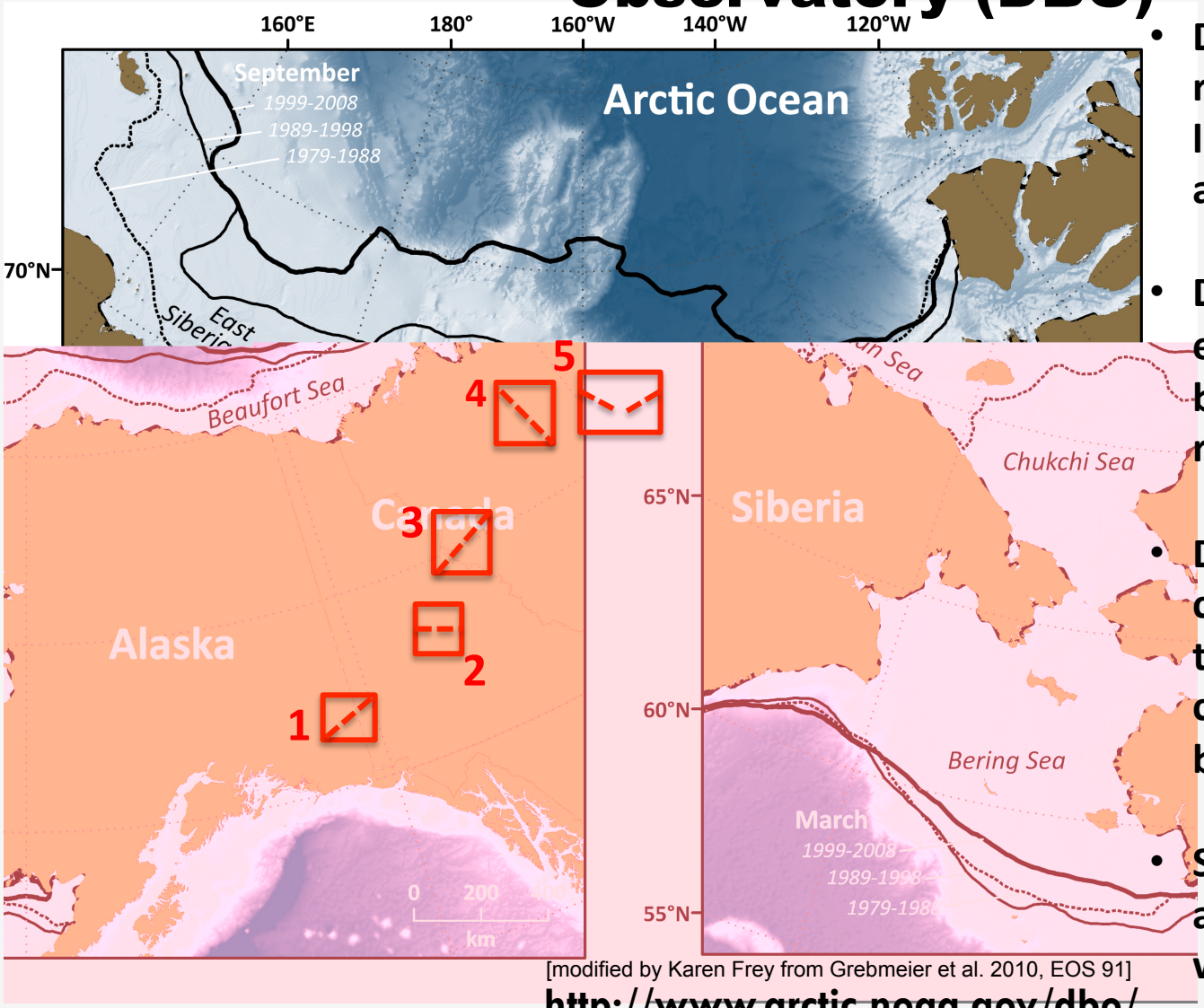
DBO Physical, chemical and biological field efforts and data teams-2012

Physical/hydrography/chemistry: Robert Pickart (co-leader), Mitoyo Itoh (co-leader), Koji Shimada, Svein Vagle, Takashi Kikuchi, Jianfeng He, Jinping Zhao, Ho Kyung Ha, Rebecca Woodgate, Shigeto Nishino, Liqi Chen, Michiyo Yamamoto-Kawai, Kyung Ho Chung, Jia Wang, Igor Semiletov

Biological/chemical: Jackie Grebmeier (leader), Jianfeng He, John Nelson, Diana Varela, Kevin Arrigo, Karen Frey, Carin Ashjian, Sang Lee, Eun Jin Yang, Toru Hirawake, Jeff Napp, Sue Moore, Nadja Steiner

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



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

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

- 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

Distributed Biological Observatory: Linking Physics to Biology

Core standardized ship-based sampling:

- CTD
- Chlorophyll
- Nutrients
- Ice algae/Phytoplankton (size, biomass and composition)
- Zooplankton (size, biomass and composition)
- Benthos (size, biomass and composition)
- Seabird (standard transects, no additional shiptime)
- Marine mammal observations (no additional ship time)

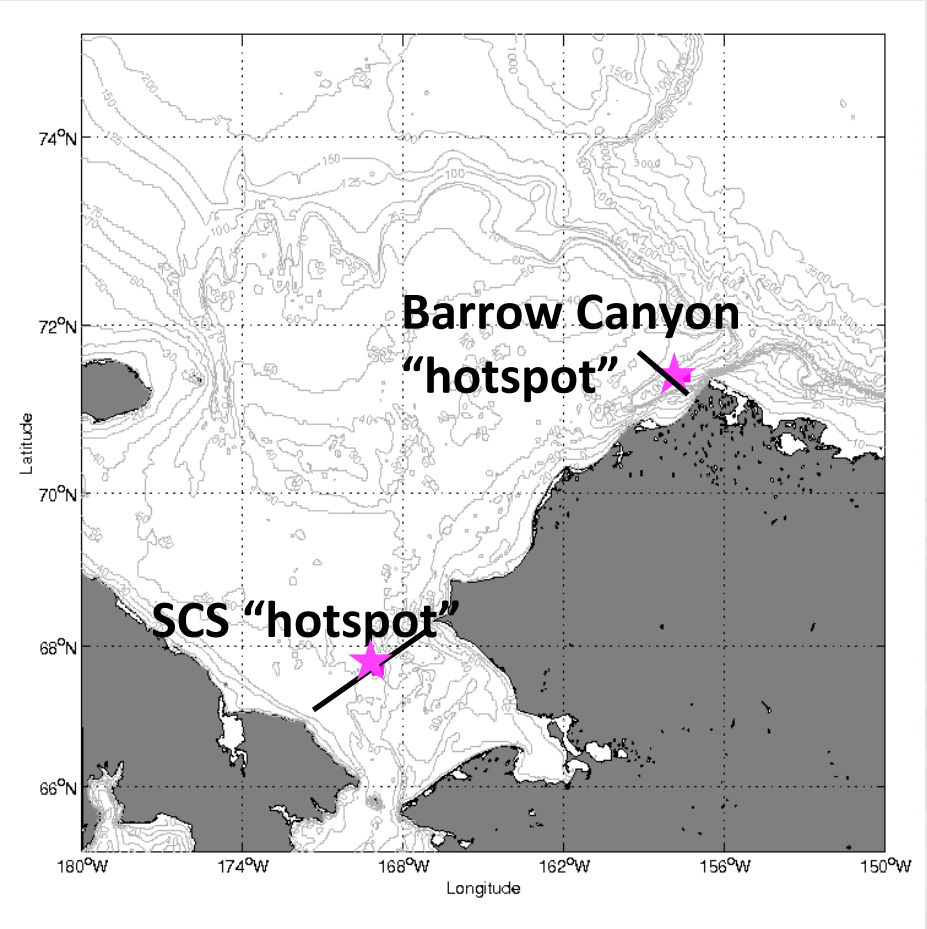
"Change detection array" – same measurements every year, process information in near real time <6 mos; detect regime shifts in rapid changes

Second tier ship-based sampling:

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

DBO occupations by national and international science programs

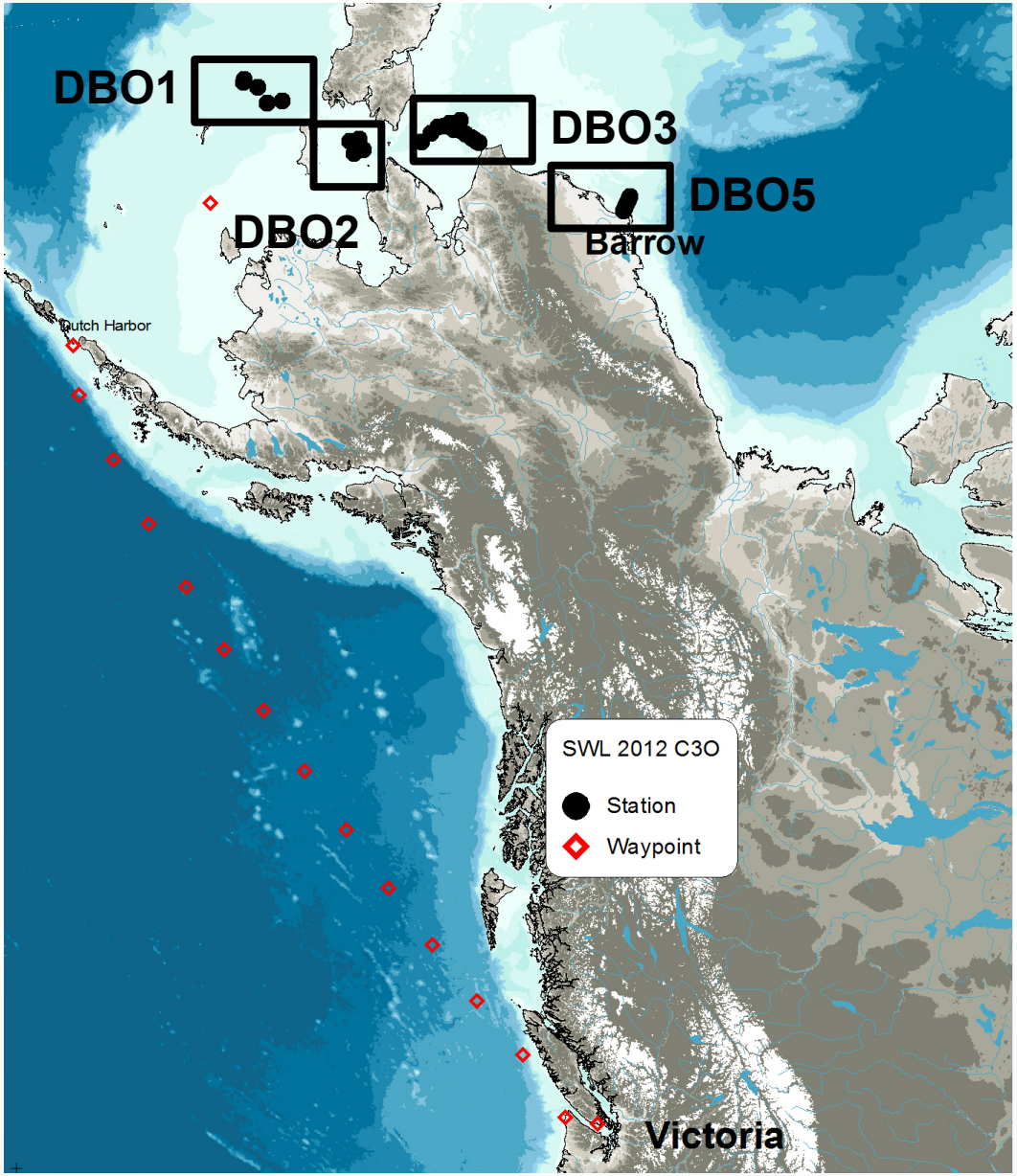
DBO 2010 -2012 “Pilot Program”

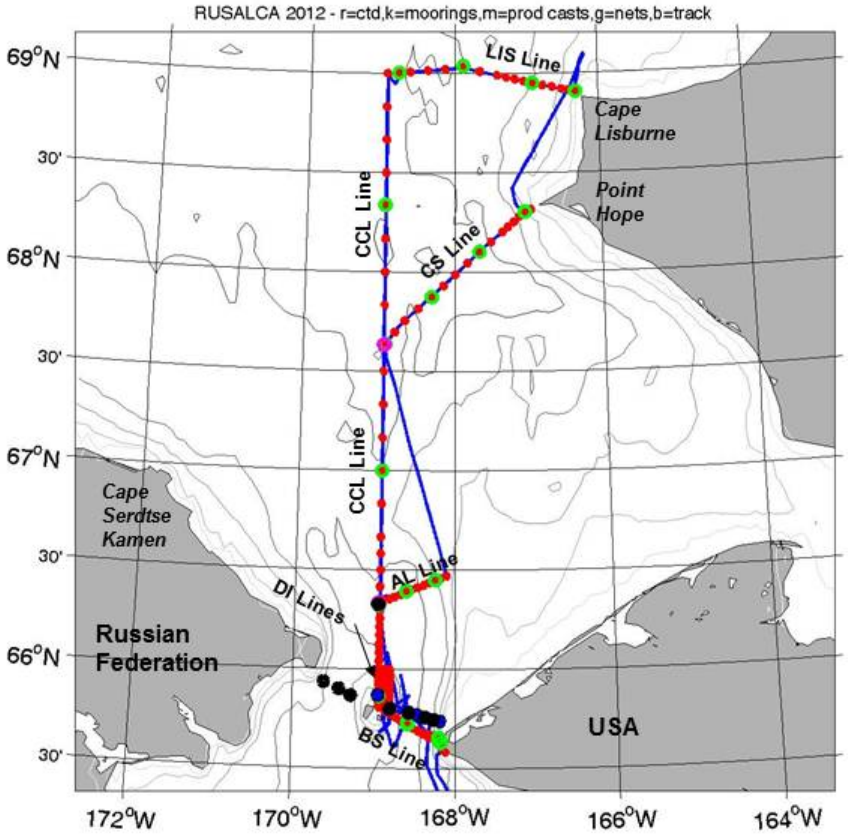


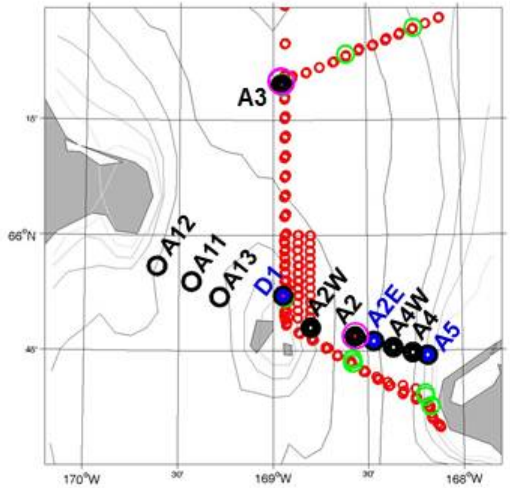
http://www.arctic.noaa.gov/dbo/
http://pag.arcticportal.org

Vessel	Country	PI
Moana Wave, Healy	USA	Grebmeier
Healy	USA	Arrigo
Xuelong	China	He
Mirai *Laurier*	Japan Canada	Itoh (2010) Kikuchi (2012) Vagle
Araon	Korea	Chung
Khromov	Russia and USA	Woodgate
Alaskan Enterprise	USA	Napp
Annika Marie	USA	Ashjian

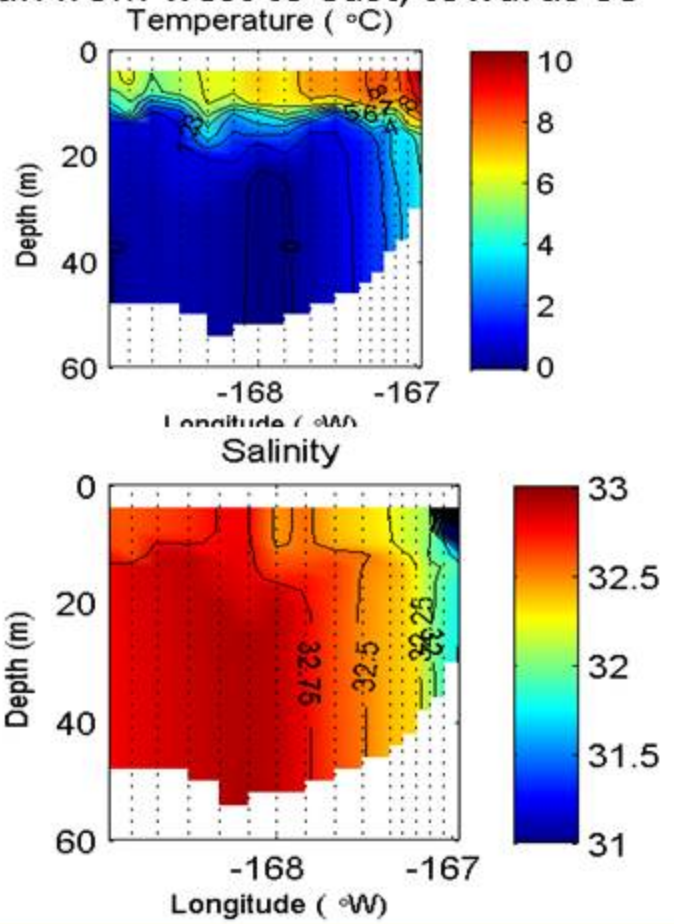
DBO-C30 cruise on CCGS Sir Wilfird Laurier-July 2012



