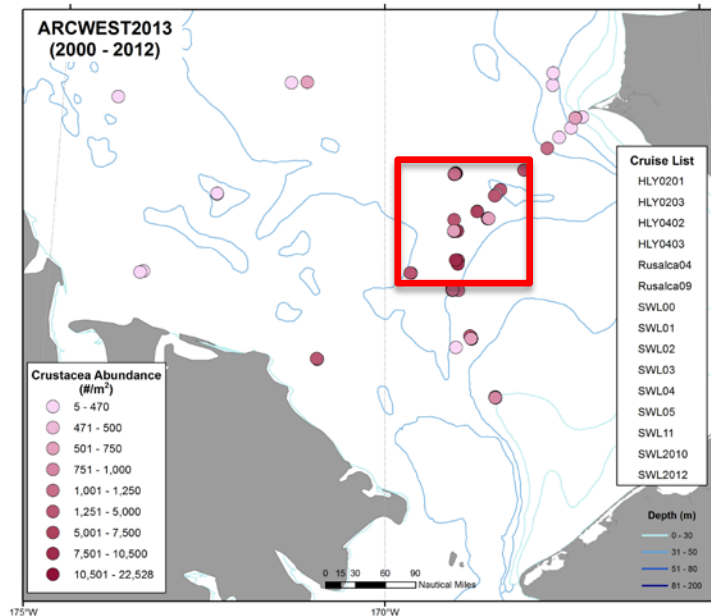
Broad-scale benthic biomass in the Northern Bering and Chukchi Seas, 1977-2012

