Distributed Biological Observatory (DBO) 2010 Pilot Program, Data Plans, and Future

Jacqueline M. Grebmeier

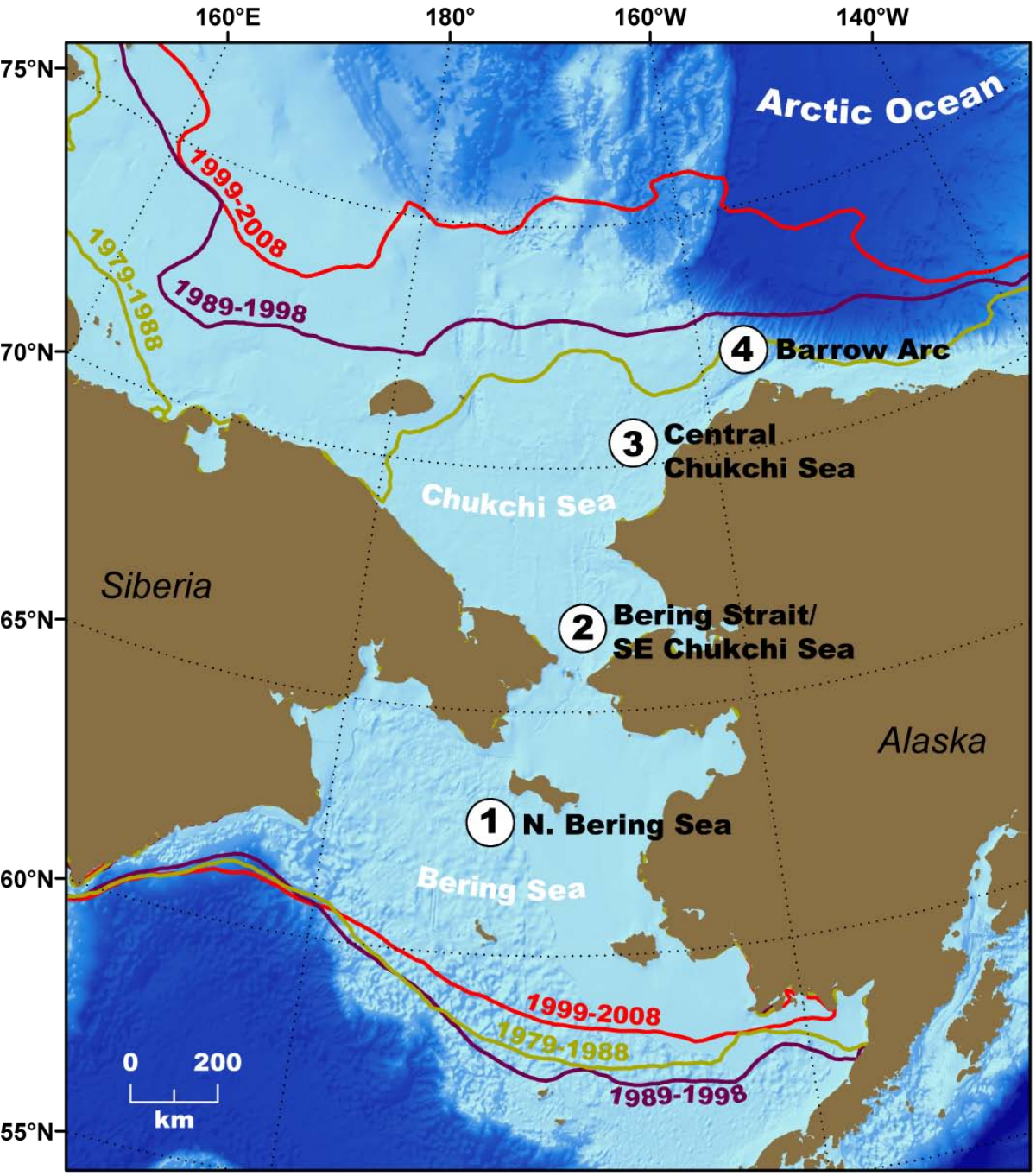
Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, Solomons, Maryland, USA

10-11 December 2010
National Institute of Polar Research (NIPR)
Tokyo, Japan

OUTLINE:

- DBO Concept
- Summary Matrix 2010 measurements
- Review DBO data templates
- Discuss concept of integrated databases and how it might be achieved
- Discuss possible joint analysis of data in integrated databases