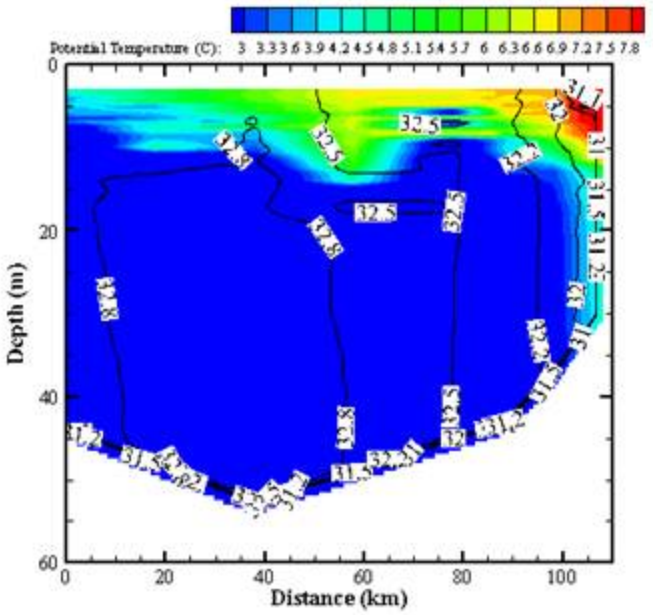

RUSALCA 2012 - r=ctd,k=moorings,m=prod casts,g=nets,b=track
69°N
30'
68°N
30'
67°N
30'
66°N
30'
172°W
170°W
168°W
166°W
164°W
LIS Line
Cape
Lisburne
Point
Hope
CCL Line
CS Line
CCL Line
Cape
Serdtse
Kamen
AL Line
DI Lines
Russian
Federation
USA
BS Line


A3
66°N
OA12
OA11
OA13
D1
A2W
A2
A2E
A4W
A4
A5
170°W
30'
169°W
30'
168°W

KHROMOV 16th July 2012 1203GMT
to 17th July 2012 0154 GMT
(run from west to east, towards US

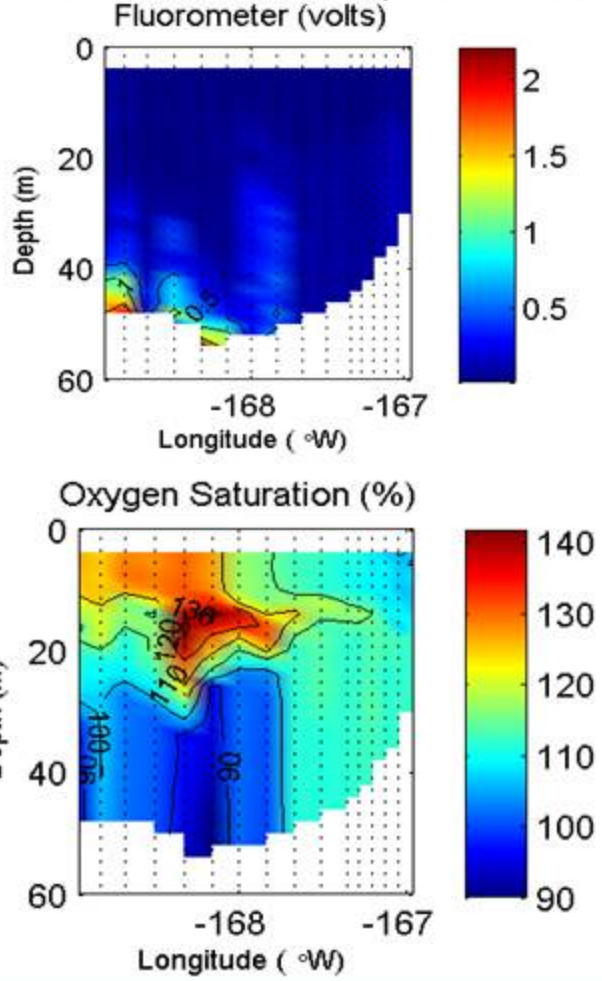


Preliminary CS Section from Khromov Mooring Cruise plotted J. Whitefield August 2012.
Rebecca Woodgate woodgate@apl.washington.edu

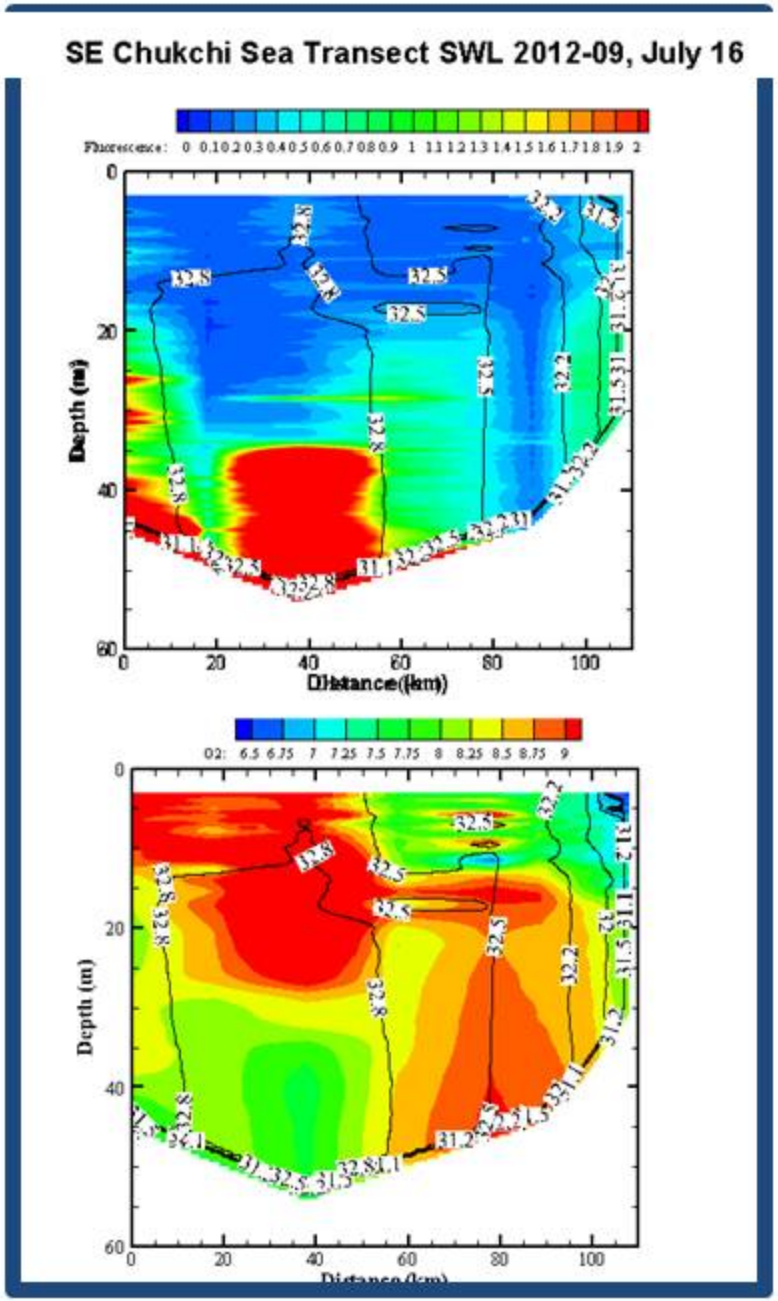


Preliminary Section from Laurier
Cruise courtesy of Svein Vagle,
August 2012

KHROMOV 16th July 2012 1203GMT
to 17th July 2012 0154 GMT
(run from west to east, towards US

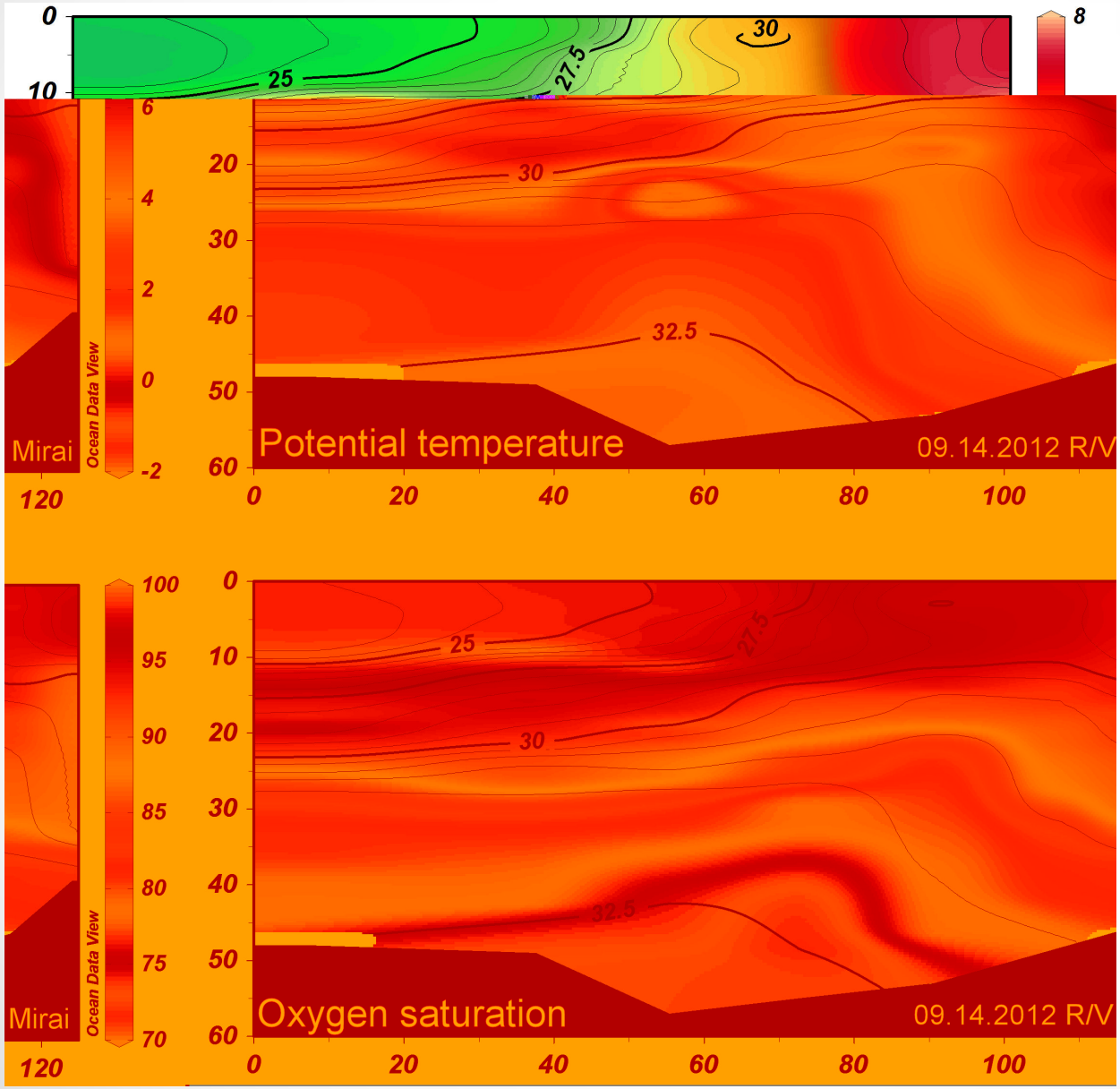


Preliminary CS Section from Khromov Mooring Cruise
plotted J. Whitefield August 2012.
Rebecca Woodgate woodgate@apl.washington.edu



Preliminary Section from Laurier Cruise
courtesy of Svein Vagle, August 2012

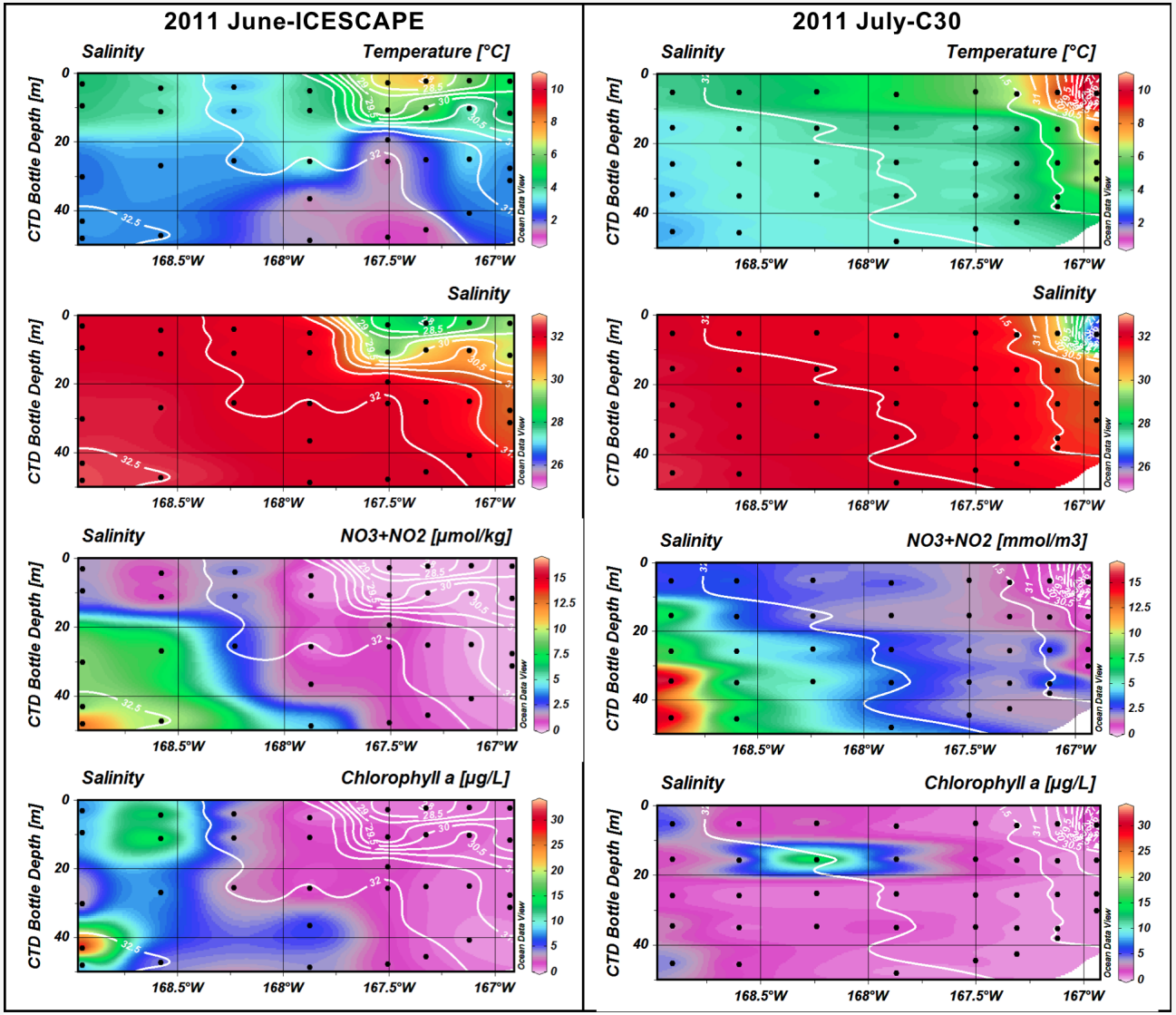
DBO3 (CS line)-Southern Chuchi Sea, September 2012



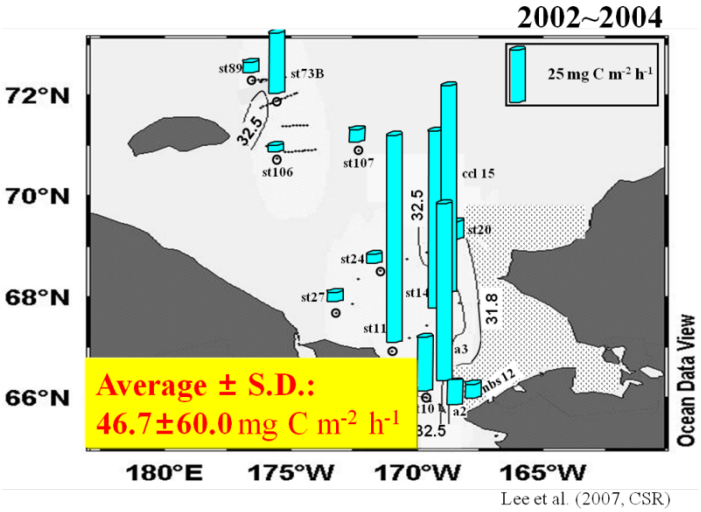
- Compared with results from July cruises, surface salinity around 168W (and westward) significantly decrease in mid September.
- Another interesting point is that oxygen saturation in the Hope Valley (central and western sides of this section) also significantly decrease.

