

# Distributed Biological Observatory (DBO)

*Linking Physics & Biology in the Arctic*

## The Distributed Biological Observatory (DBO): 2014 Updates of Activities and Data Workshops

Jacqueline M. Grebmeier

Chesapeake Biological Laboratory

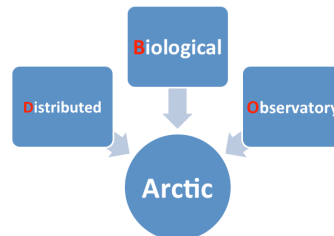
University of Maryland Center for Environmental Science, Solomons, MD, USA

Pacific Arctic Group

October 28-29, 2014

PMEL/NOAA

Seattle, Washington, USA



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



# DBO UPDATE OUTLINE

- Introduction of agenda 2<sup>nd</sup> DBO data workshop, Oct 29-31, 2014
- Brief highlight science findings from the DBO pilot program 2010-2014
- Establishing new DBO lines in Beaufort Sea, NW Chukchi Sea, N Barents Sea
  - Beaufort Sea region (Jackie Grebmeier)
  - NW Chukchi Sea (Kathy Crane/RUSALCA)
  - Northern Barents Sea (Lis Lindal Jørgensen, Institute of Marine Research, Tromsø, Norway)
- DBO AXIOM workspace and EOL archive, DBO and PAG data metadata policy
- Plans for DBO publications and 2015 field activities
- Future Earth Science Cluster Network update (Sue Moore)

# 2<sup>nd</sup> DBO DATA WORKSHOP BRIEF AGENDA

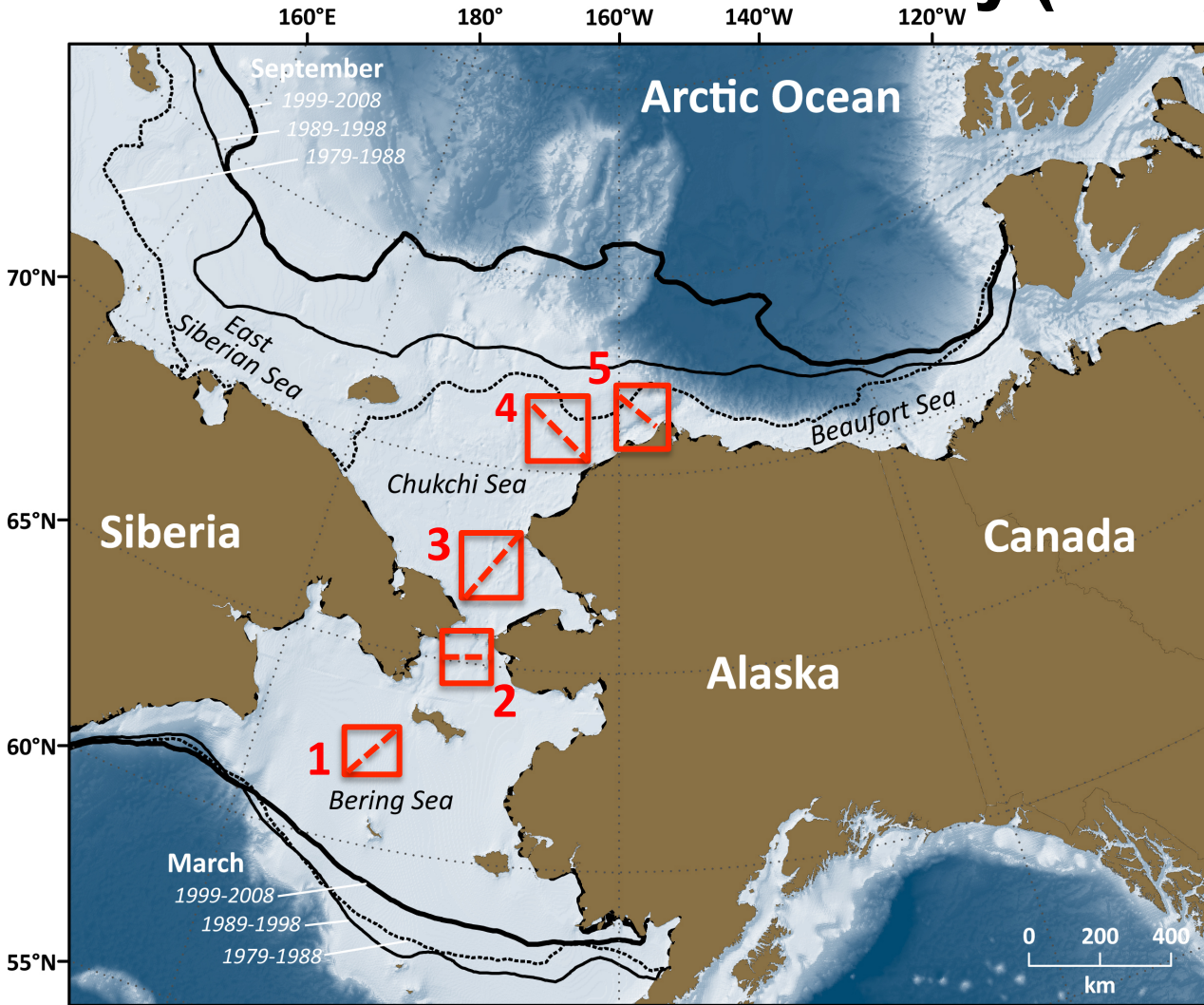
29 October (1:30 pm)-31 October (3 pm) 2014

PMEL/NOAA, Seattle, Washington, USA

**Workshop Overview:** We have 4 objectives for this workshop:

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

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



[modified 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 will 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





## 2014 DBO Field Season: Sampling Contributors (as of October 21\_2014)

Region Key: DBO1=So. St. Lawrence Is., DBO2=Chirikov Basin, DBO3=So Chukchi Sea, DBO4=NE Chukchi Sea, DBO5=Barrow Canyon.