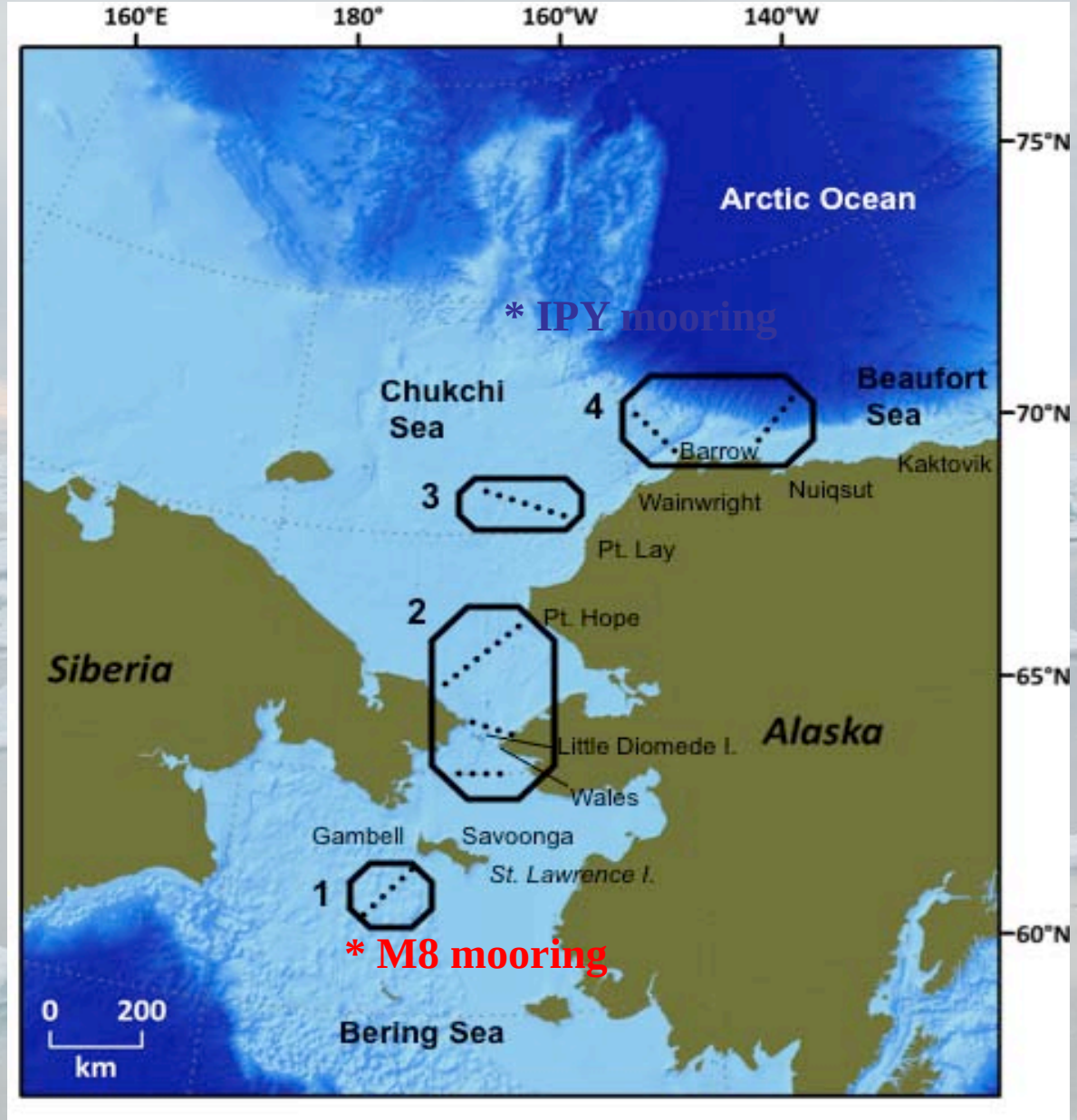
Linking Physics-Biology: the Distributed Biological Observatory (DBOs)



- The DBO will focus on four regional "hotspot" locations along a latitudinal gradient
- DBO regions exhibit high productivity, biodiversity, and overall rates of change
- The DBO will serve as a *change detection array* for the identification and consistent monitoring of biophysical responses

[see Grebmeier et al. 2010 for further information]