[Takashi Kikuchi]

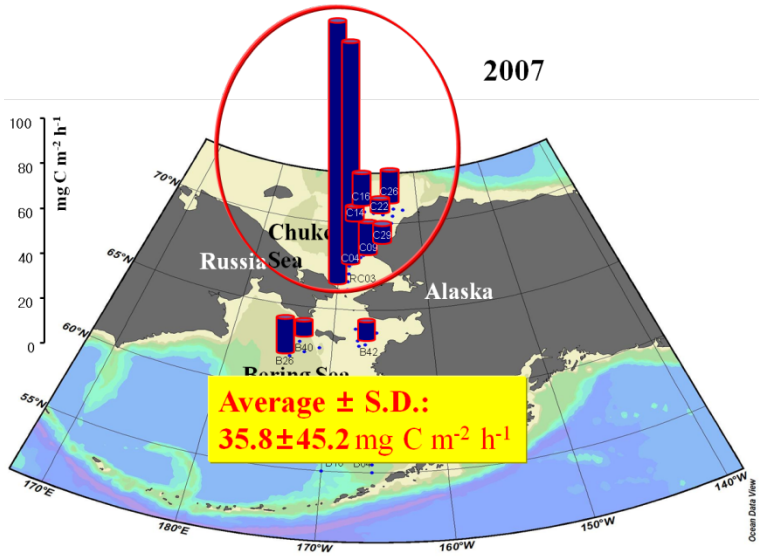
Temperature, salinity, nitrate/nitrite and chlorophyll a profiles overlain on salinity collected in 2010 and 2011 on the DBO-SCS line by the ICESCAPE program (data courtesy Kevin Arrigo) and the C30 program (data from Grebmeier/Cooper).

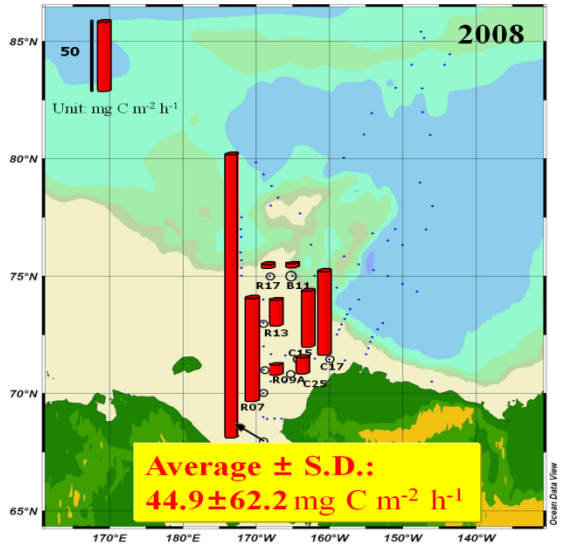


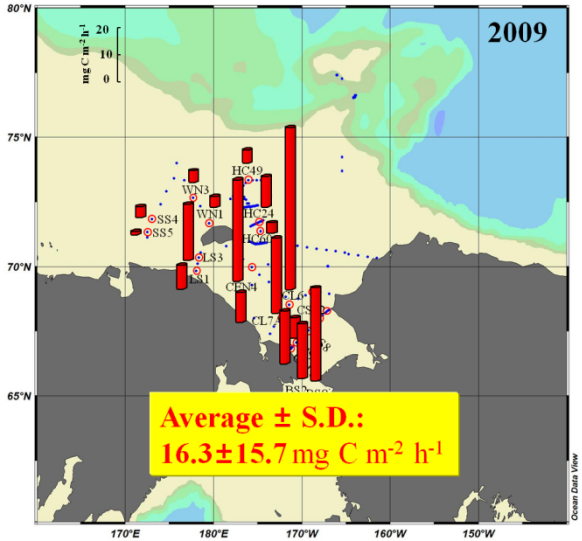
Continuing measurement for Primary Productivity in the Chukchi Sea



Lee et al. (2007, CSR)



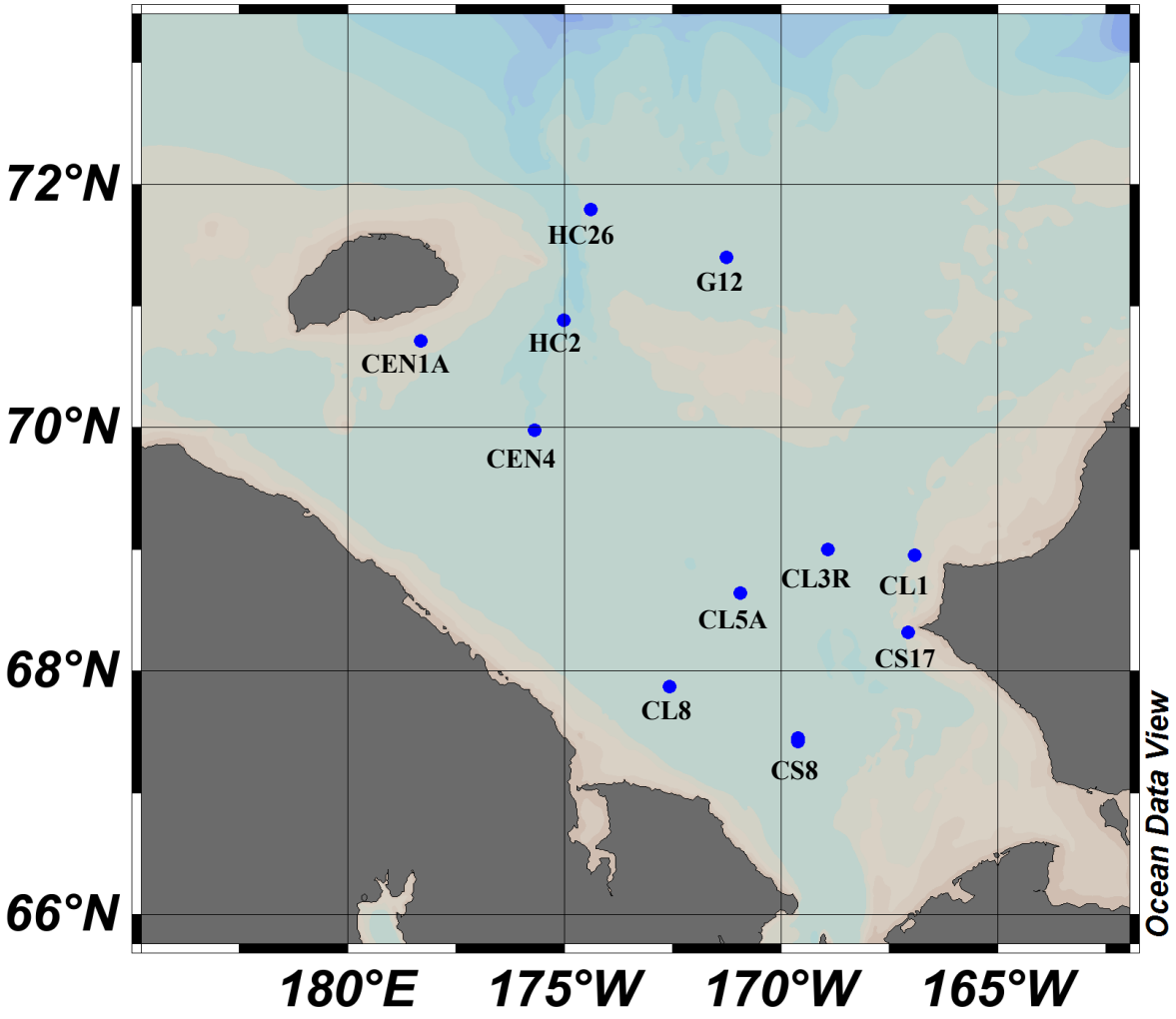




[Sang Lee]

➔ **Recent Productivity is ~3 times lower than decade(s) ago in the Chukchi Sea!**

2012 Productivity stations from 3rd Rusalca cruise (8.27~9.16, 2012)



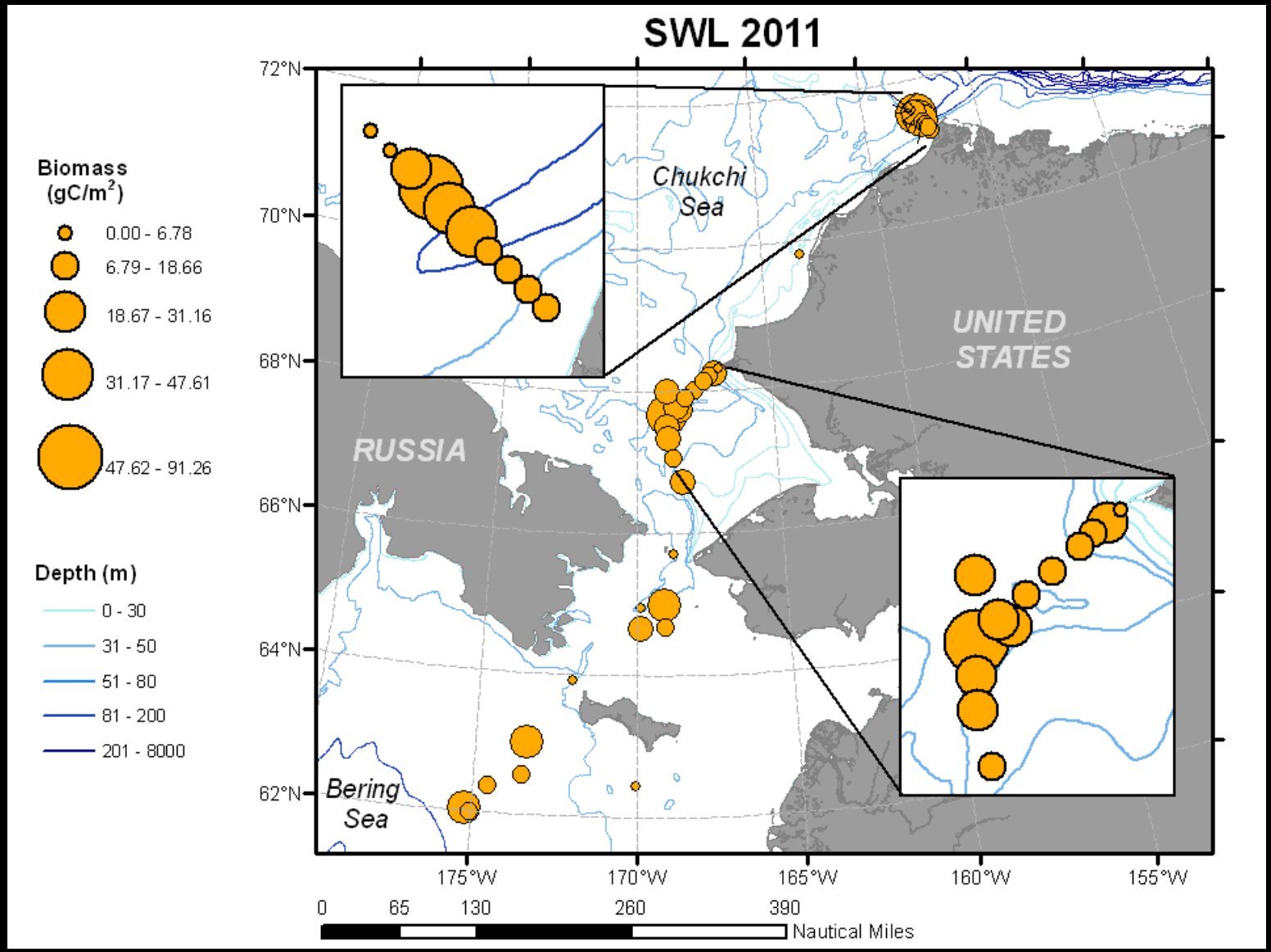
Station	P.P	HPMA	TSS	Macro
CS8	○	○	○	○
CS17	○	○	○	○
CL1		○		○
CL5A	○	○	○	○
CEN4	○	○	○	○
CEN1A	○	○	○	○
HC2	○	○	○	○
HC26	○	○	○	○
G12	○	○	○	○
CL3R	○	○	○	○
CL8	○	○	○	○
CS8R	○	○	○	○

- Primary productivity (Total and small)
- HPMA, TSS, Macro comp at 3 light depth (%) : 100, 30, 1