Dates (Port calls)	Ship	DBO Region	Projects	PAG contact	Chief Scientist
June 30-July 7 (Nome-Nome)	Norseman 2	3	Bering Strait Mooring Project/AON	Rebecca Woodgate <a href="mailto:woodgate@apl.washington.edu">woodgate@apl.washington.edu</a>	Rebecca Woodgate <a href="mailto:woodgate@apl.washington.edu">woodgate@apl.washington.edu</a>
July 8-17 (Anadyr-Anadyr)	Khromov	3	RUSALCA Bering Strait mooring	<a href="mailto:Kathy.Crane@noaa.gov">Kathy.Crane@noaa.gov</a> <a href="mailto:Phyllis.Stabeno@noaa.gov">Phyllis.Stabeno@noaa.gov</a>	<a href="mailto:Kathy.Crane@noaa.gov">Kathy.Crane@noaa.gov</a>
July 4-23 (Victoria, BC-Barrow)	Sir Wilfrid Laurier	1,2,3,4,5; + moorings at 3 and 5	C30/DBO, plus JAMSTEC DBO moorings	Jackie Grebmeier <a href="mailto:jgrebmei@umces.edu">jgrebmei@umces.edu</a> ; Takashi Kikuchi <a href="mailto:takashik@jamstec.go.jp">takashik@jamstec.go.jp</a>	<a href="mailto:Svein.Vagle@dfo-mpo.gc.ca">Svein.Vagle@dfo-mpo.gc.ca</a>
July 18-Sept 18 (Shanghai-return)	Xuelong	(1-2 partial), 3,5	Chinese Arctic Research Expedition	Jianfeng He <a href="mailto:jhe@pric.gov.cn">jhe@pric.gov.cn</a>	Jianfeng He <a href="mailto:jhe@pric.gov.cn">jhe@pric.gov.cn</a>
July 4-29-August 15 (Dutch-Barrow)	Healy	5 (TBD)	AON	Robert Pickart <a href="mailto:rpickart@whoi.edu">rpickart@whoi.edu</a>	Robert Pickart <a href="mailto:rpickart@whoi.edu">rpickart@whoi.edu</a>
July 31-August 22 (Nome-Barrow)	Araon	3	Korean Expedition (KOPRI)	Sung-Ho Kang <a href="mailto:shkang@kopri.re.kr">shkang@kopri.re.kr</a>	Sung-Ho Kang <a href="mailto:shkang@kopri.re.kr">shkang@kopri.re.kr</a>
August-Sept (Barrow-Barrow)	Annika Marie	5	AON	Carin Ashjian <a href="mailto:cashjian@whoi.edu">cashjian@whoi.edu</a>	Carin Ashjian <a href="mailto:cashjian@whoi.edu">cashjian@whoi.edu</a>
Sept 7 – Oct 20 (Nome-Dutch)	R/V Aquila	4,5 1,2,3,4,5 PAM 1,4,5 biophys. moor.	ARCWEST/CHAOZ-X	<a href="mailto:Sue.Moore@noaa.gov">Sue.Moore@noaa.gov</a> <a href="mailto:Catherine.Berchok@noaa.gov">Catherine.Berchok@noaa.gov</a> <a href="mailto:Phyllis.Stabeno@noaa.gov">Phyllis.Stabeno@noaa.gov</a> <a href="mailto:Jeff.Napp@noaa.gov">Jeff.Napp@noaa.gov</a>	<a href="mailto:Catherine.Berchok@noaa.gov">Catherine.Berchok@noaa.gov</a>
August-October	Westward Wind	4 (modified)	CSESP	Tom Weingartner <a href="mailto:weingart@ims.uaf.edu">weingart@ims.uaf.edu</a>	Bob Day <a href="mailto:bday@abrinc.com">bday@abrinc.com</a> John Burns <a href="mailto:jburnssr@gci.net">jburnssr@gci.net</a>
Aug 30-Sept 12 (Dutch-Nome)	Alaska Endeavor	2	BASIS	<a href="mailto:Ed.Farley@noaa.gov">Ed.Farley@noaa.gov</a>	<a href="mailto:jim.murphy@noaa.gov">jim.murphy@noaa.gov</a>
Sept 21-Oct 14 (Dutch-Kodiak)	Oscar Dyson	1	BASIS	Ed Farley : <a href="mailto:ed.farley@noaa.gov">ed.farley@noaa.gov</a>	Lisa Eisner : <a href="mailto:lisa.eisner@noaa.gov">lisa.eisner@noaa.gov</a>
September 9-25 (Barrow-Kugluktuk)	Amundsen	5	ArcticNet	<a href="mailto:Martin.Fortier@arcticnet.ulaval.ca">Martin.Fortier@arcticnet.ulaval.ca</a> <a href="mailto:Keith.Levesque@arcticnet.ulaval.ca">Keith.Levesque@arcticnet.ulaval.ca</a>	<a href="mailto:Louis.Fortier@bio.ulaval.ca">Louis.Fortier@bio.ulaval.ca</a>

**Projects Key:** AON=US Arctic Observing Network; ARCWEST = Arctic Whale Ecology Study; BASIS=Bering Arctic Subarctic Integrated Survey COMIDA=Chukchi Offshore Monitoring in Drilling Area; CSESP=Chukchi Sea Environmental Studies Program; C30=Canada's Three Oceans; JAMSTEC= Japan Agency for Marine-Earth Science and Technology; KOPRI = Korea Polar Research Institute.

# 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)

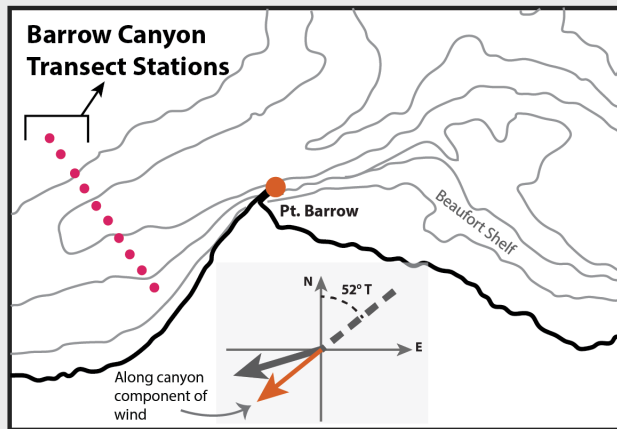
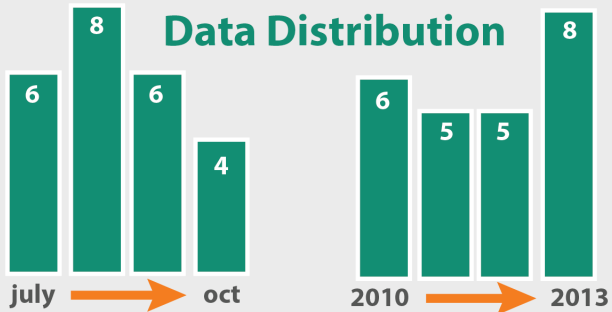
**DBO sampling by national & international science programs**