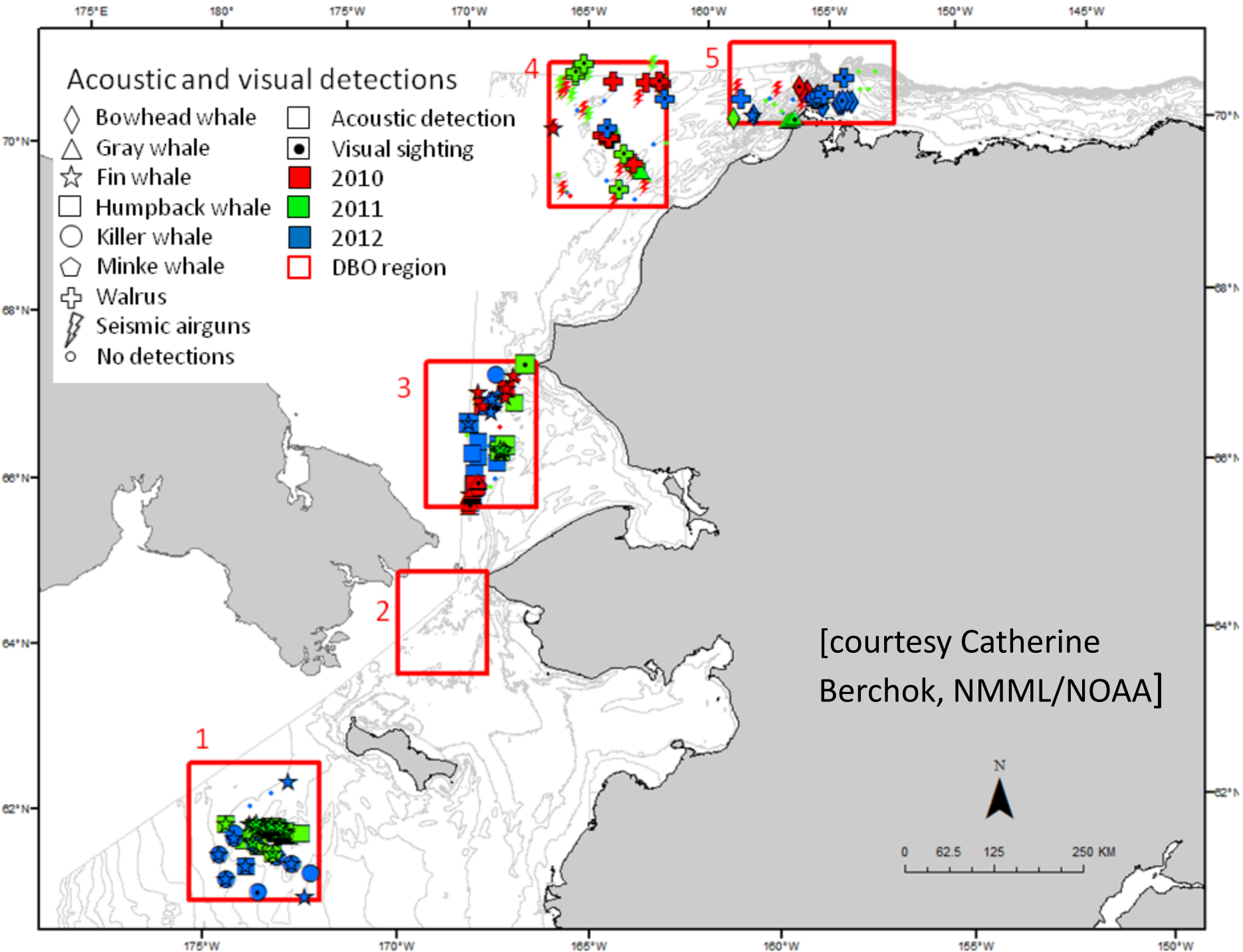


Tagged gray whales and benthic crustaceans-SE Chukchi Sea



- Tagged gray whales in DBO SE Chukchi Sea hotspot; then moved westwards (NOAA)
- Benthic crustaceans highest abundance and biomass in hotspot and to the SW off Russian coast, lower westward and eastward (Grebmeier)





Project View: AOOS DBO workspace for all participants in program

AOOS Ocean Workspace Distributed Biological Observatory Search... Jackie Grebmeier

Create a project

Notices

ALL (7)

MY PROJECTS 0

- Cruise Reports 16 Chris Mar 25
- DBO1 — St. Lawrence Island 14 Chris Mar 25
- DBO2 — Northern Bering Sea 5 Chris Mar 25
- DBO3 — Southern Chukchi Sea 18 Chris Mar 25
- DBO4 — Central Chukchi Sea 37 Chris Apr 01
- DBO5 — Barrow Canyon 26 Chris Mar 25
- DBO Presentations & Administrative Documents 6 Chris Jan 23

Latest activity

- 3 days ago Jerry added 20 files DBO4 — Central Chukchi Sea CSESP_PLK_BIOMAS... CSESP_PLK_Biomass... CSESP_PLK_ABUNDA... And 17 more...
- 7 days ago Jerry joined the group.
- 7 days ago Christie joined the group.
- 10 days ago Jackie added 8 files Cruise Reports DBO1-5 map Grebmeier ... 5 DBO sta GPS Mar 25

- in each DBO region folder is a listing of common data parameters
- drop and load capability with metafile

- Steamlines working access for DBO participants, but short-term password protected
- Retains continued use national data archives
- In process to develop visualization tools
- Data migrate to long-term archive



Data Access
About
Archive Summary
How to Submit
Data
Writing a Readme

Distributed Biological Observatory

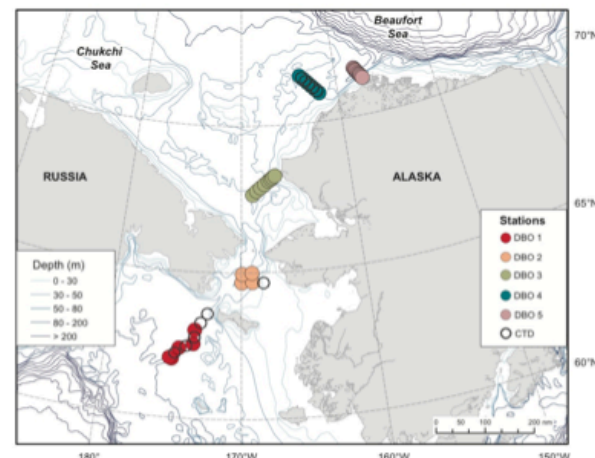
A Data Archive Linking Physics & Biology

NEW! Submit Data

Welcome to the Distributed Biological Observatory Data Archive!