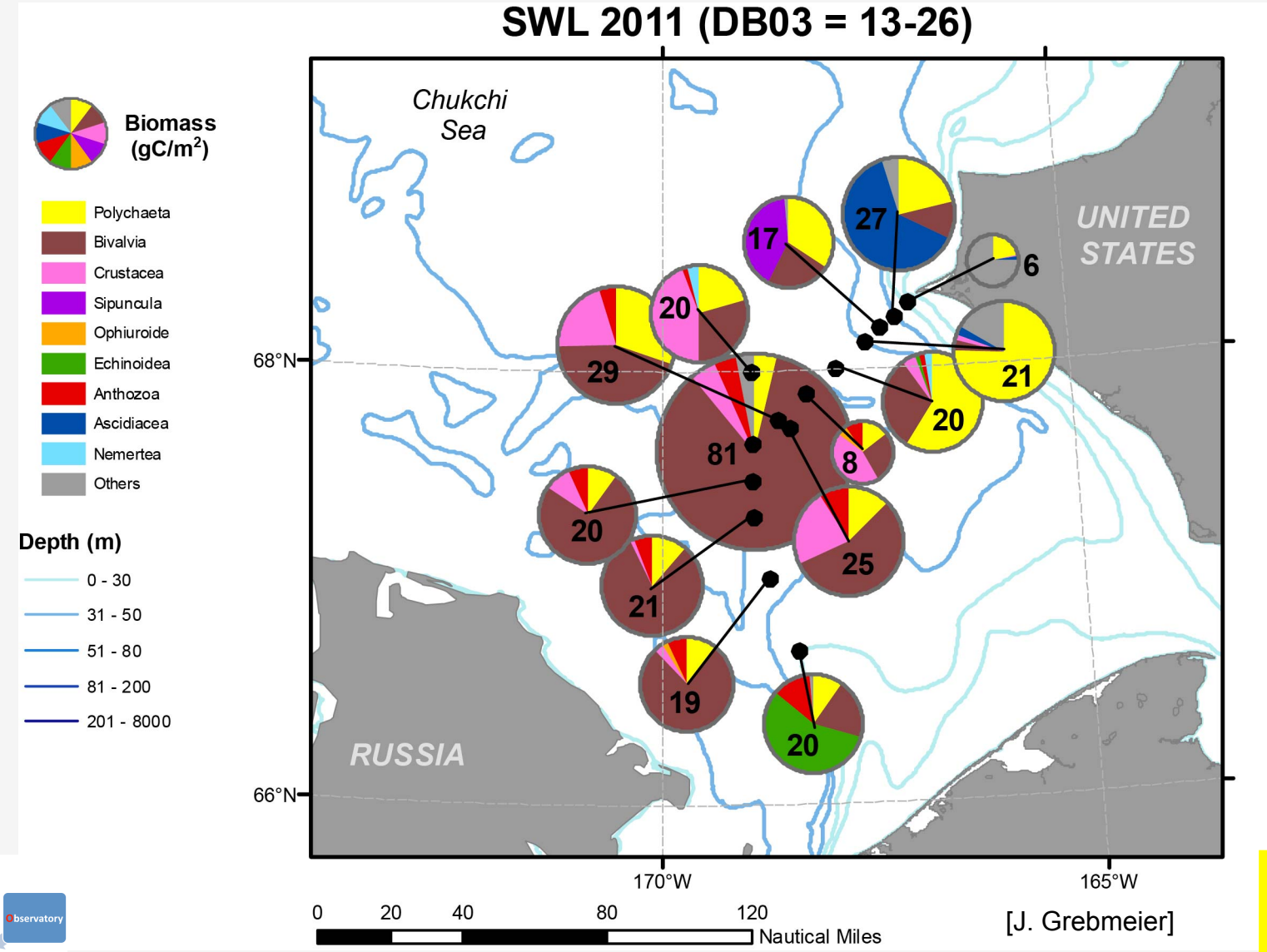
➔ **This data are processing now!**

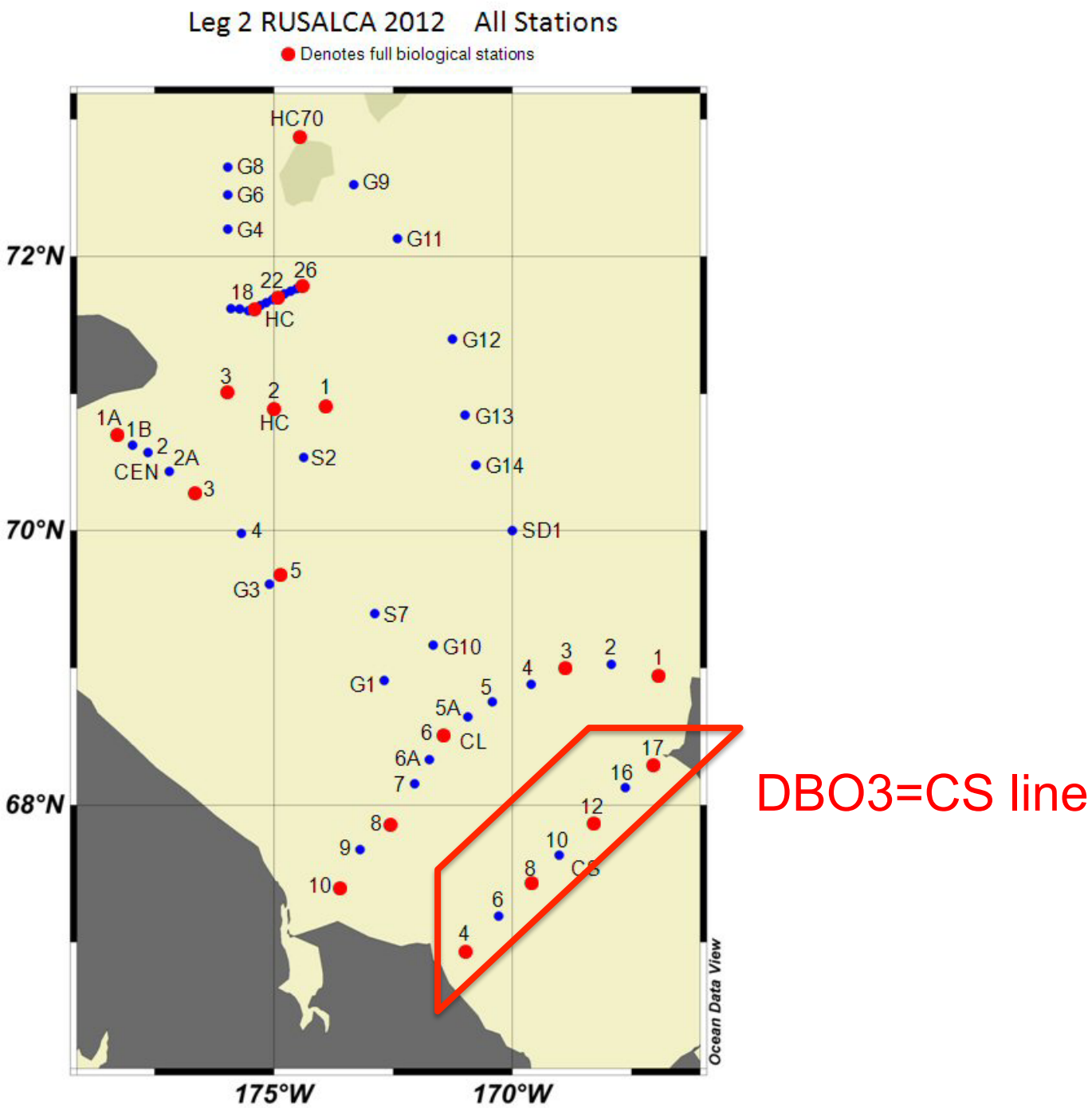
[Sang Lee]

SWL 2011 Benthic Biomass (gC/m2)

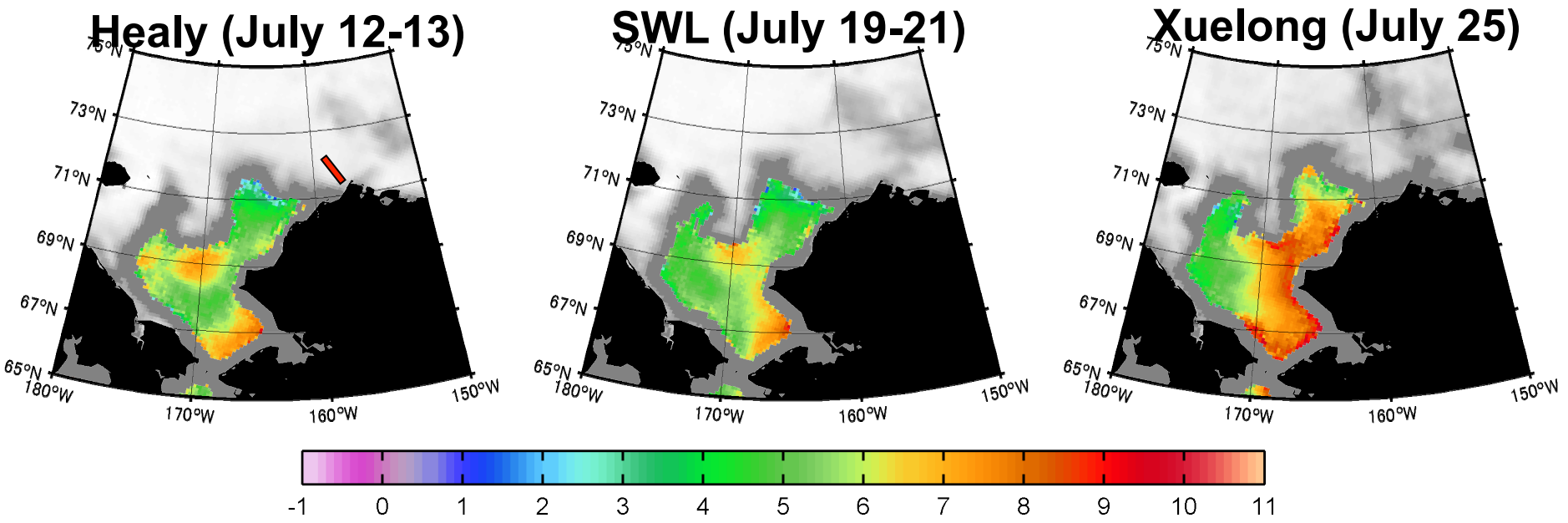


DBO 3-So Chukchi Sea Benthic macroinfaunal biomass-July 2011

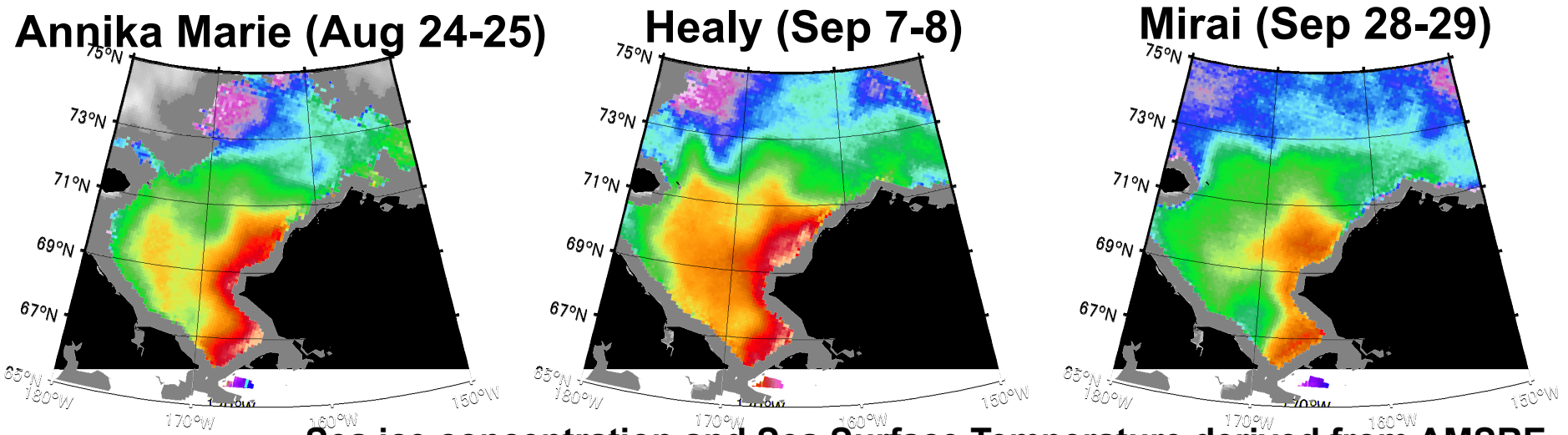



Leg 2 RUSALCA 2012 All Stations
Denotes full biological stations
HC70
G8
G6
G4
G9
G11
72°N
18
22
26
HC
G12
3
2
1
HC
1A
1B
2
2A
CEN
3
S2
G13
G14
70°N
4
SD1
5
G3
S7
G10
G1
3
2
1
4
5
5A
6
CL
6A
7
17
16
12
68°N
8
9
10
10
8
6
4
Ocean Data View
175°W
170°W
DBO3=CS line

Sea ice extent and surface temperature in summer 2010

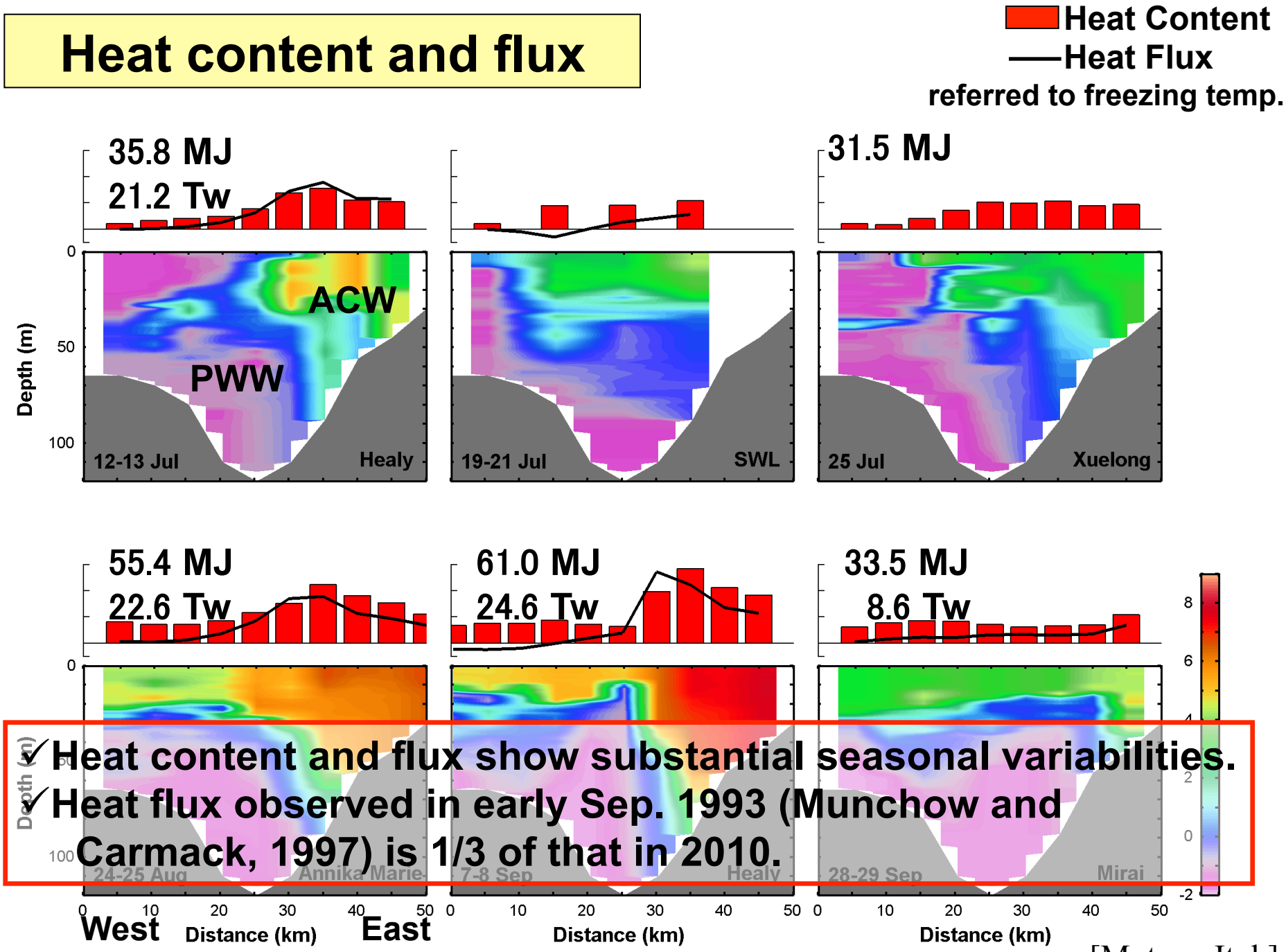


[Motoyo Itoh]



Sea ice concentration and Sea Surface Temperature derived from AMSRE

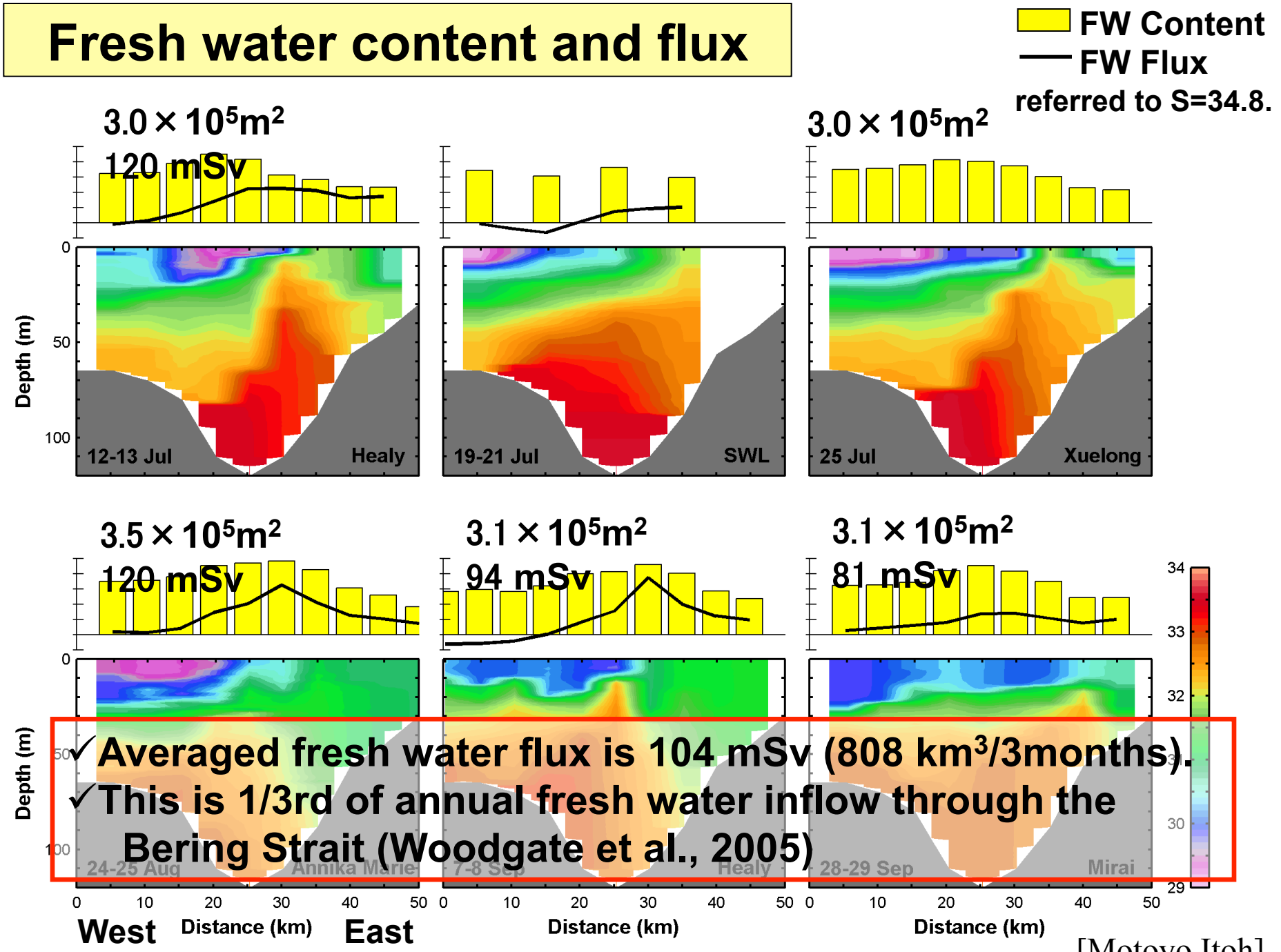
Heat content and flux



- ✓Heat content and flux show substantial seasonal variabilities.
- ✓Heat flux observed in early Sep. 1993 (Munchow and Carmack, 1997) is 1/3 of that in 2010.