# DBO line 5 Barrow Canyon

24 occupations

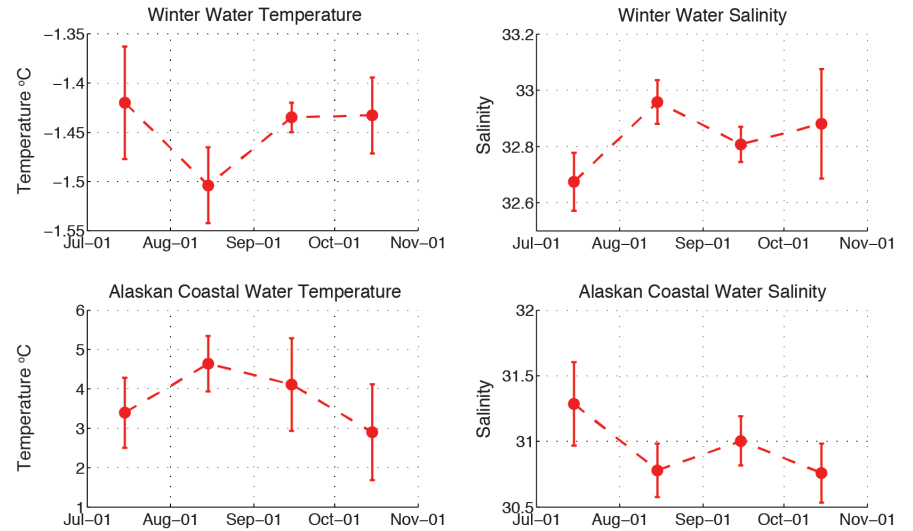
11 chief scientists

202 total CTD casts

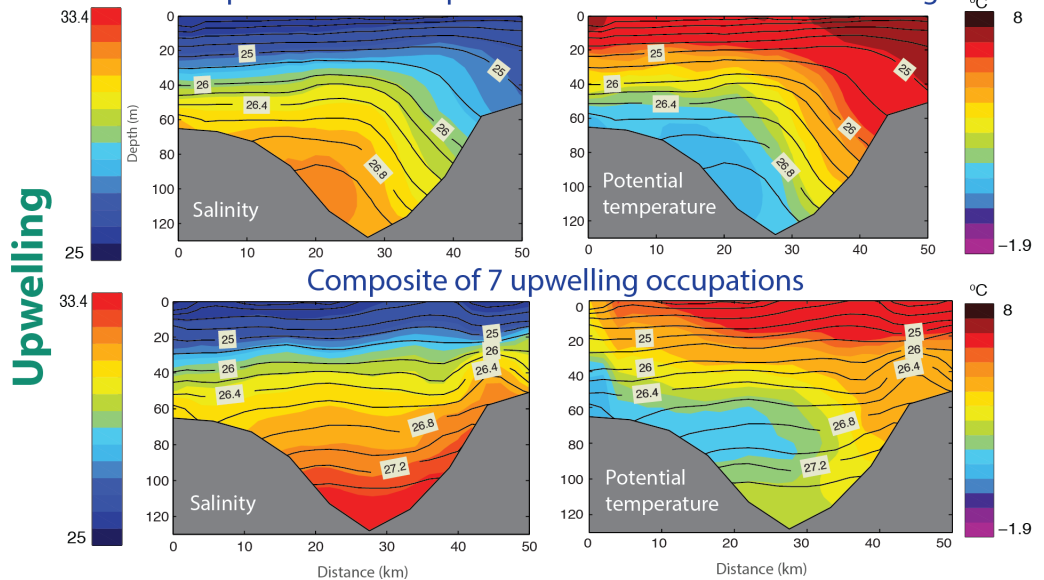


## Monthly mean water mass properties in the absence of wind forcing

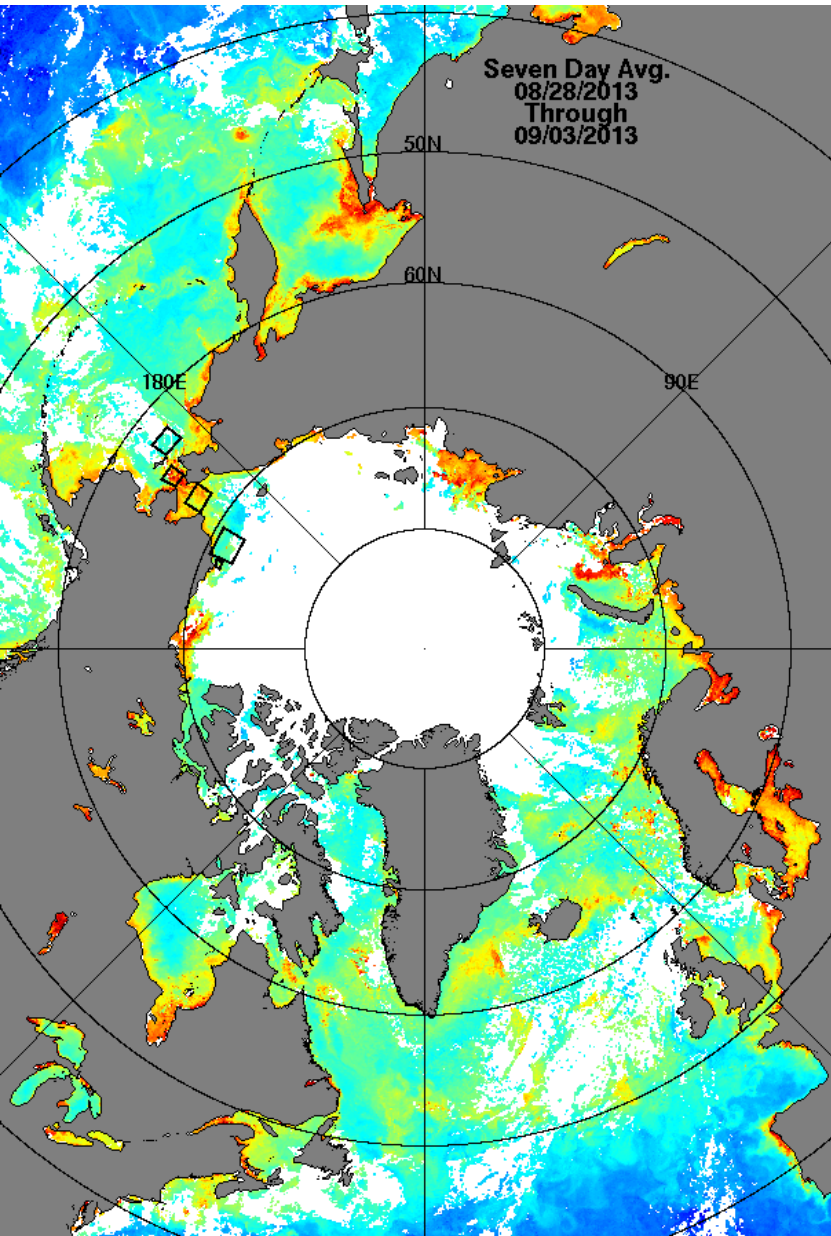
Seasonality



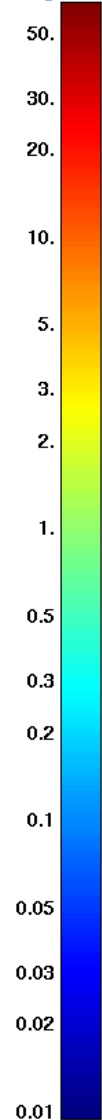
## Composite of 16 occupations in the absence of wind forcing



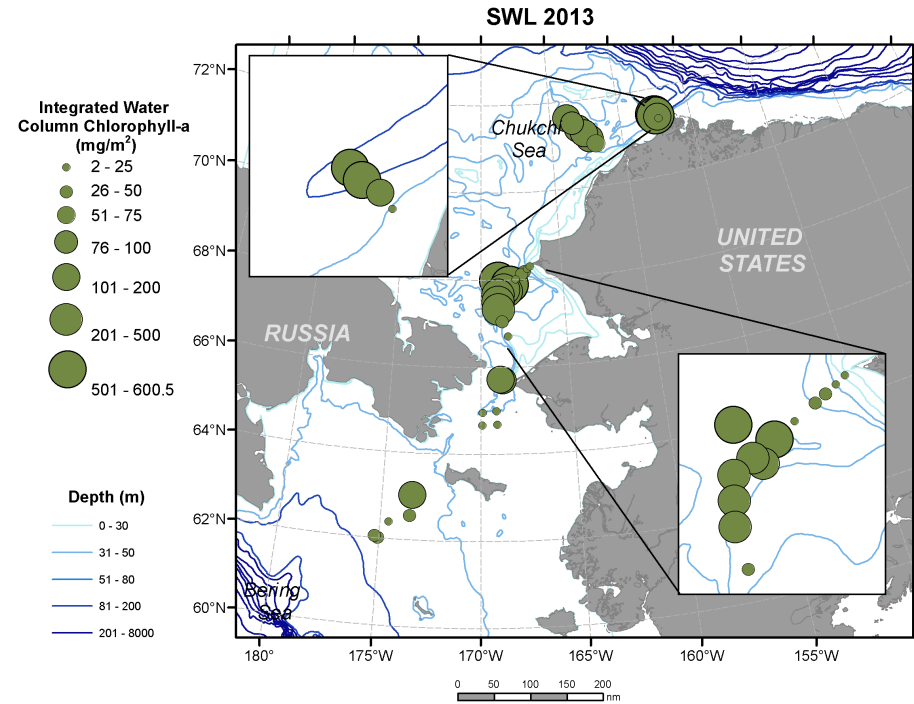
# NASA DBO-surface chlorophyll and field collected integrated values