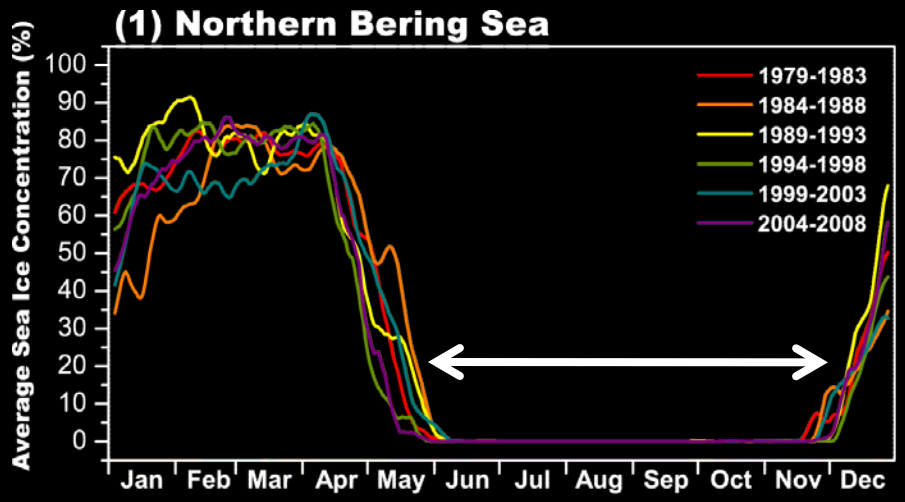
DBO- Repeated Oceanographic Sampling with Links to Community-based "research partnerships"

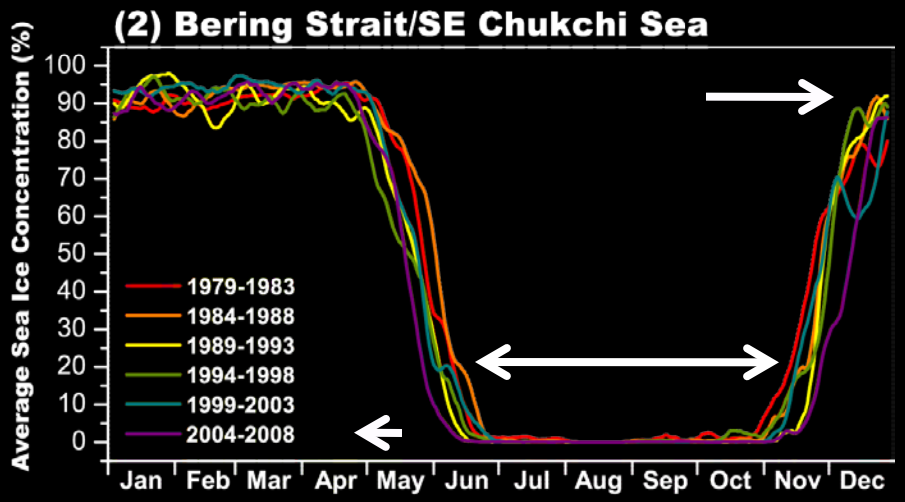


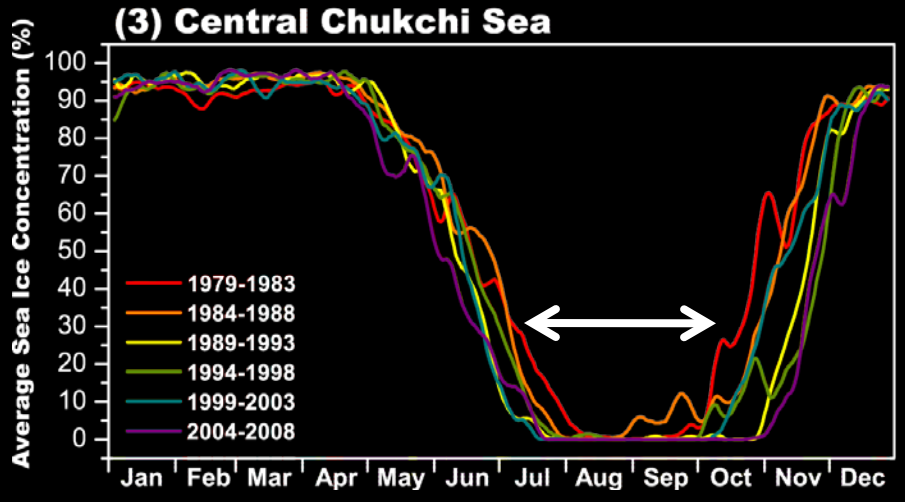
- Stations from prior & existing research programs: SBI, RUSALCA, C30 SNACS, BOWFEST, ICESCAPES