[Motoyo Itoh]

Fresh water content and flux

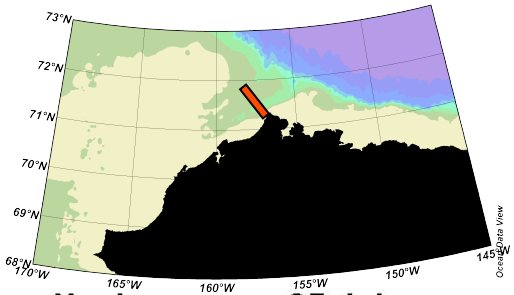


✓Averaged fresh water flux is 104 mSv (808 km^3/3months).

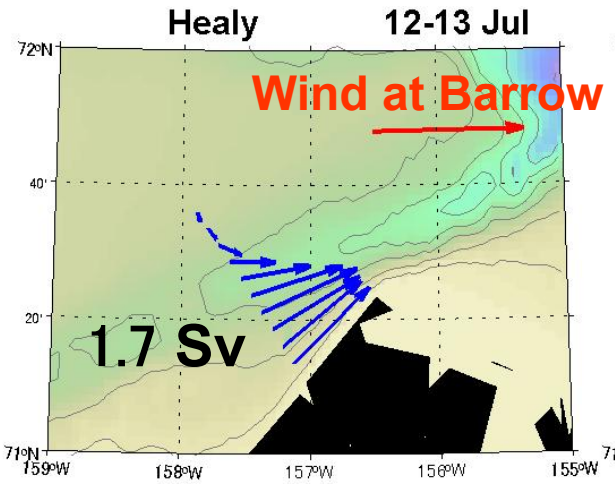
✓This is 1/3rd of annual fresh water inflow through the Bering Strait (Woodgate et al., 2005)

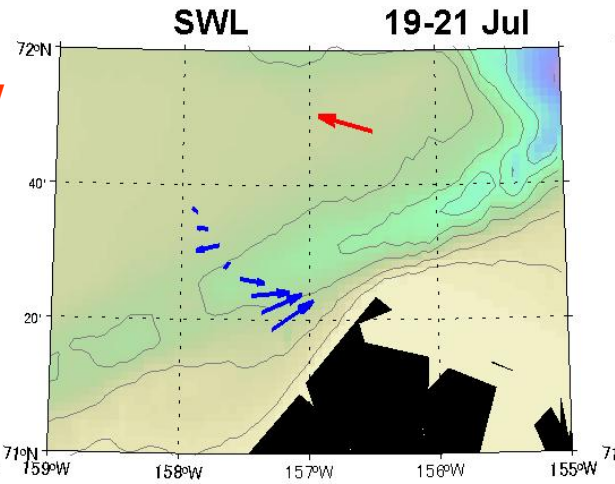
[Motoyo Itoh]

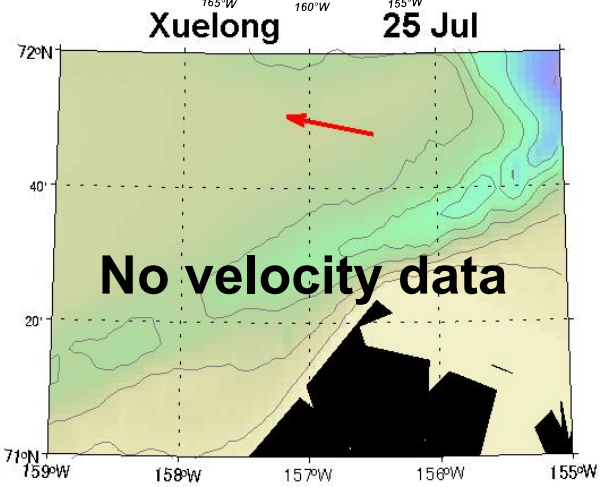
Barrow Canyon through flow

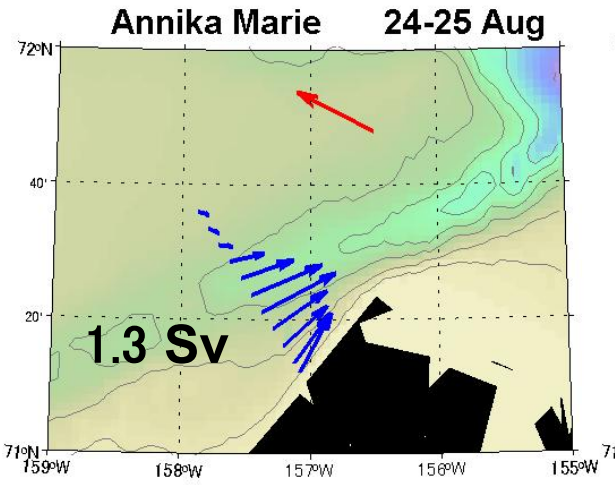


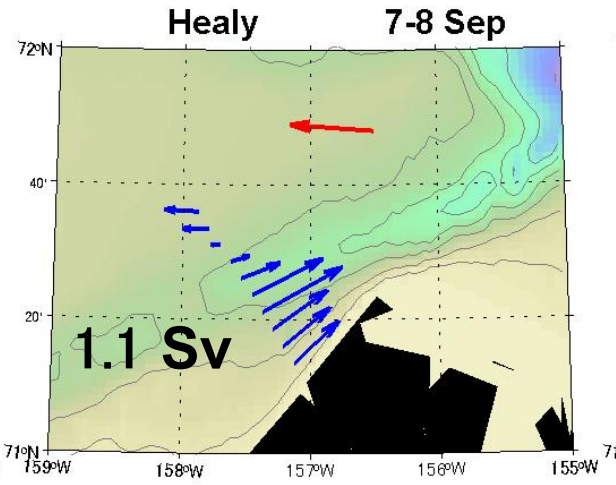
Depth averaged velocity

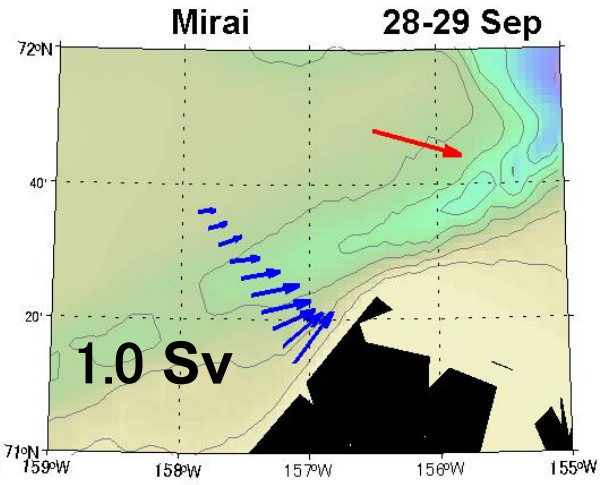








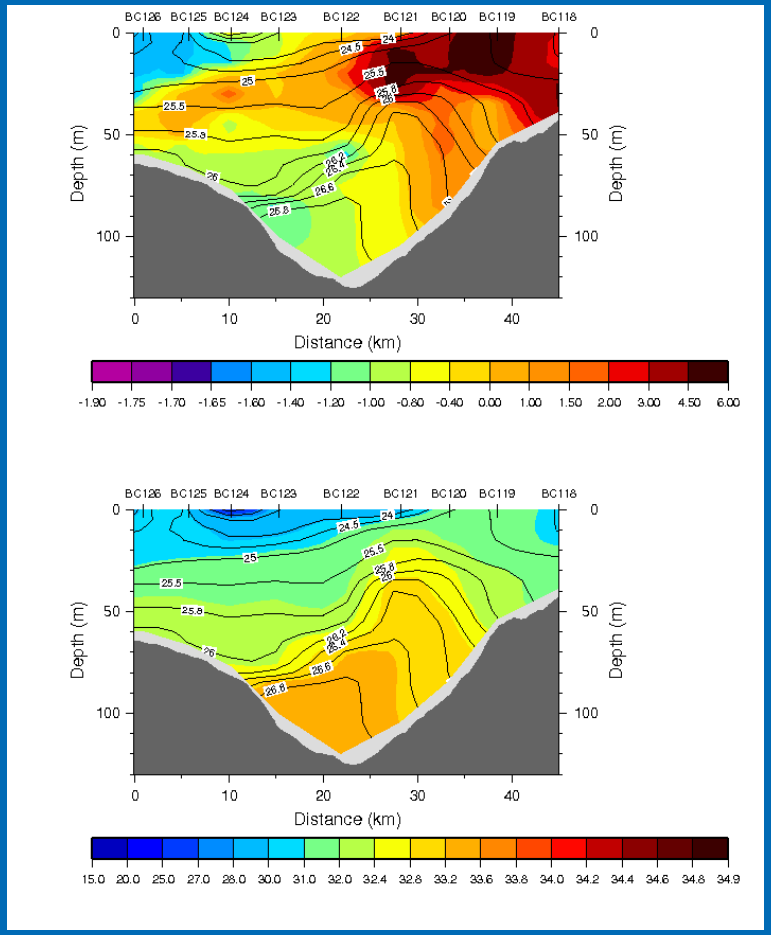




[Motoyo Itoh]

Comparison between July 2010 and July 2011

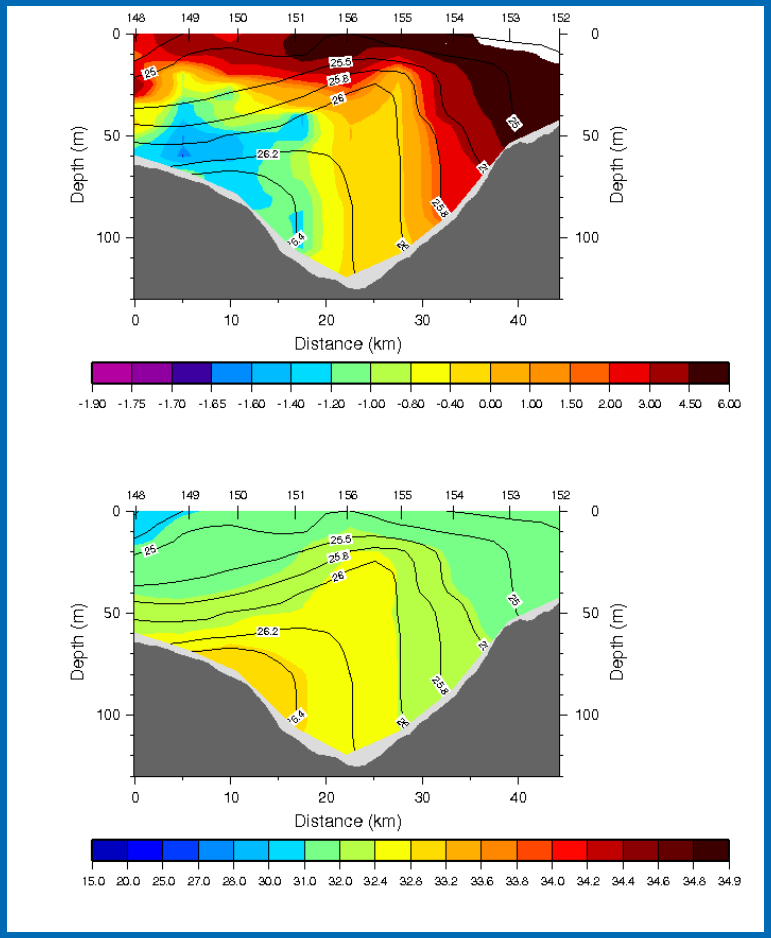
2010



Temp (°C)

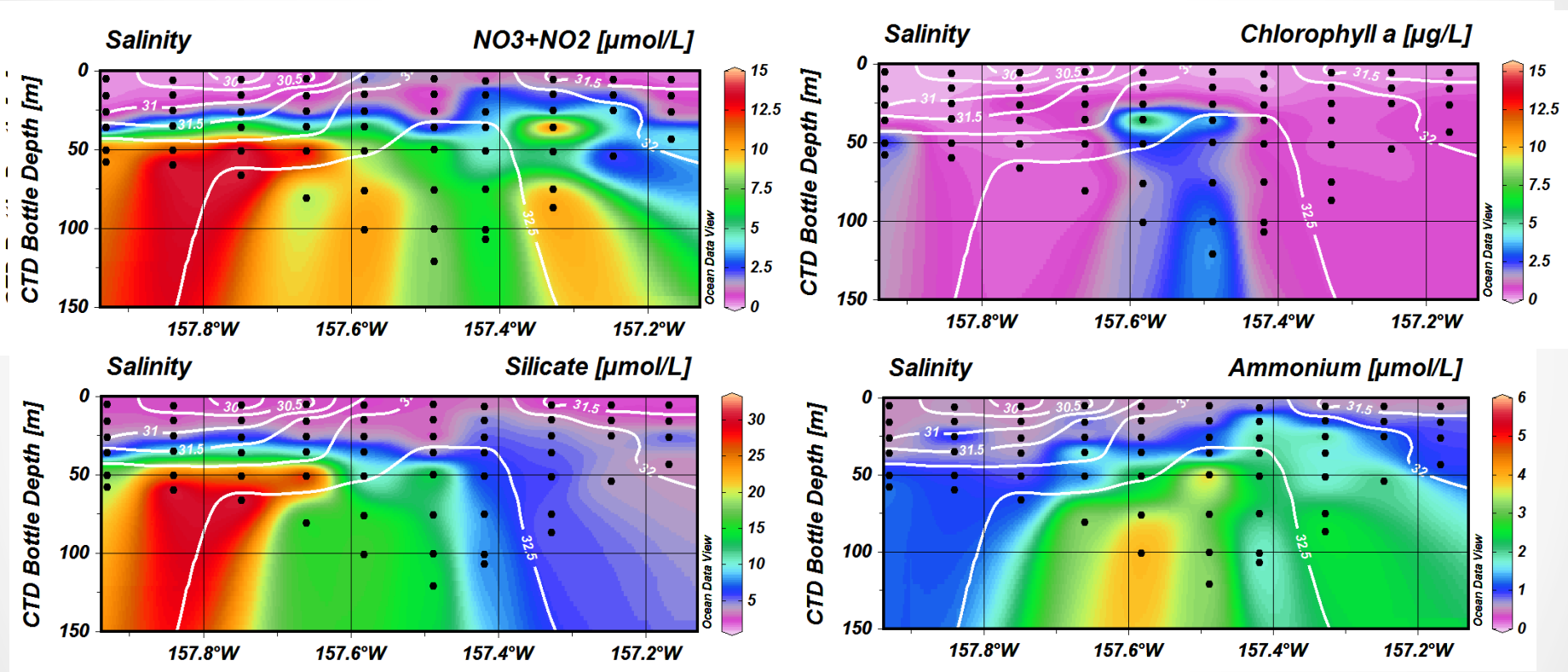
Salinity

2011



In early summer 2011 the ACC was warmer and the subsurface winter-remnant water was colder. However, the winter water was pronouncedly less dense. *Why ??*

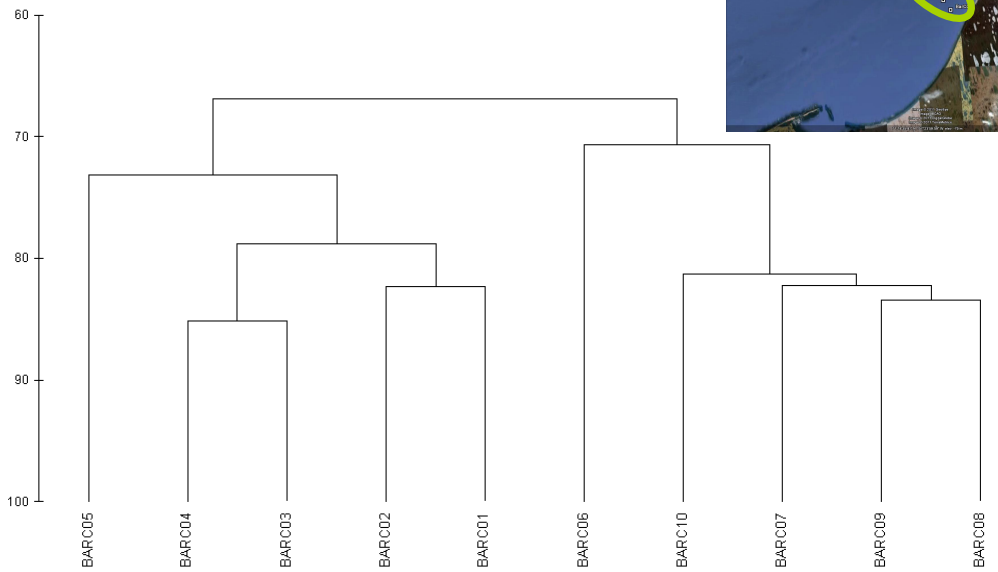
[Robert Pickart]



[Cooper and Grebmeier]