Chlorophyll  
mg/m<sup>3</sup>



Sep 4, 2013

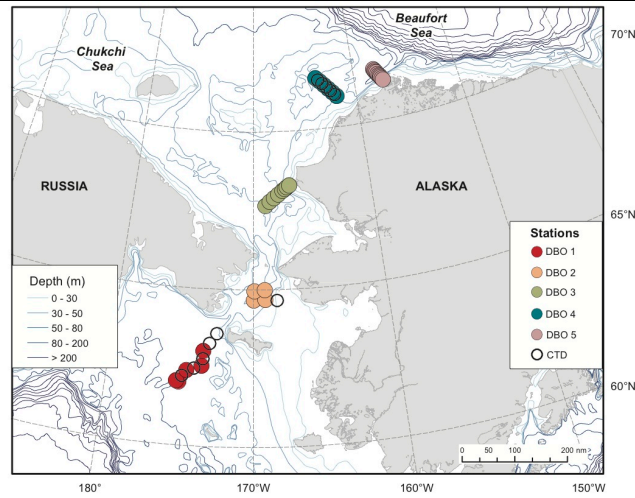
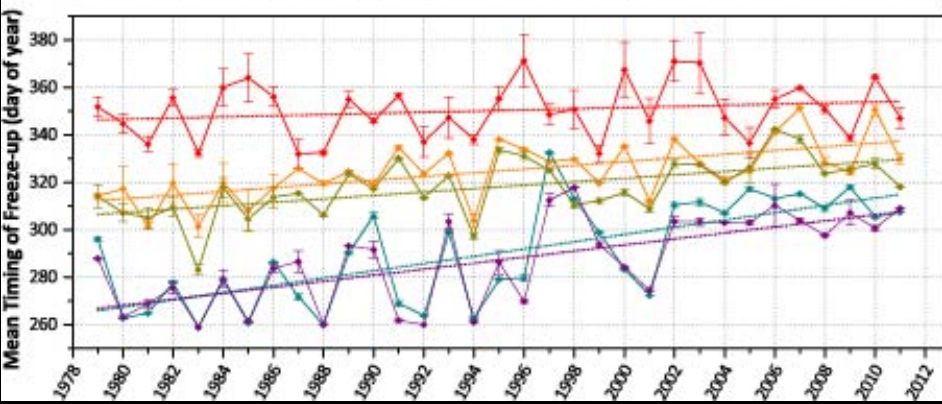
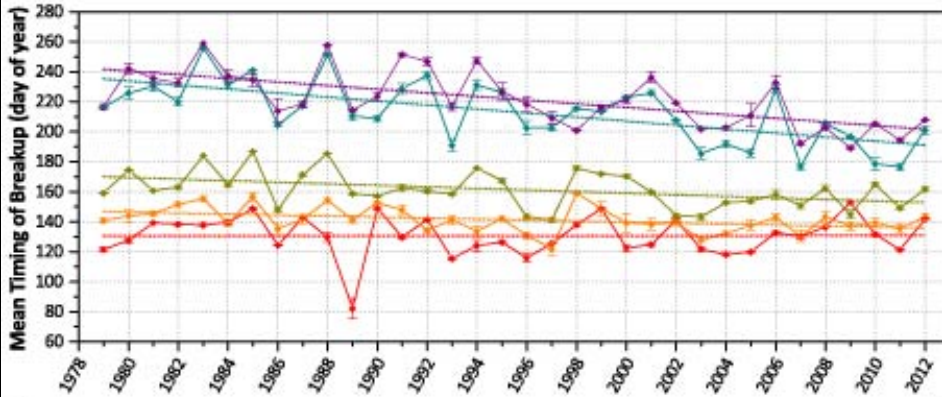
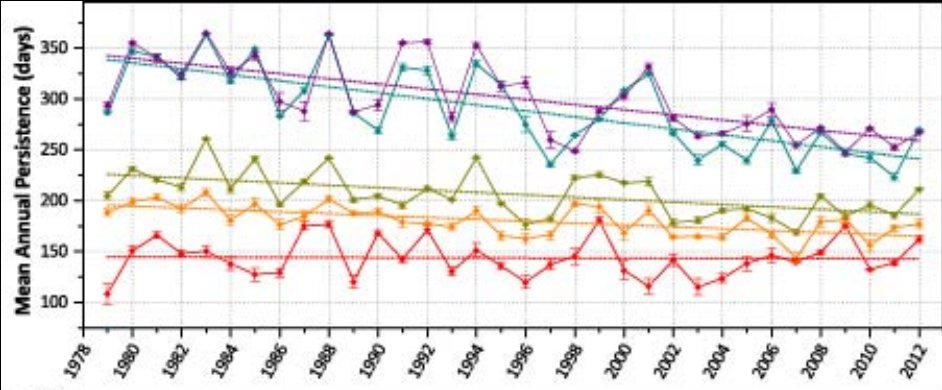


[L.Cooper]

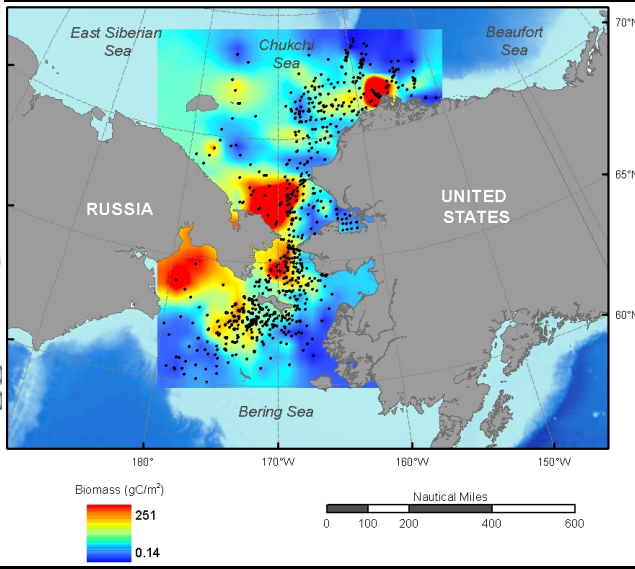
- Highest chl a via satellites and field data in Bering Strait and offshore SE Chukchi Sea DBO3 SE Chukchi Sea hotspot



# Sea Ice Persistence, Timing of Break-up, and Freeze-Up from DBO1 (south) to DBO5 (north)



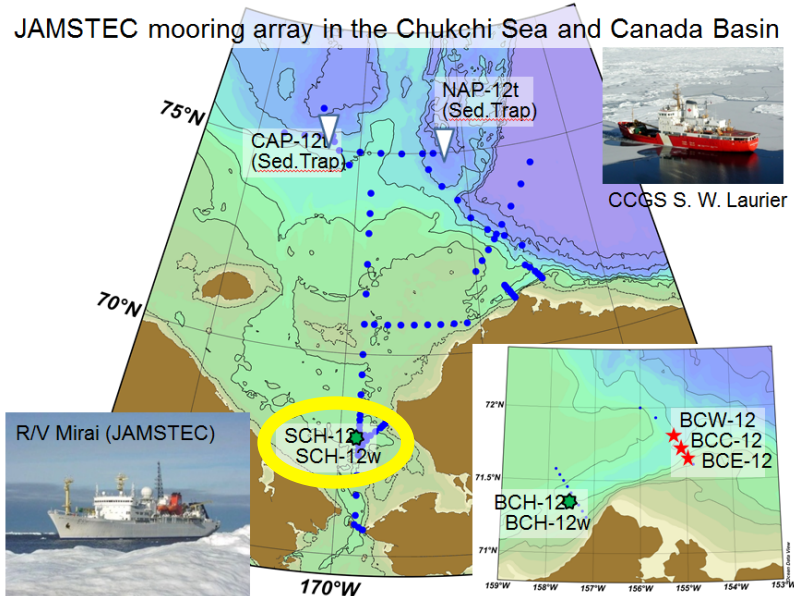
[macrofaunal biomass- 1976-2012]