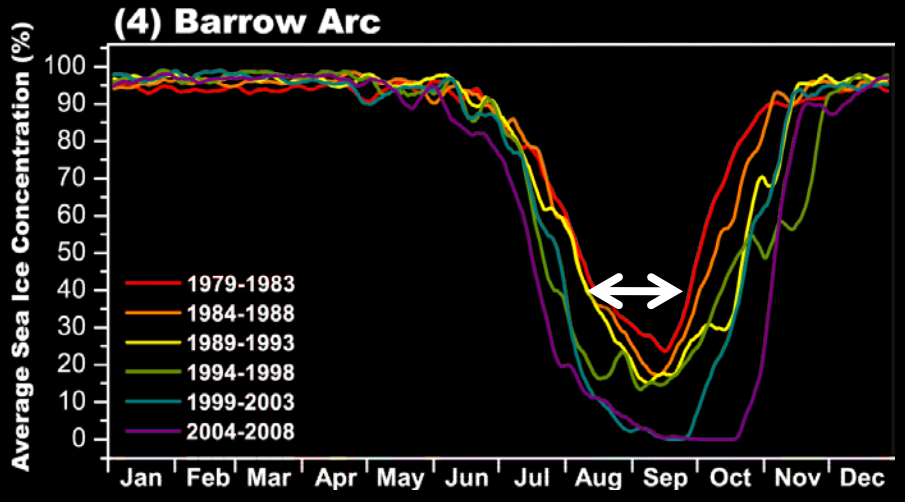
Links to prior & existing Community-based Research: SLI/Diomede Pt. Lay, Barrow

Sea Ice Seasonality Shifts at DBOs (1979-2008) - early spring sea ice retreat, later fall ice formation