The data archive for the Distributed Biological Observatory (DBO) is envisioned as a change detection array along a latitudinal gradient extending from the northern Bering Sea to the Barrow Arc. DBO sampling is focused on transects centered on locations of high productivity, biodiversity and rates of biological change. The DBO sampling framework was initially tested during the successful 2010 Pilot Study, which consisted of international ship occupations of two of the DBO sites, one in the SE Chukchi Sea and one across upper Barrow Canyon. The DBO is specifically included in the draft US National Ocean Policy Strategic Plan. In addition, the Marine Working Group of the International Arctic Science Committee (IASC) has endorsed the DBO and is supporting similar activities in the Atlantic sector of the Arctic. The U.S. Interagency Arctic Research Policy Committee (IARPC), comprised of representatives from 13 Federal agencies, developed a five year plan (2013-2017) focused on seven research themes, with further development of the DBO included under the first theme: Sea ice and Marine Ecosystems.

The DBO IT is now focused on bringing together data from 2010-2013 sampling efforts, to demonstrate the value-added of this national and international, sampling shared-data approach to the investigation of biological responses to a rapidly changing Arctic marine ecosystem. Expanding from the Pacific Arctic sector, the DBO will also serve as a framework for international research coordination via the Arctic Council Circumpolar Biodiversity Monitoring Program (CBMP), and is recognized as a task of the pan-arctic Sustaining Arctic Observing Network (SAON) program.



The area of interest and specific station sites for the Distributed Biological Observatory.



Data Access
About
Archive Summary
How to Submit
Data
Writing a Readme

Distributed Biological Observatory

A Data Archive Linking Physics & Biology

NEW! Submit Data

Transect

- ☐ Barrow Canyon
- ☐ Chirikov Basin
- ☐ NE Chukchi Sea
- ☐ Southern Chukchi Sea
- ☐ Southern St. Lawrence

Researcher

- ☐ Bob Day
- ☐ Catharine Berchok
- ☐ Doug Daisher
- ☐ Ian Hartwell
- ☒ Jackie Grebmeier
- ☐ Jeff Napp

Vessel

Year

Months

Keywords

Filters: Jackie Grebmeier

Dataset Title	Author/Researcher	Transect	Vessel	Dates	Comments
Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) Hanna Shoal 2010	Grebmeier, Jacqueline M.	Southern Chukchi Sea Barrow Canyon	R/V Moana Wave	2010-07-24 to 2010-08-12	The data set is in Progress.
Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) Hanna Shoal 2012	Grebmeier, Jacqueline M.	NE Chukchi Sea Barrow Canyon	USCGC Healy	2012-06-05 to 2012-08-25	The data set is in Progress.
Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) Hanna Shoal 2013	Grebmeier, Jacqueline M., Lee Cooper, Tom Weingartner	Barrow Canyon	USCGC Healy	2013-07-29 to 2013-08-15	The data set is in Progress.
Canada's Three Oceans (C3O) - DBO 2010	Grebmeier, Jacqueline M., Svein Vagle	Southern Chukchi Sea Barrow Canyon	CCGS Sir Wilfrid Laurier	2010-07-06 to 2010-07-22	Created on 2014-10-28.
Canada's Three Oceans (C3O) - DBO 2011	Grebmeier, Jacqueline M., Svein Vagle, Robert Fudge	Southern Chukchi Sea Barrow Canyon	CCGS Sir Wilfrid Laurier	2011-07-06 to 2011-07-21	The data set is in Progress.
Canada's Three Oceans (C3O) - DBO plus Japan Agency for Marine-Earth Science and Technology (JAMSTEC) DBO moorings 2013	Grebmeier, Jacqueline M., Takashi Kikuchi, Svein Vagle	Southern St. Lawrence Island Chirikov Basin Southern Chukchi Sea NE Chukchi Sea Barrow Canyon	CCGS Sir Wilfrid Laurier	2013-07-04 to 2013-07-25	The data set is in Progress.
Canada's Three Oceans (C3O) - DBO plus Japan Agency for Marine-Earth Science and Technology (JAMSTEC) DBO moorings 2014	Vagle, Svein, Jacqueline M. Grebmeier, Takashi Kikuchi	Southern St. Lawrence Island Chirikov Basin Southern Chukchi Sea NE Chukchi	CCGS Sir Wilfrid Laurier	2014-07-04 to 2014-07-23	The data set is in Progress.