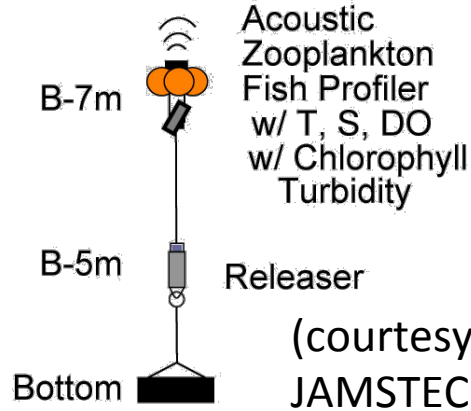
# SCH mooring

Time series of T, S, Chl-a,  
Turbidity, and Oxygen Saturation  
(Oct. 2, 2012 to Jul.20, 2013)

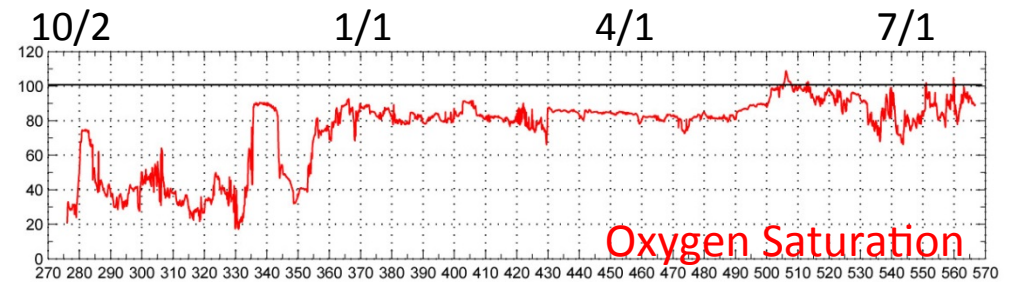
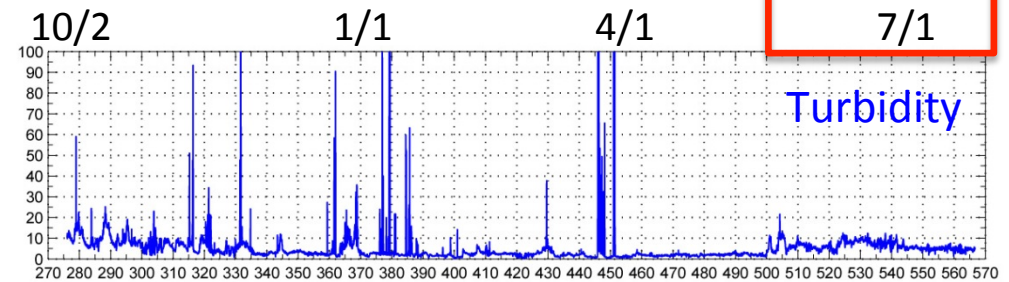
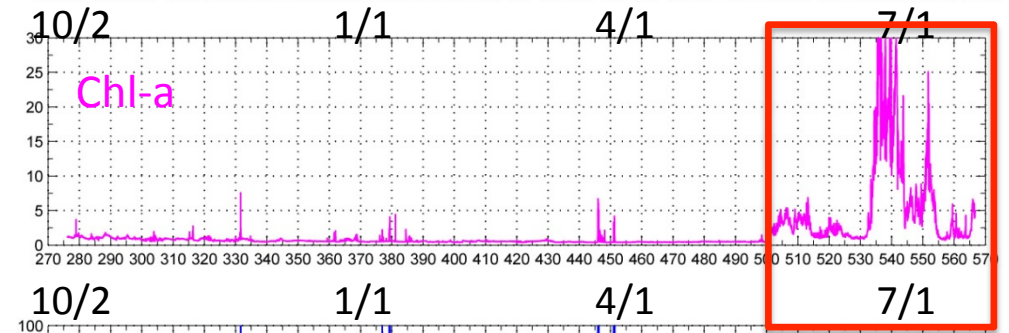
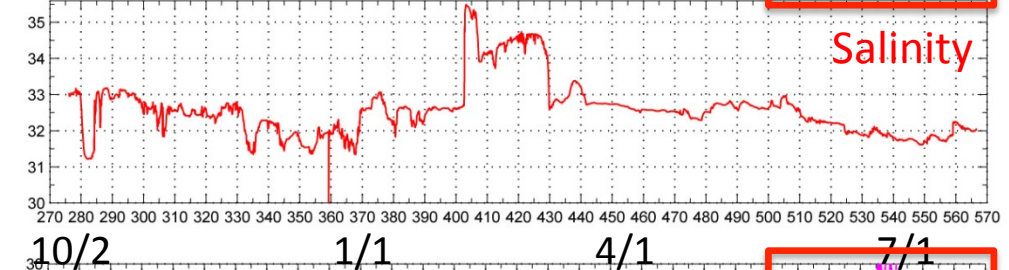
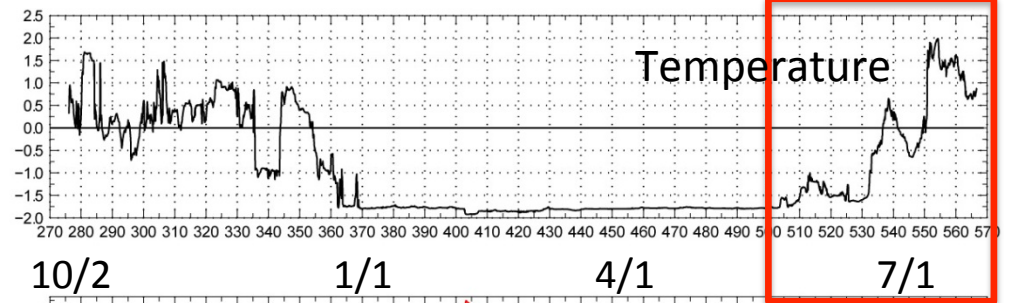
JAMSTEC mooring array in the Chukchi Sea and Canada Basin