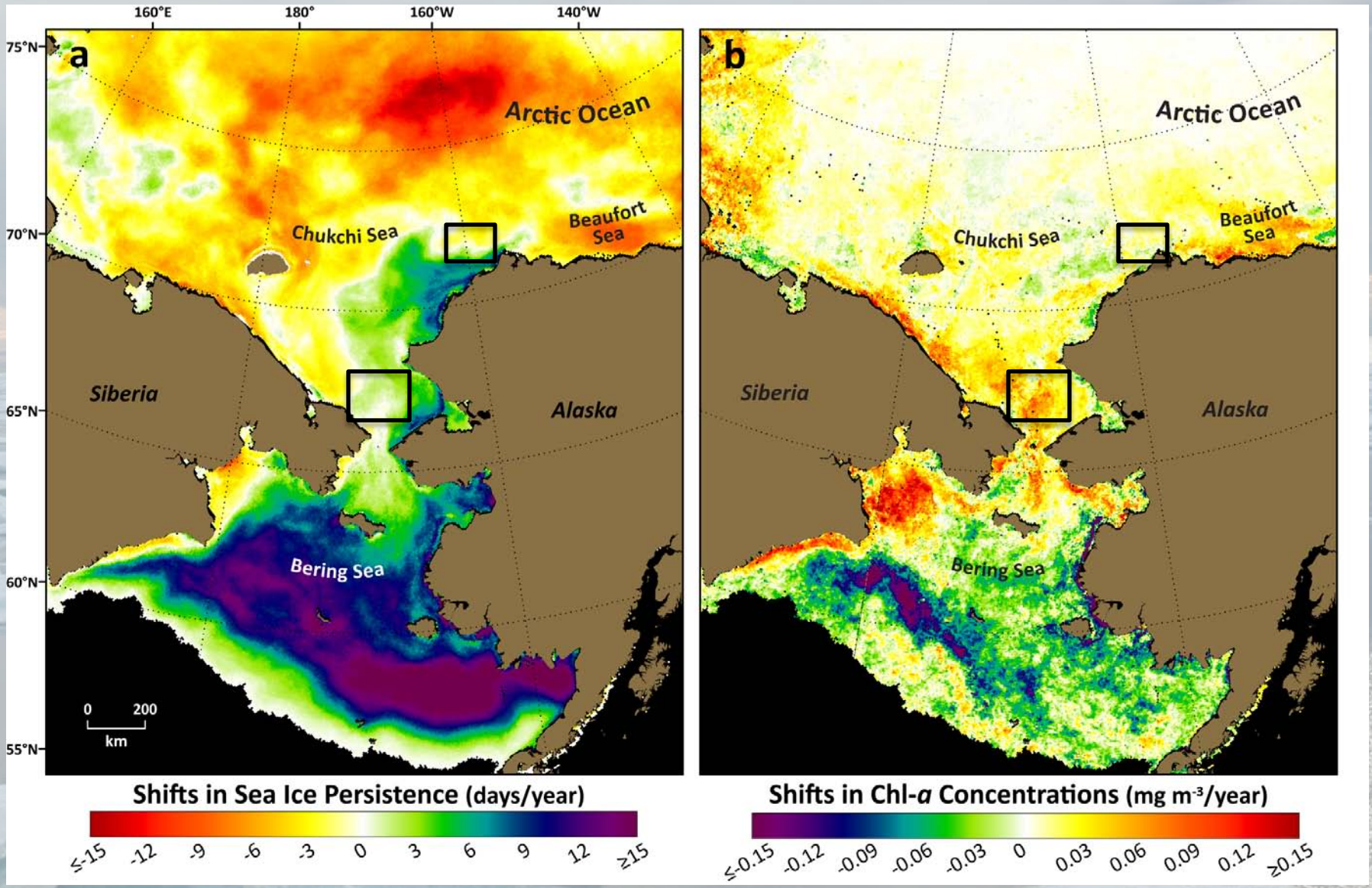




Based on SMMR and SSM/I Satellite-Derived Sea Ice Concentrations (1979-2008)