Data Access
About
Archive Summary
How to Submit
Data
Writing a Readme

Distributed Biological Observatory

A Data Archive Linking Physics & Biology

Switch to Geographical View

Filters:

Transect

- ☐ Barrow Canyon
- ☐ Central Chukchi Sea
- ☐ Chirikov Basin
- ☐ Southern Chukchi Sea
- ☐ Southern St. Lawrence

Researcher

Vessel

Year

Month

Dataset Title	Author/Researcher	Transect	Vessel	Keywords
AON	Carin Ashjian	Barrow Canyon	Annika Marie	
AON	Robert Pickart	Barrow Canyon	Healy	
BOWFEST	Carin Ashjian	Barrow Canyon	Annika Marie	chlorophyll, marine mammal survey, nutrients, zooplankton
CHAOZ	Catherine Berchok, Phyllis Stabeno, Jeff Napp, Sue Moore	Barrow Canyon	Mystery Bay	marine mammal survey, zooplankton
Shell - Conoco Phillips Environmental Program	Tom Weingartner, Bob Day, John Burns	Barrow Canyon	Westward Wind	
AON	Robert Pickart	Barrow Canyon	Healy	nutrients, seabird surveys
Conoco Phillips - Shell - Statoil Environmental Program (CESP)	Bob Day	Central Chukchi Sea	Westward Wind	

DBO Data Policy

- “DBO distributed data archive” is defined as a set of distributed international data centers with a commitment to long-term data stewardship
- In the USA, The DBO EOL data archive (<http://dbo.eol.ucar.edu>) is the designated site for submission of a generic metadata file that identifies the standard DBO
- This template may be linked from other sites that are supporting the DBO effort (e.g., the Alaska Ocean Observing System (AOOS) DBO workspace).
- The DBO can serve as a framework for international research coordination, specifically as being part of the Arctic Council Circumpolar Biodiversity Monitoring Program ([CBMP](#)) and is a recognized task of the pan-Arctic Sustaining Arctic Observing Networks ([SAON](#)) program, facilitated by the Arctic Council

Suite of selected DBO data types and parameters

- 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 trap
- 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 (SLP)
- Other (a text entry): model output, other parameters being collected on DBO lines, but not a core DBO measurement listed above.