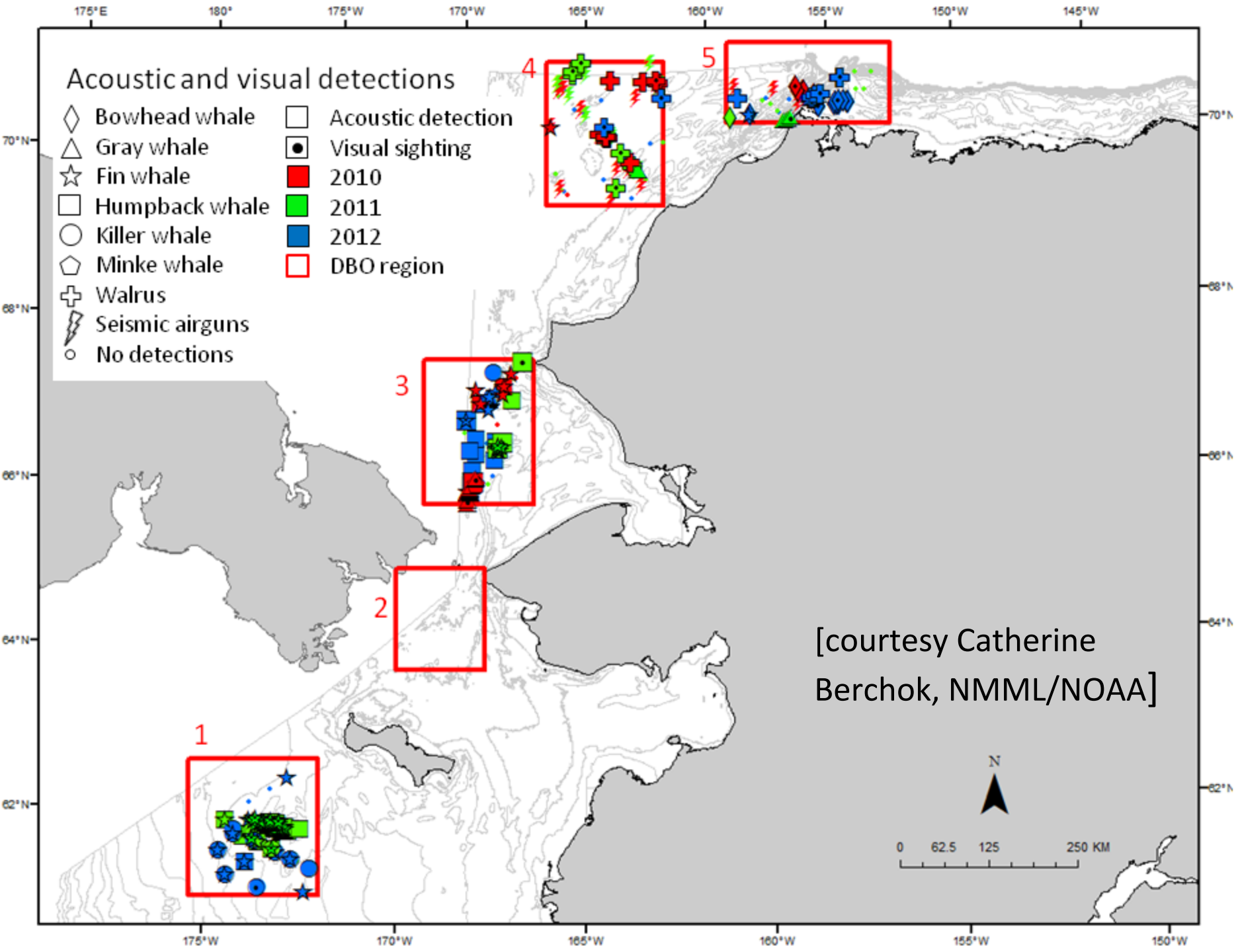
## SCH-12



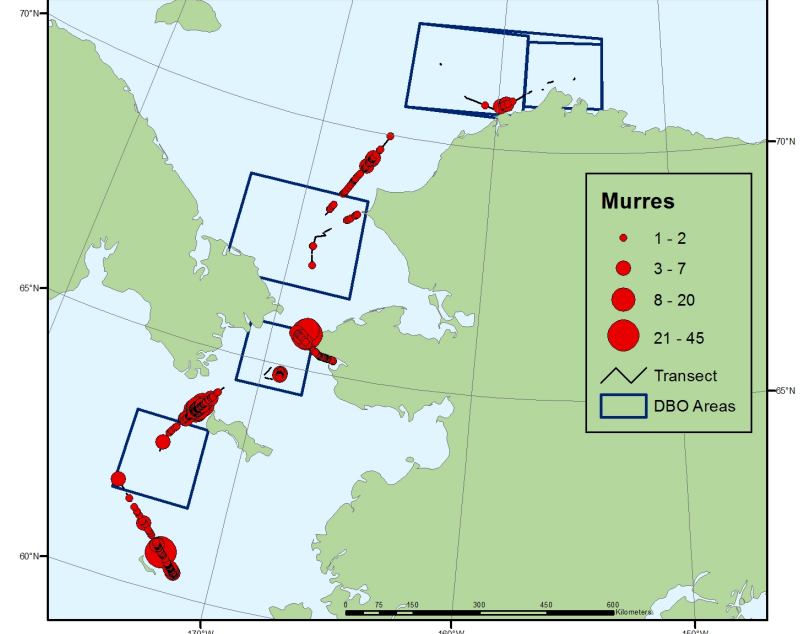
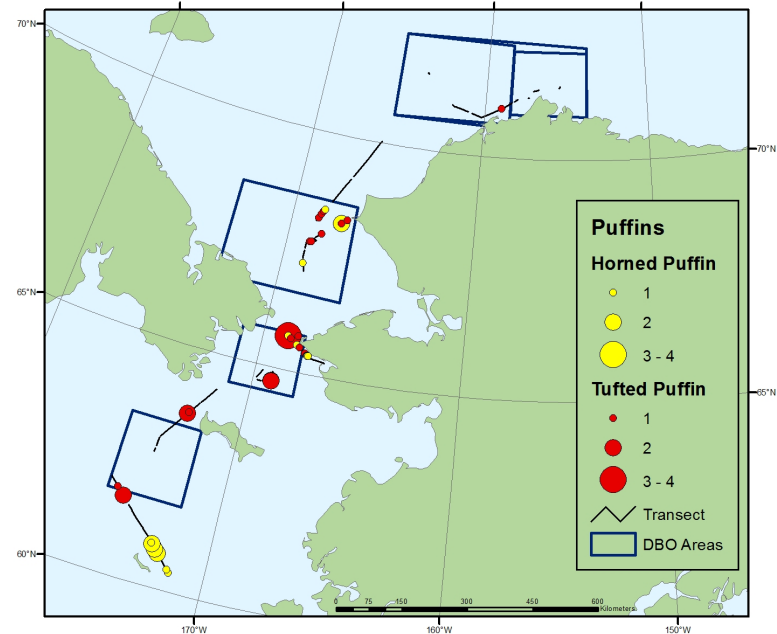
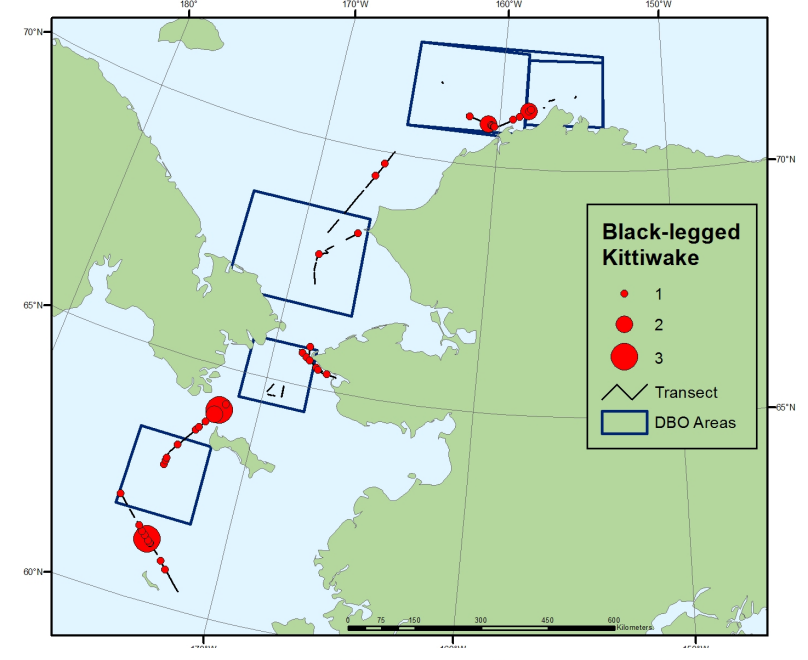
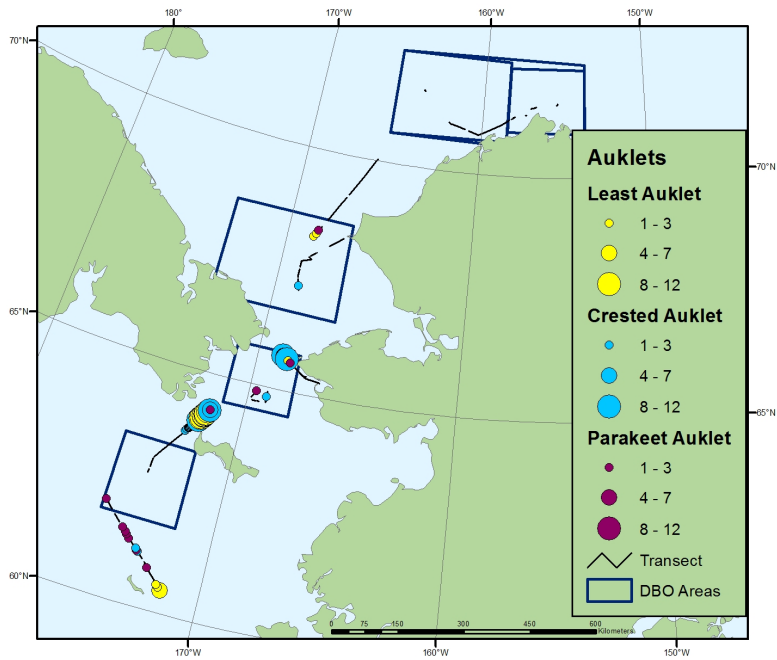
(courtesy T. Kikuchi,  
JAMSTEC 2013)