Cluster analysis of zooplankton communities on DBO BC line-July 2011

2011 DBO- results

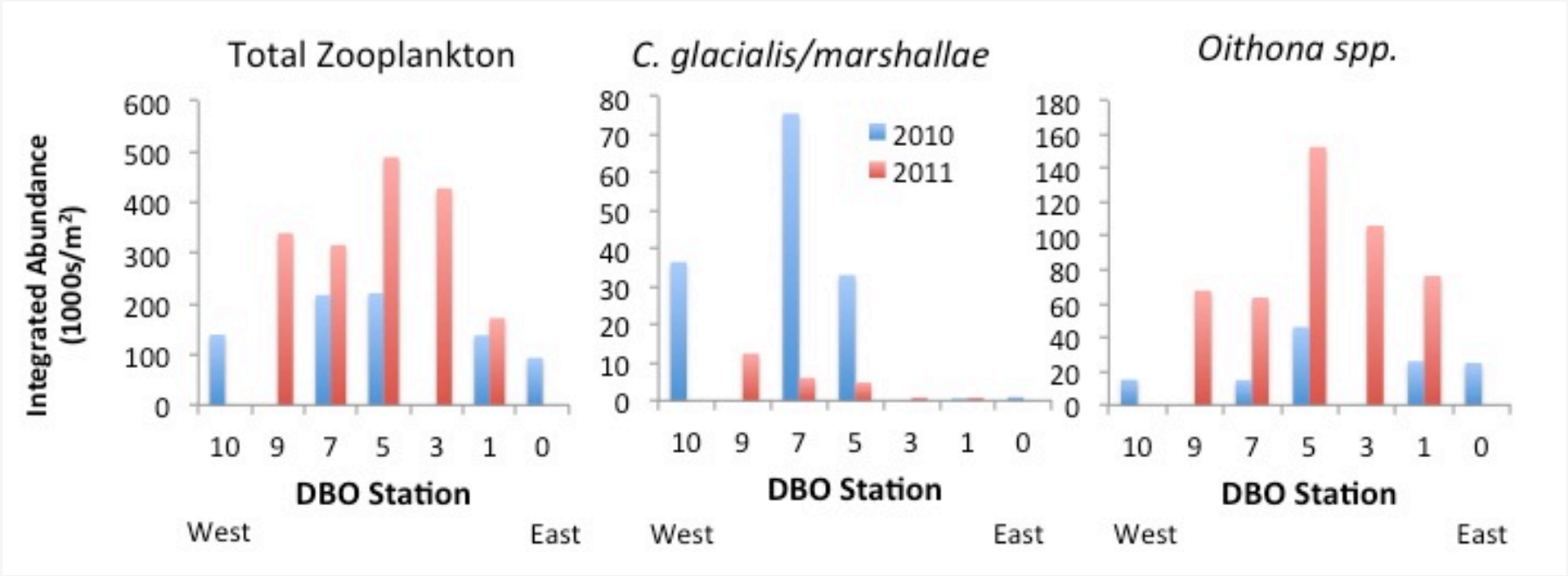


– 4th root transformed Bray-Curtis similarity based on abundance

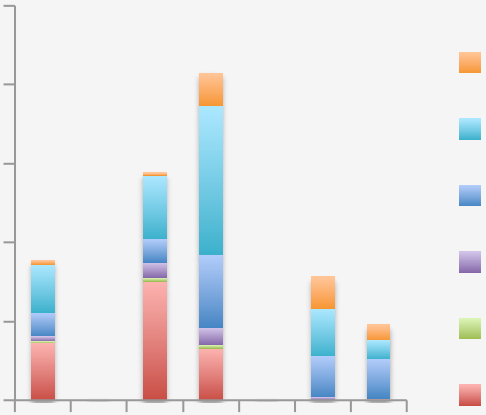
[John Nelson]

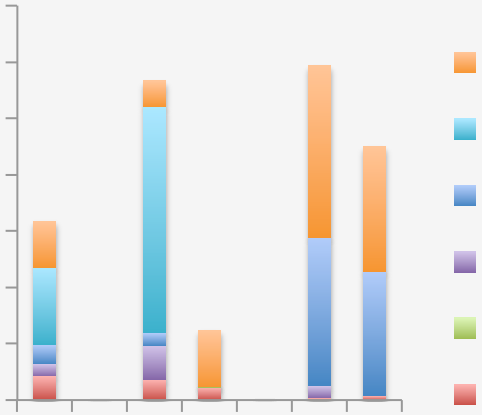
Heavy colored bars indicate stations characterized by copepods *Neocalanus sp* (Pacific) and *Calanus hyperboreous* (Arctic). Inset shows this species distribution overlaid on a chart of the stations

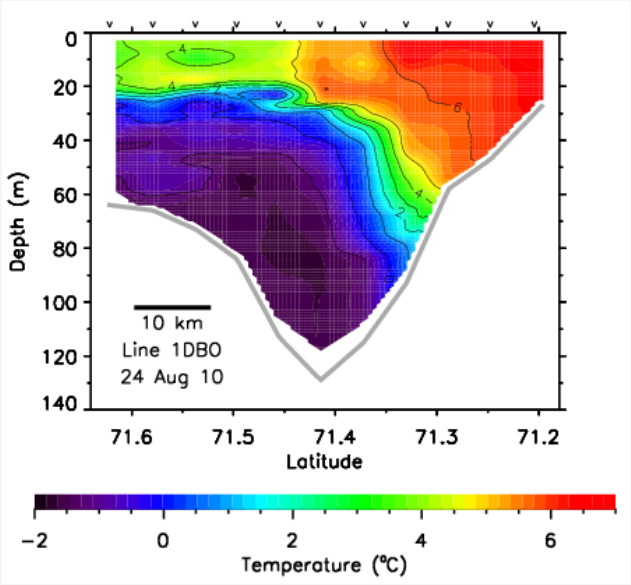
C. glacialis/marshallae *Oithona*



2010 Taxonomic Composition-DBO BC-Aug/Sept



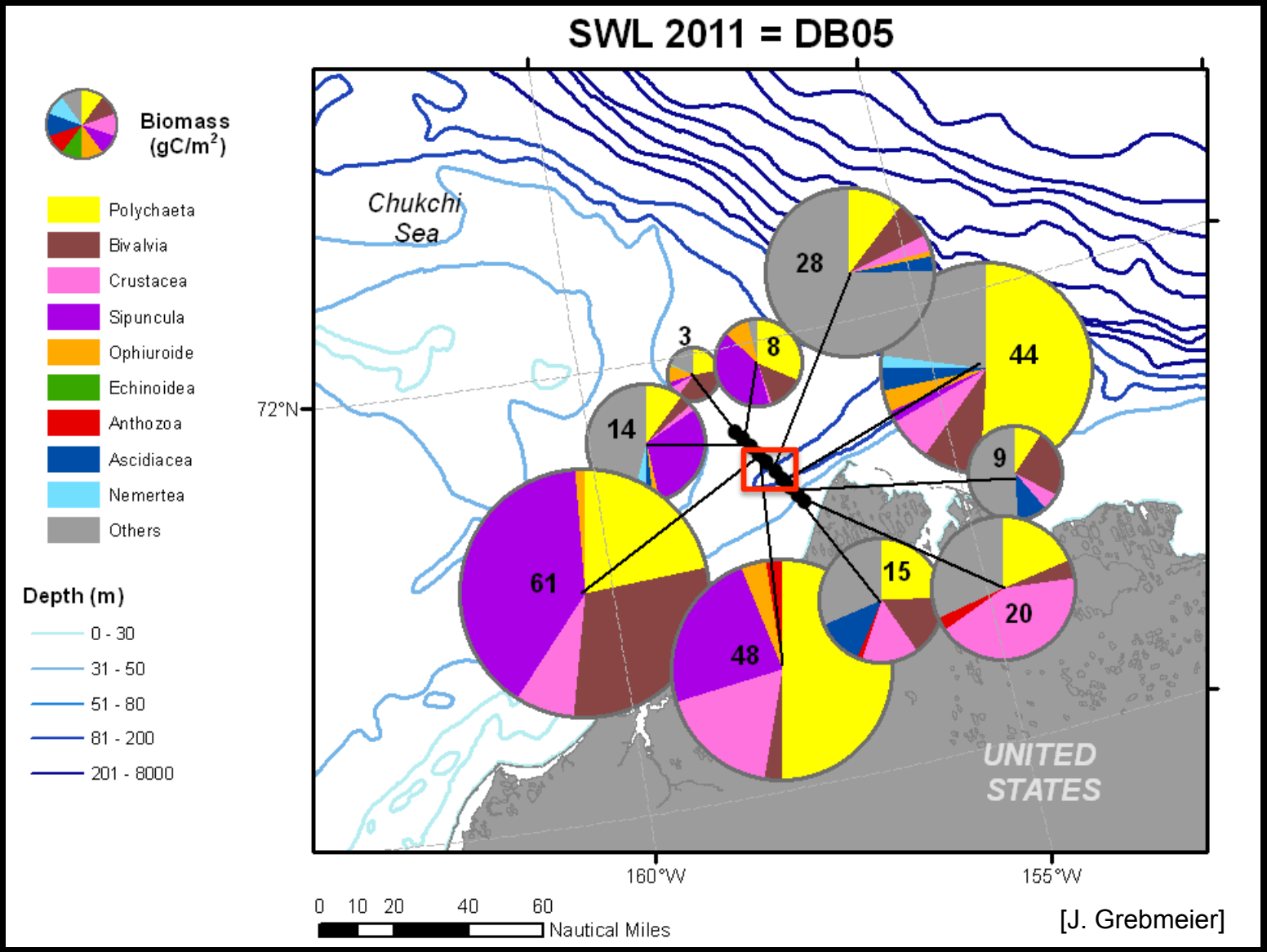




- *Calanus*
-
-

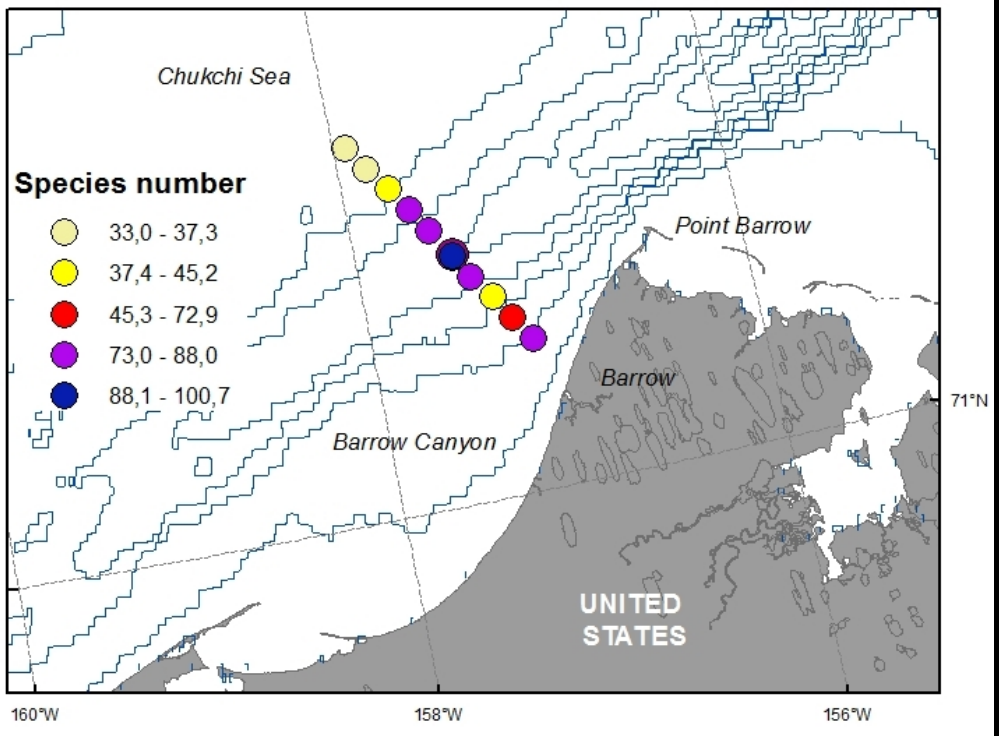
[Carin Ashjian]

DBO 5-Barrow Canyon benthic macroinfaunal biomass-July 2011



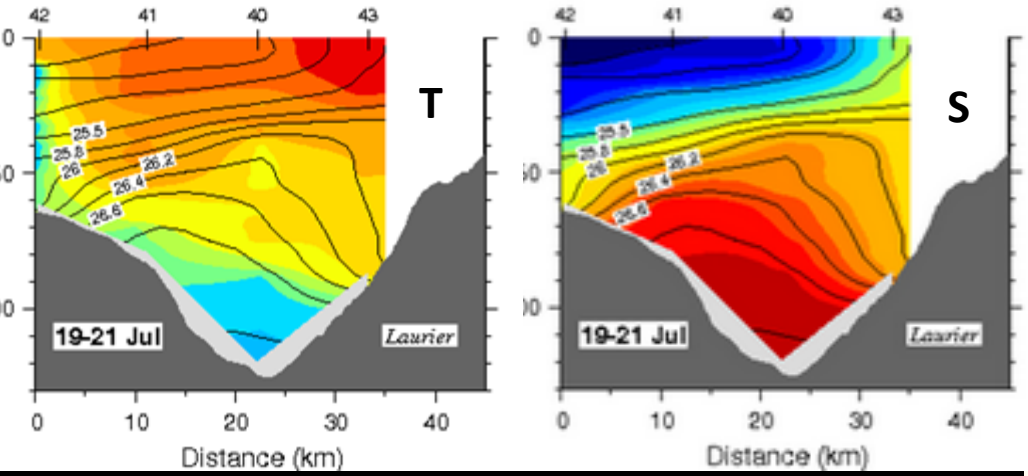
[J. Grebmeier]

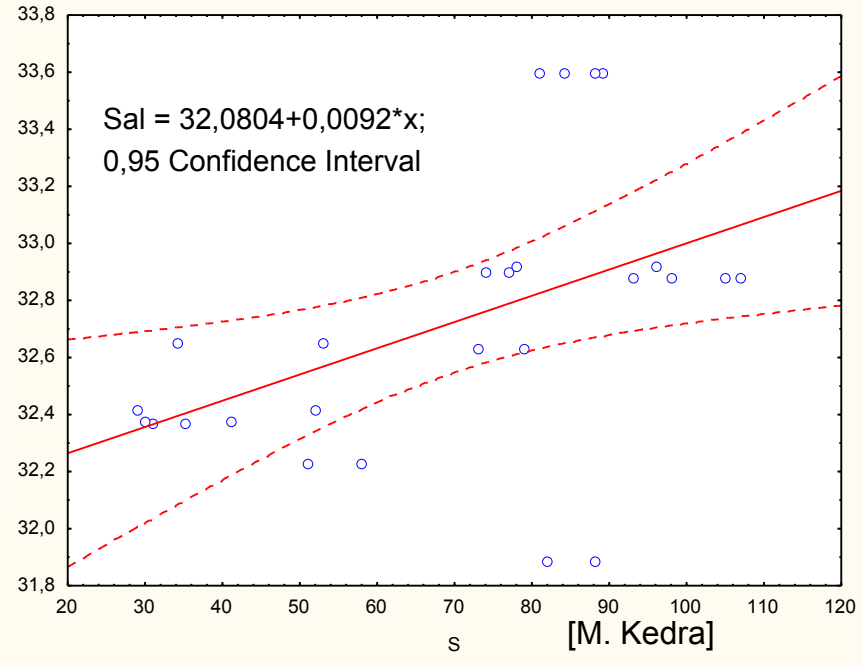
Barrow Canyon



Spearman correlations:
Species richness & bot. sal.: 0.55*
Species richness & chl a: 0.59*
Species richness & TOC : 0.4*