3rd DBO DATA WORKSHOP BRIEF AGENDA

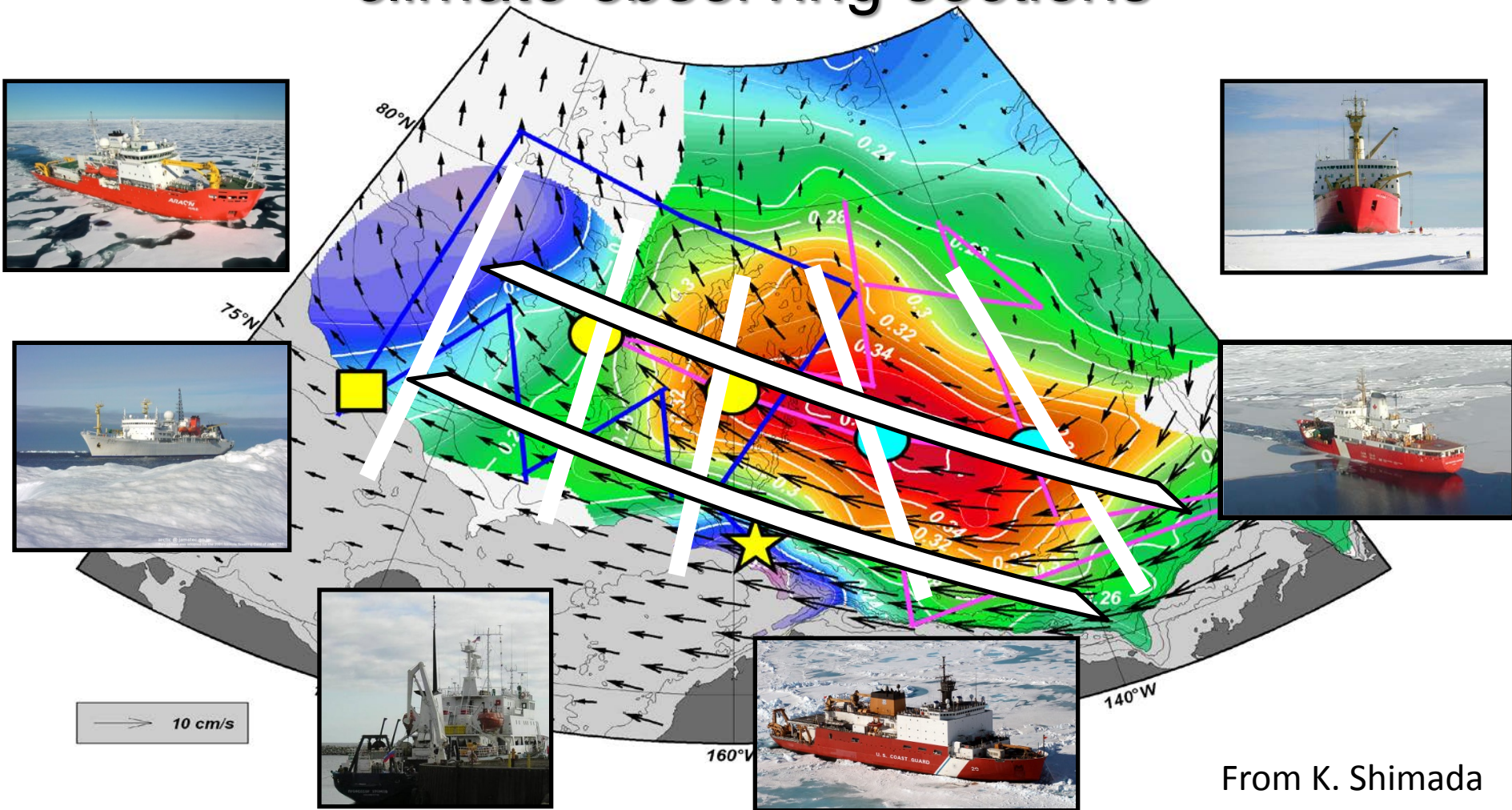
March 8-10, 2016

PMEL/NOAA, Seattle, Washington, USA

Workshop Overview: We have 4 objectives for this workshop:

1. Present results from the 2010-2015 DBO field program, in context if papers to showcase results of the DBO international effort
2. Overview DBO data submission effort through the EOL open data site
3. Evaluate results new DBO transect lines in the Beaufort Sea, planned western Chukchi Sea, and developing northern Barents Sea, and
4. Future efforts

Proposed international Pacific Arctic climate observing sections



Background color: dynamic height at 100dbar relative to 800dbar from Mirai and Louis S. St-Laurent 2008 cruises (Oceanic Beaufort Gyre)

Black vectors: average sea ice motion vectors for Nov. 2007- Apr. 2008 (Sea Ice Beaufort Gyre)

Symbols: Mooring array in 2012-2013 (TUMSAT/KOPRI/NIPR & WHOI)