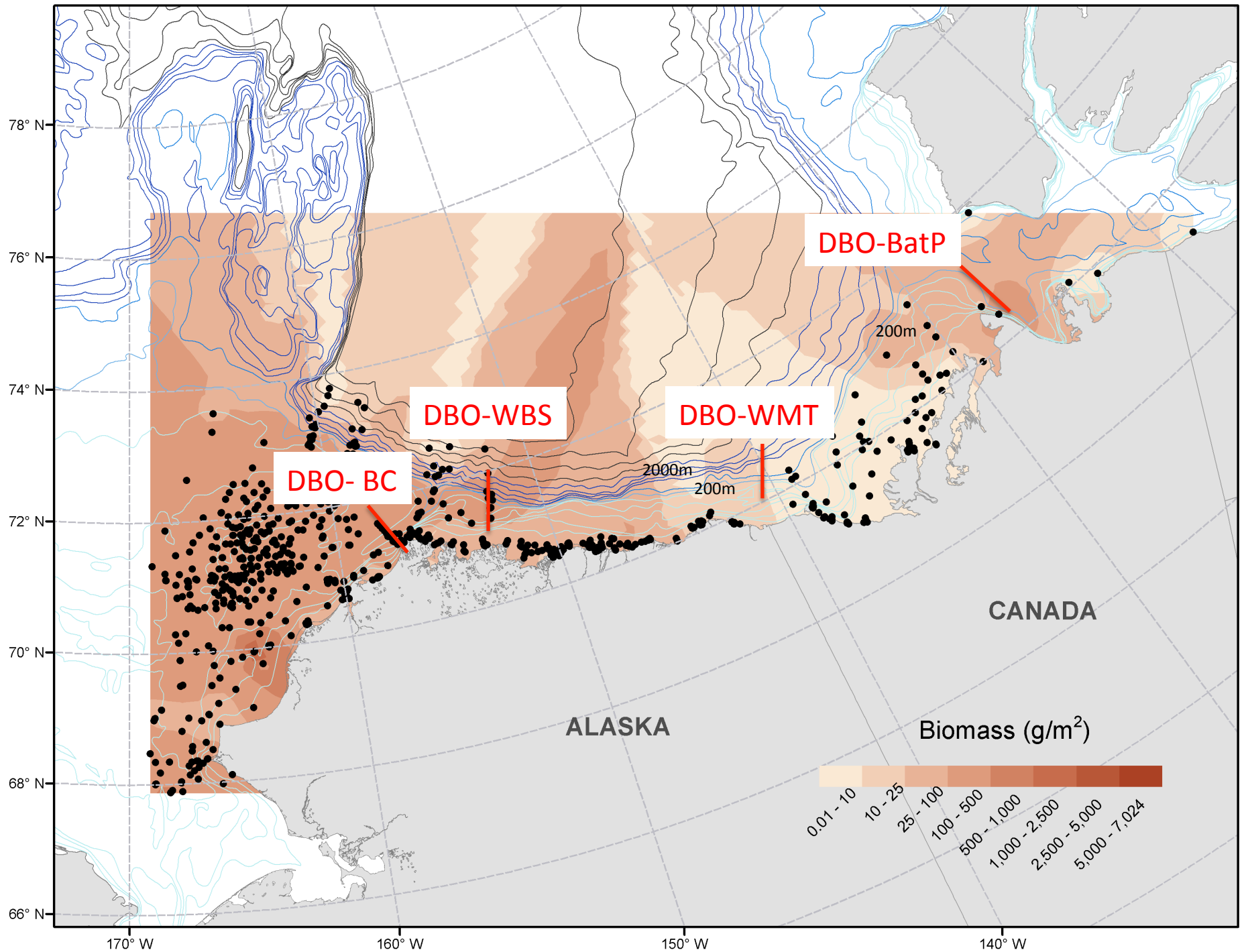


# SWL13-July 2013 Seabird surveys-Pelagic feeders (Kathy Kuletz, USFWS)



# DBO UPDATE OUTLINE

- Introduction of agenda 2<sup>nd</sup> DBO data workshop, Oct 29-31, 2014
- Brief highlight science findings from the DBO pilot program 2010-2014
- Establishing new DBO lines in Beaufort Sea, NW Chukchi Sea, N Barents Sea
  - Beaufort Sea region (Jackie Grebmeier)
  - NW Chukchi Sea (Kathy Crane/RUSALCA)
  - Northern Barents Sea (Lis Lindal Jørgensen, Institute of Marine Research, Tromsø, Norway)
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- Plans for DBO publications and 2015 field activities
- Future Earth Science Cluster Network update (Sue Moore)