Similar correlations found
for abundance and biomass

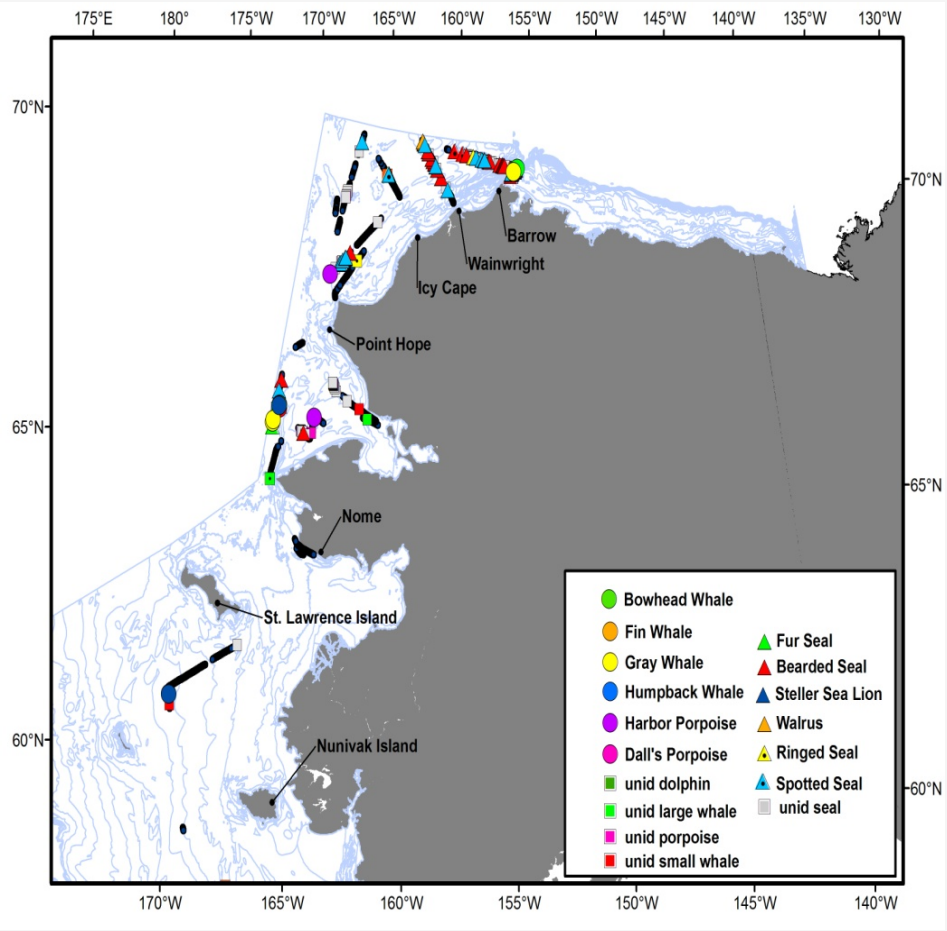




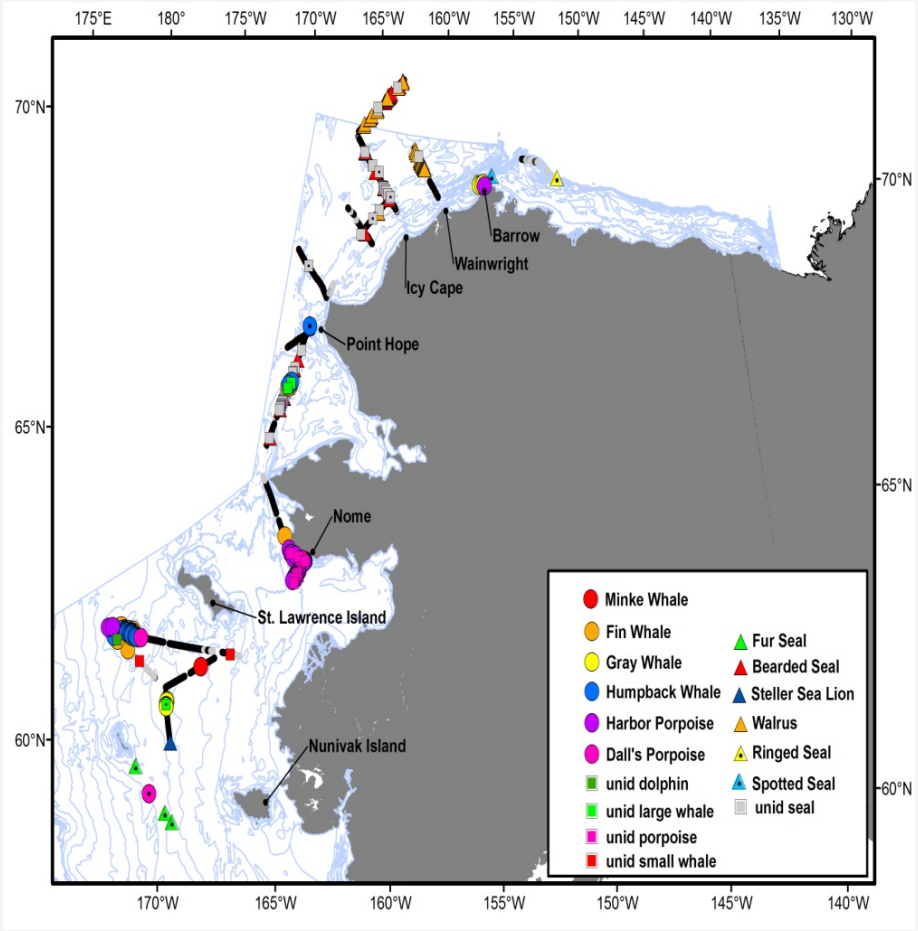
Marine Mammal Sightings (CHAOZ)

Standard Survey Protocol

2010 – DBO Region 3 – 'hotspot'

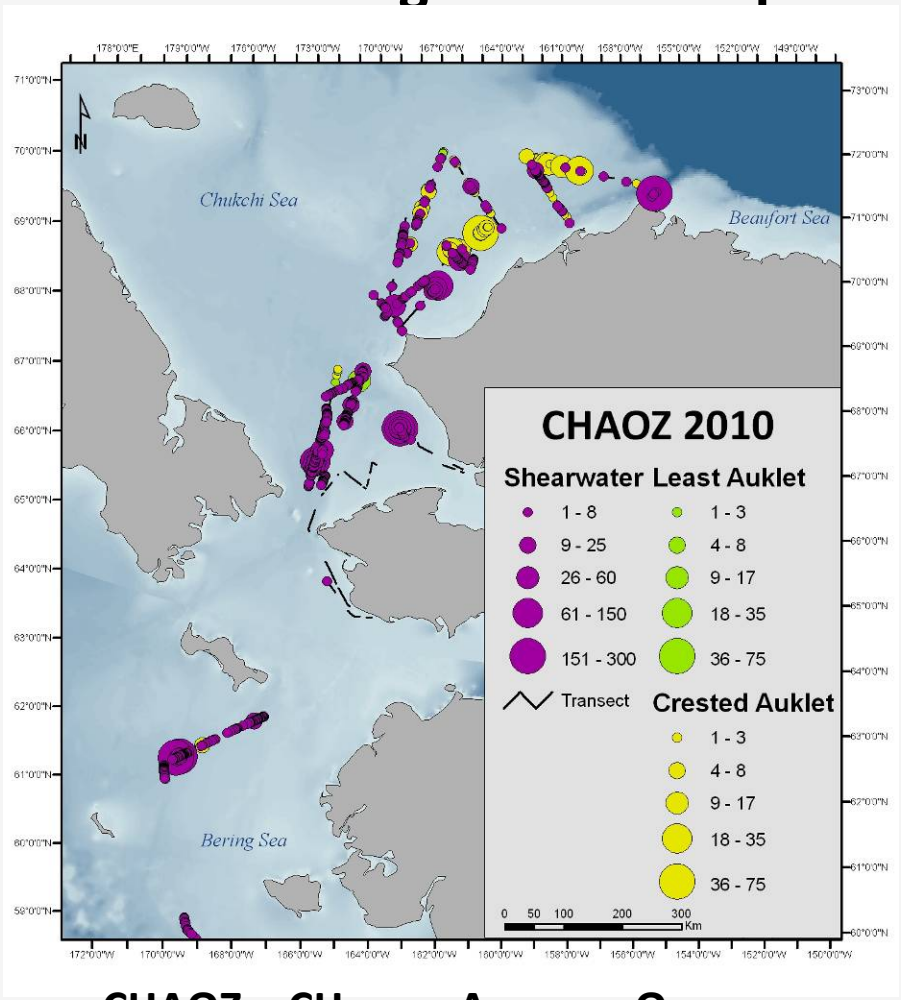


2011: DBO Region 1 – 'hotspot'

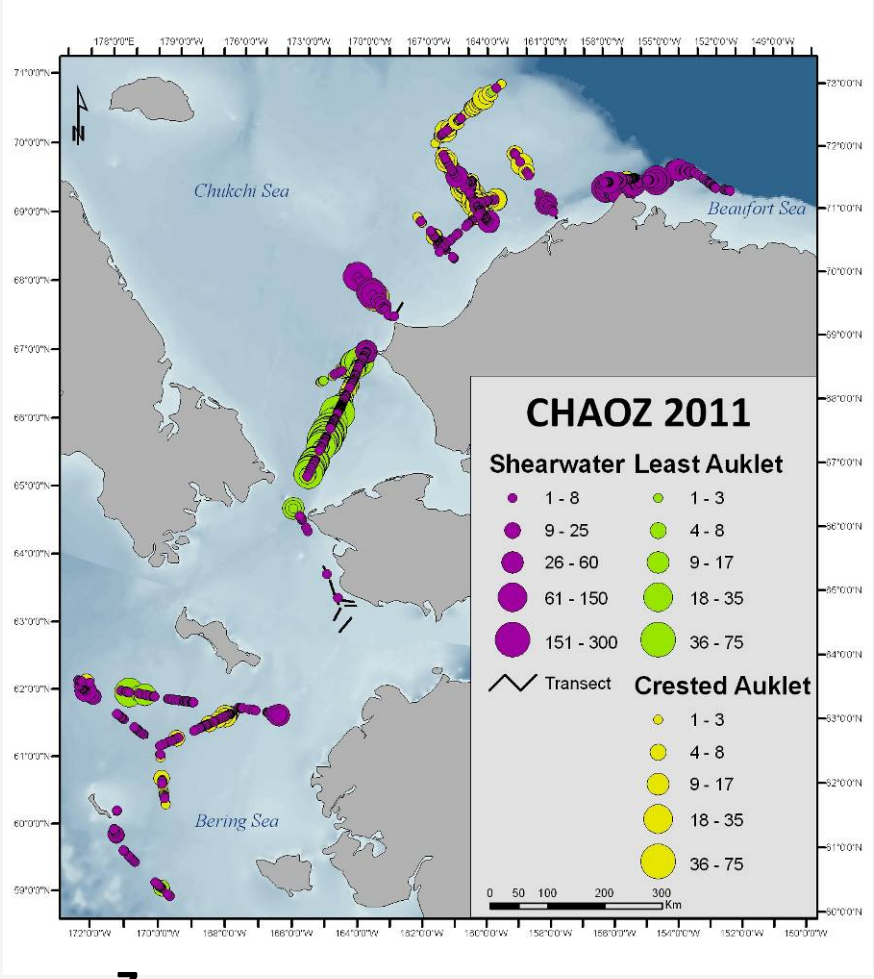


Seabird Sightings from CHAOZ Cruises (USFWS Survey Protocol)

2010 – DBO Region 3 – 'hotspot'

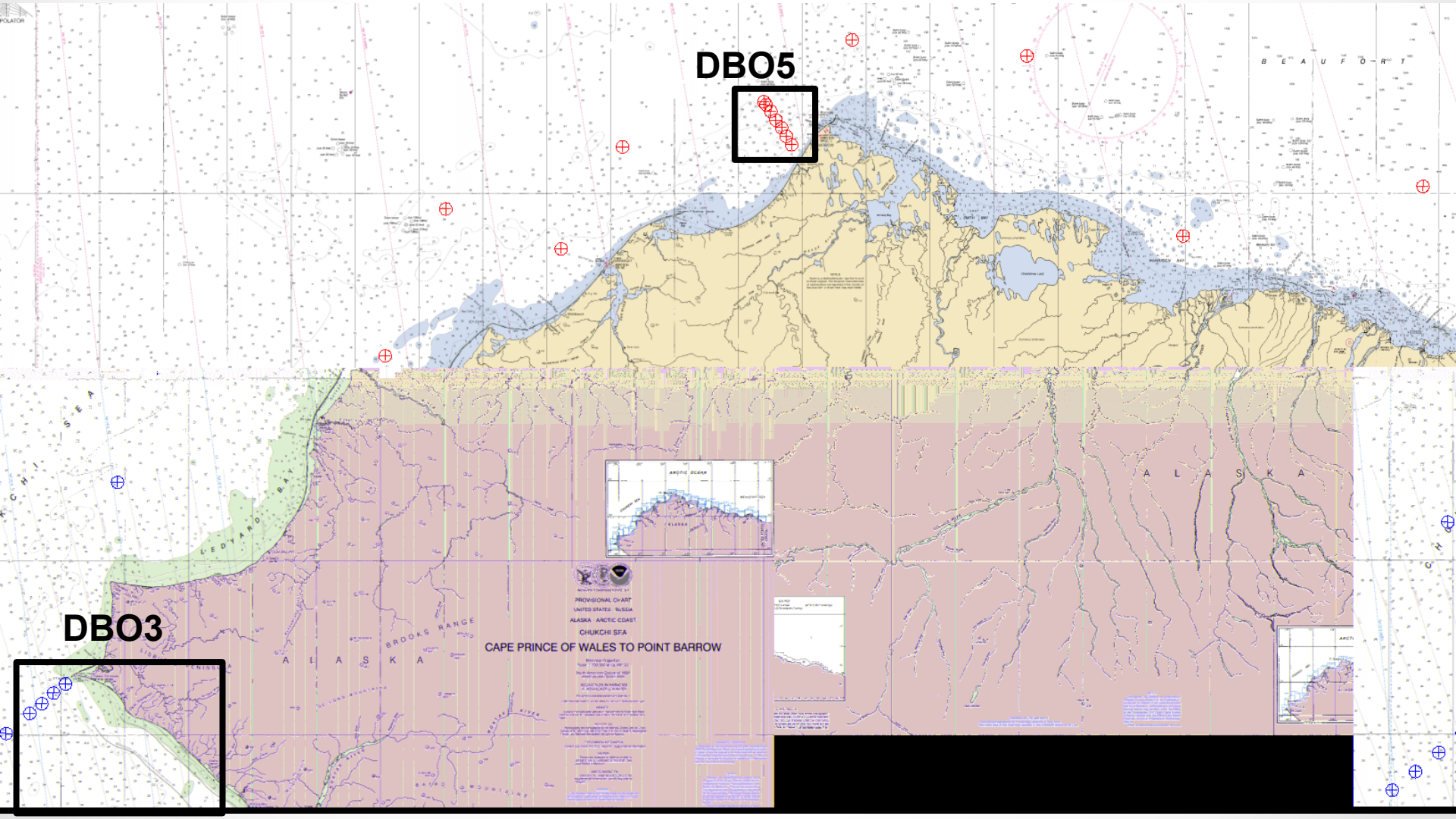


2011: DBO Region 1& 3 – 'hotspot'