# Considerations for 2014-2019 sampling



2 U.S. Russian DBO lines



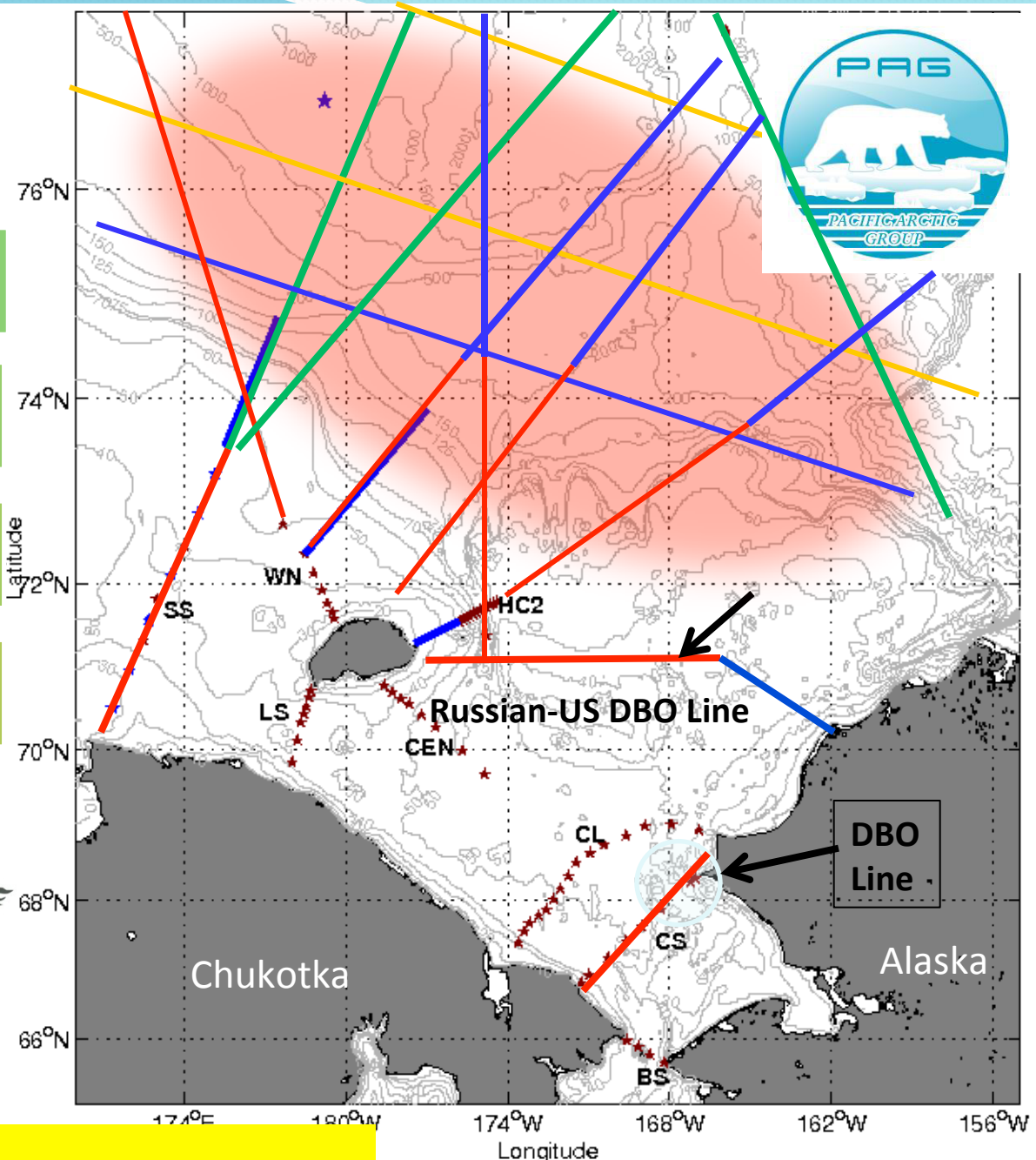
12 Repeat hydrographic lines



Ecosystem and Methane



RUSALCA + Korea, China, Japan, Canada, Germany, Sweden?



PAG + Others

USA





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# 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

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

Latest activity

- Jerry added 20 files 3 days ago
- DBO4 - Central Chukchi Sea
  - CSESP\_PLK\_BIOMAS...
  - CSESP\_PLK\_Biomass...
  - CSESP\_PLK\_ABUNDA...And 17 more...
- Jerry joined the group. 7 days ago
- Christie joined the group. 7 days ago
- Jackie added 8 files 10 days ago
- Cruise Reports
  - DBO1-5 map Grebmeier ...
  - 5 DBO ... GPS Mar 25

- 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

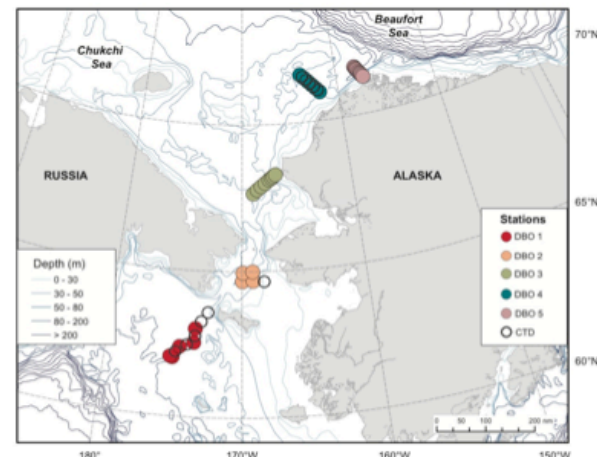
A Data Archive Linking Physics & Biology

**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.



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## Distributed Biological Observatory

A Data Archive Linking Physics & Biology

**NEW!** [Submit Data](#)

Transect: - Filters: Jackie Grebmeier

Clear

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

Researcher: -

Clear

- Bob Day
- Carin Ashjian
- Catherine Berchok
- Doug Daisher
- Ian Hartwell
- Jackie Grebmeier
- Jeff Napp
- Eriksson Lisa

Vessel: +

Year: +

Month: +

Keywords: +

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 2010-06-12	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 2012-06-25	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 2013-06-15	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 meetings 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 meetings 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.



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## Distributed Biological Observatory

A Data Archive Linking Physics & Biology

Switch to Geographical View

Filters:

Transect: -

Clear

- 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 Stabano, 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	

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- **Future Earth Science Cluster Network update (Sue Moore)**

# ICSU Future Earth Initiative

**FutureEarth** has funded these organizations to **establish a research network and develop a proposal** re: Arctic/Polar matters (target: April 2015)

**International Interdisciplinary  
Polar Science Network**  
*Lead PI: Faye McNeill (OASIS/AICI)*

**Participants:** OASIS/AICI, BEPSII, ArcticNET, HitT, SVALI, CRAICC, DEFROST, ASP, SEARCH, SVALI, NORDFROST, WCRP/CLIC, WCRP/CLIVAR, AMAP, PEEX, DBO, ISAC

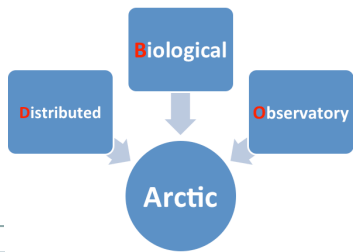
**IGPB Core Projects:** IGAC, SOLAS

**Circumpolar Arctic Coastal Communities  
Observatory Network (CACCON)**  
*Lead PI: Don Forbes (LOICZ SSC)*

**Participants:** LOICZ, IASC, ArcticNET, AACCA, IPA, ACD, IASSA, SliCA

**Arctic Coasts: Changes and Governance**  
*Lead PI: Ilan Chabay (KLSC, IASS, ESG)*

**Participants:** ESG, KLSC, LOICZ, IASS



Further information at  
<http://www.arctic.noaa.gov/dbo/> and  
<http://pag.arcticportal.org>



# THE END

- Any questions?
- Research funding provided by the US NOAA, NASA, NSF, BOEM, CSESP (industry), AOOS, along with separate funding and efforts of our international partners