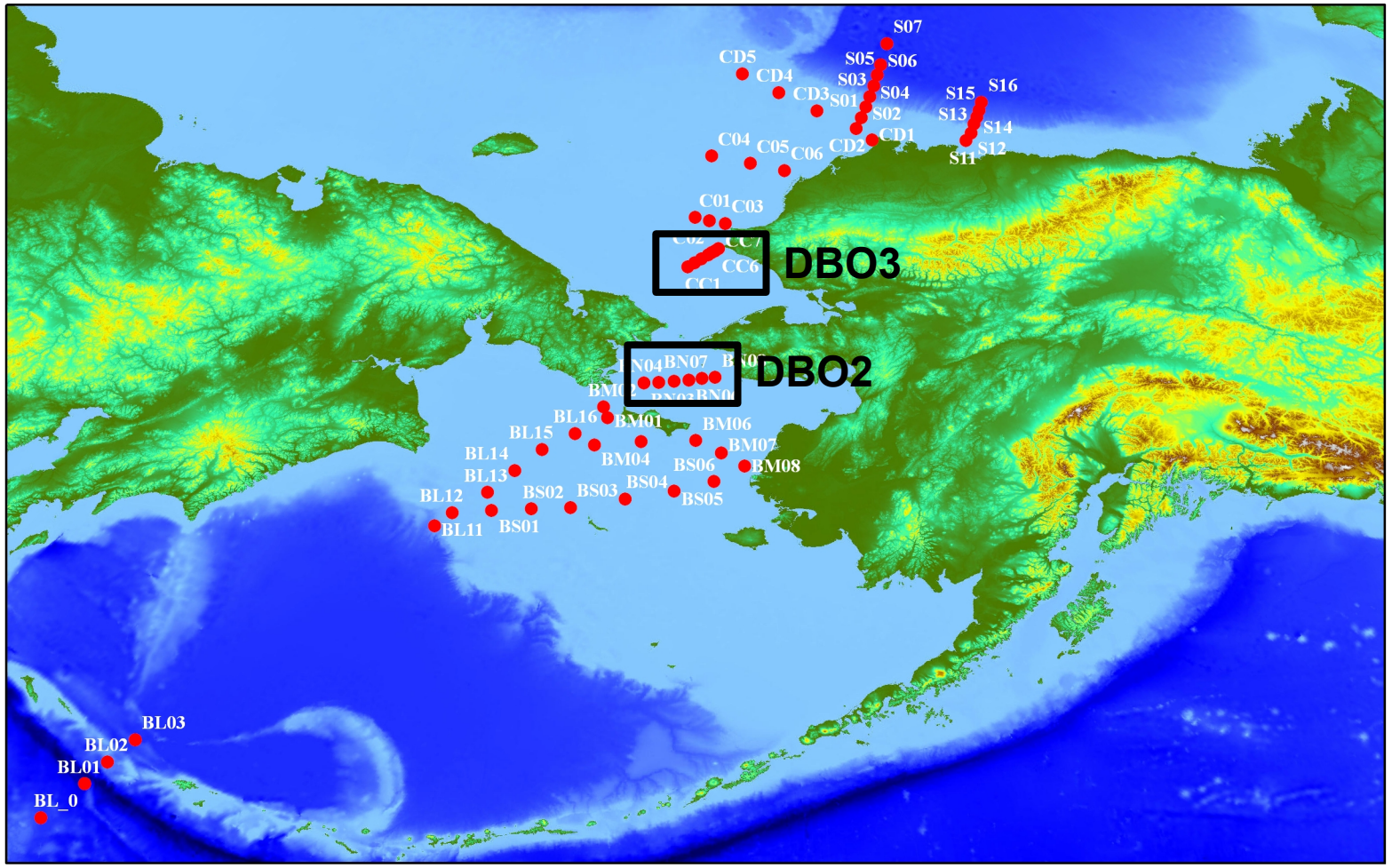


CHAOZ CH A O Z

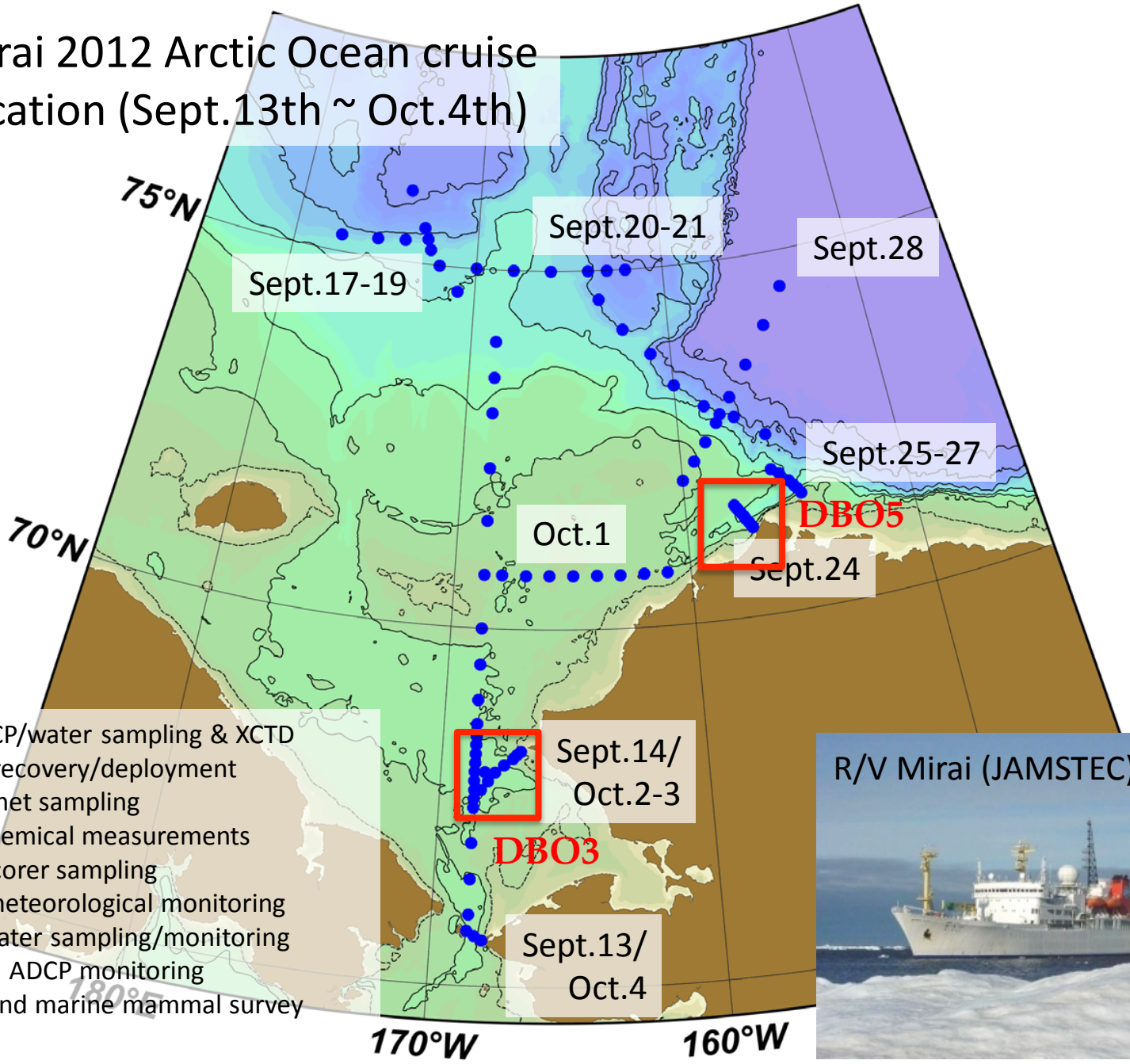
RV Fairweather-NOAA Hydrographic Survey- CTD data in hand (August 2012)



2012 Xuelong planned cruise track



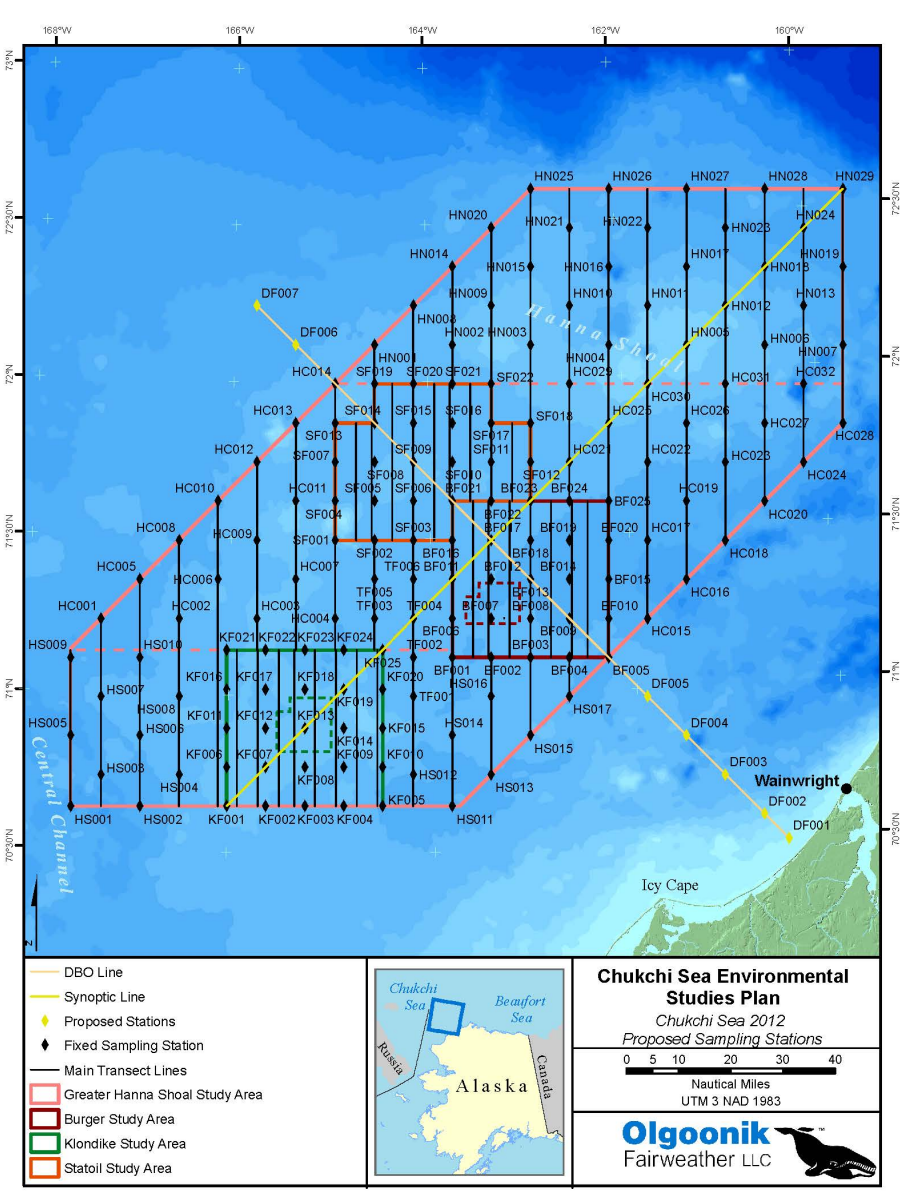
R/V Mirai 2012 Arctic Ocean cruise
CTD location (Sept.13th ~ Oct.4th)



- CTD/LADCP/water sampling & XCTD
- Mooring recovery/deployment
- Plankton net sampling
- Bio-geochemical measurements
- Multiple corer sampling
- General meteorological monitoring
- Surface water sampling/monitoring
- Shipboard ADCP monitoring
- Sea bird and marine mammal survey

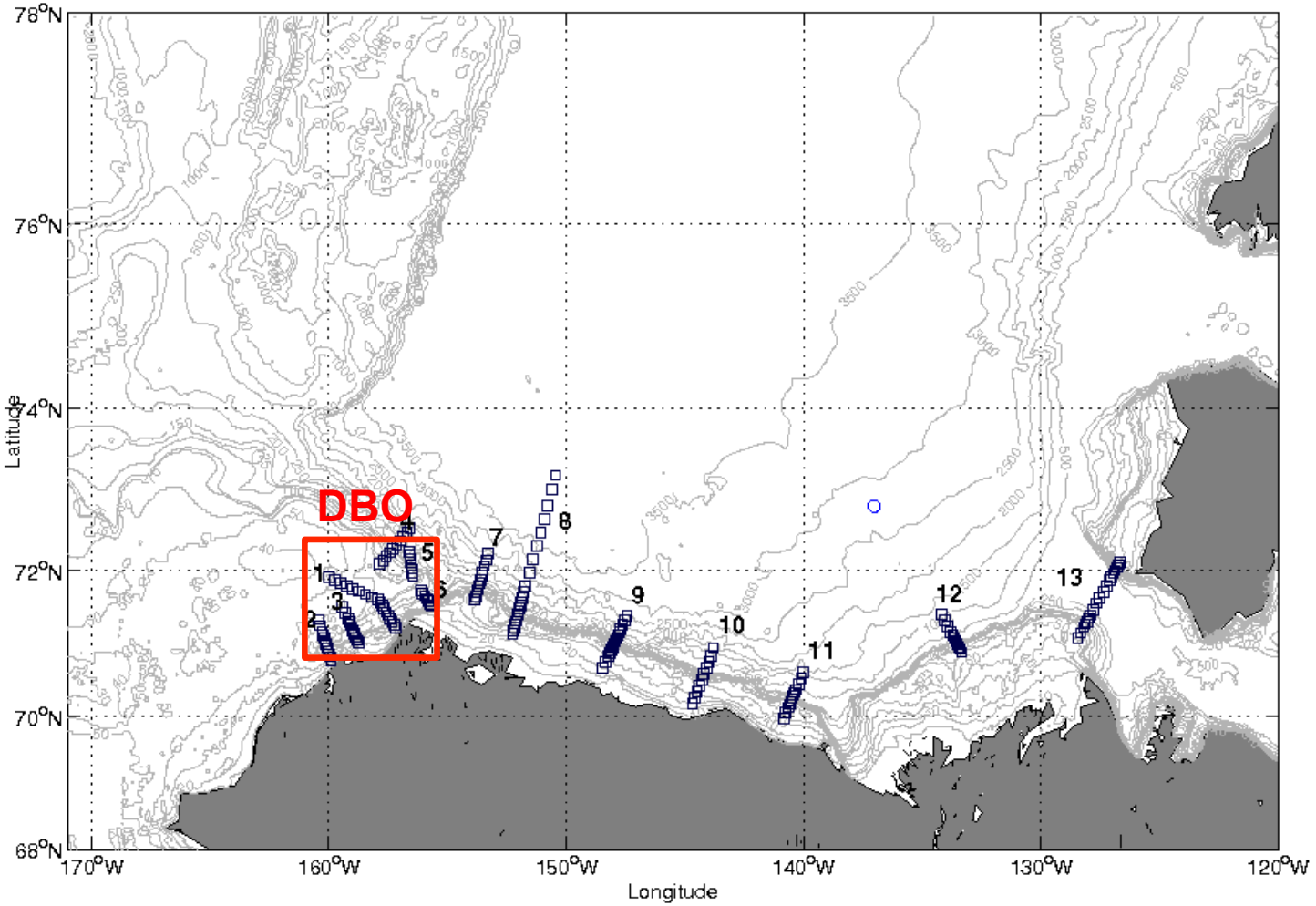
[Takashi Kikuch

CSEAP (Chukchi Sea Environmental Assessment Program (Shell-Conoco-Phillips-StatOil)-August 2012



- Tentative DBO4, but too long and industry only occupied part of it in 2012; I suggest revise to focus SE side of Hanna Shoal biological hotspot and new current flow pattterns observed

HLY1203-Pickart AON, Oct 2012



DBO Data Management Considerations-working with Jim Moore-UCAR/EOL

>Develop an International DBO data policy and exchange protocol (including priority measurements) to facilitate:

- Dataset exchange and access
- Preparation of datasets for data integration, intercomparison and modeling studies

>Encourage broad access to data and metadata beyond national restrictions through scientific collaboration/cooperation

>Coordinate with other National and International Projects

>Consider data format and documentation guidelines to enhance international data exchange and analysis

>Document and standardize (if possible) data collection protocols (time, sensors, processing, parameters, units)

DBO Questionnaire: GOAL: The DBO questionnaire is first step to develop a data management plan to support the Distributed Biological Observatory (DBO) effort. Please complete all questions relevant to your research and the collaboration with international partners in the project.

1. Contact Information: name, affiliation, nation, DBO or related Project title

2. What is/are your research areas of interest? [atmosphere, oceanography, physics, hydrography, biology, plankton, benthos, ecology, higher trophic organisms, modeling]

3. What at the DBO type data sets you have collected?:
CTD data
ADCP
Chlorophyll extractions
Nutrients
Algae-ice/phytoplankton: size, biomass, compositon
Zooplankton: size, biomass, composition
Benthos: size, biomass, composition
Seabird surveys
Marine mammal surveys

3. What other data do you need to complete your research?

4. What measurements do you make?
Which nutrients, what parameters, what units?
(Jackie, if you can provide specific options, we can have a pull down menu for multiple choice—this goes for any of the questions)

5. What kind of data collection tools/ techniques do you use?

6. What is your sampling interval?

7. What processing and quality control do implement for your data?

8. How many years of data do you have?

9. What are your plans for future data collection? Do you have pending proposals relevant to DBO? Please provide details.

10. Where do you archive your data at this time? Please provide contact information (email, institution, etc.)

11. Who is the data manager in your group? Please provide contact information (email)

12. Are you willing to share your data with other DBO scientists via a specialized DBO data archive site? Would you prefer your data be password protection until it is made public?

13. What is the time frame for your data be made public for full community access?

14. Please provide contact information for data manager for specific discussions with EOL staff.

Marine Working Group

Scientific Foci

- Predicting and understanding rapid changes to the Arctic Ocean system
- Understanding biological and ecosystem processes in the Arctic and Sub-arctic seas
- Understanding sea ice structure dynamics and the Arctic system
- Understanding geochemical processes in the Arctic and Sub-arctic seas
- Facilitating Deep Sea drilling in the Arctic Ocean

Steering Group

Chair: **Bert Rudels**
Vice-Chair: **Rolf Gradinger**
Vice-Chair: **Jinping Zhao**
Past Chair: **Savi Narayanan**




Marine Working Group

Activities 2012

Title	Type of Activity	Date and Place
Arctic in Rapid Transition (ART)	Science Planning Workshops	29 February, Bremerhaven, Germany 25-26 June, Copenhagen, Denmark
Arctic Climate System Network (ACSNet)	Workshop (with IASC Network)	23 April, Montreal, Canada
International Council for Exploration of the Sea (ICES)	Science Conference Sessions	17-21 September, Bergen, Norway
Arctic in Rapid Transition (ART)/APECS	Science Conference (Cross-cutting)	22-26 October, Sopot, Poland
Distributed Biological Observatories	*Workshop*	*February 2013, Seattle, USA*
Gas Hydrates	*Workshop*	*March 2013, Copenhagen, Denmark*

DISCUSSION and WAY FORWARD

- Mechanisms to implement international synthesis from PAG DBO pilot effort
- How to complement and not compete with national efforts
- Discussion on DBO data management
- Offer from Sue Moore/NOAA to host a DBO data meeting in Seattle, Washington, February 12-14, 2013; Jackie has small 4K Euro travel budget from MWG of IASC, but most participants need find national travel support