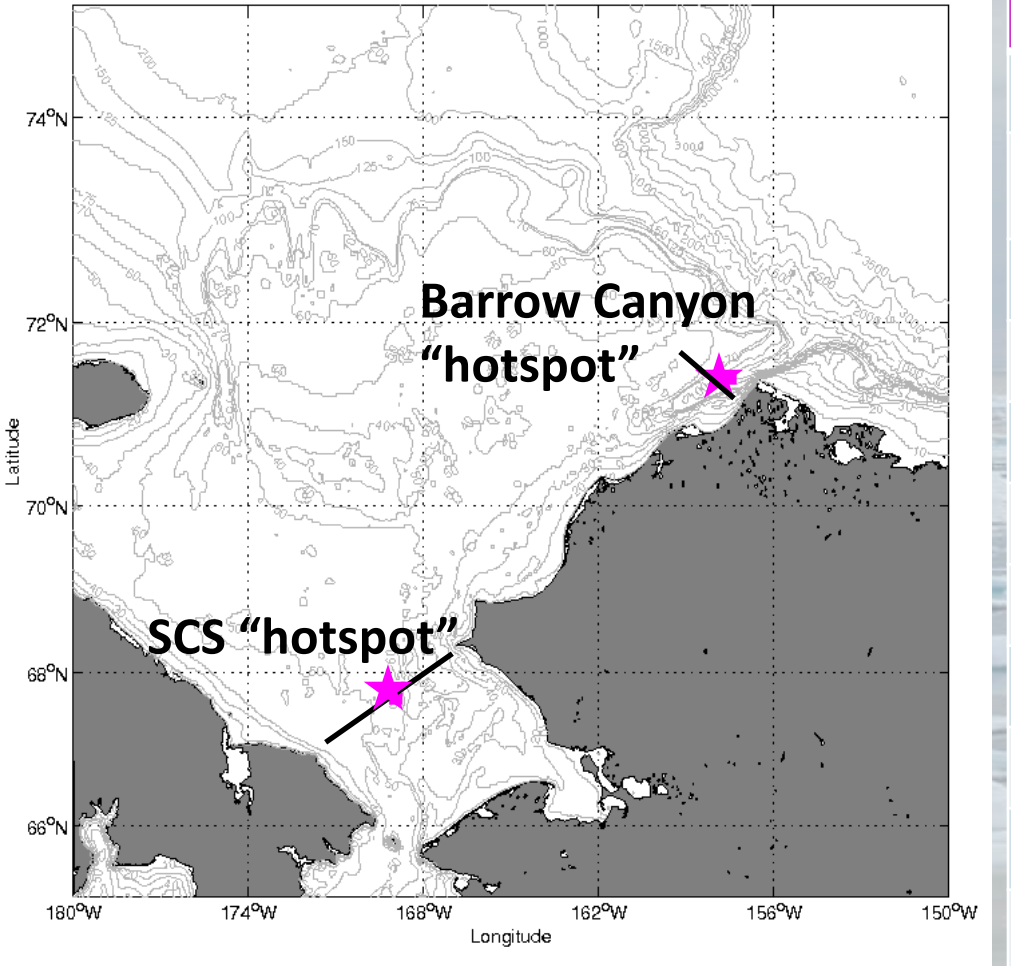
Karen Frey, Clark University

Shifts in sea ice persistence and Chl-a concentration from 2003-2009



Based on SSM/I Sea Ice Concentrations and the GlobColour (SeaWiFS, MODIS, MERIS) satellite time series

DBO 2010 “Pilot” Season: International cruises to Pacific Arctic



Vessel	Country	PI
Moana Wave	USA	Grebmeier
Alaskan Enterprise	USA	Napp
Aaron	Korea	Lee
Xue Long	China	Zhao
Mirai	Japan	Itoh
Laurier	Canada	Fudge
ST Laurent	Canada	Carmack
Healy	USA	Arrigo
Healy	USA	Pickart
Annika Marie	USA	Ashjian
Khromov	USA & Russia	Crane

http://pag.arcticportal.org

"Vision" for Distributed Biological Observatory

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)

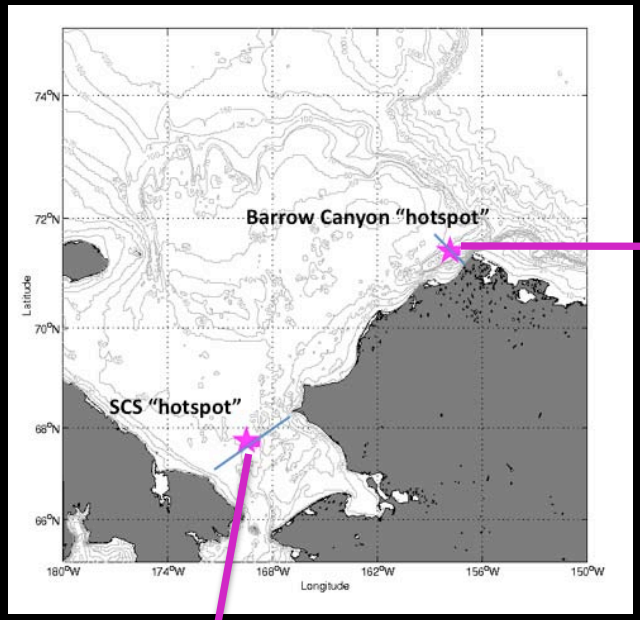
"Change detection array" – same measurements every year, process information in near real time <6 mos; detect regime shifts in rapid changes

Second tier ship-based sampling:

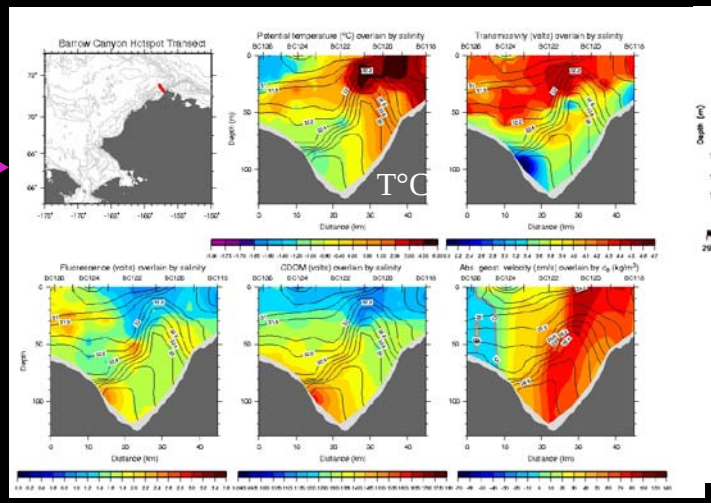
- Fishery acoustics (less effort than standardized bottom trawling)
- Bottom trawling (every 3-5 years)

Additional leveraged programs both domestic and international

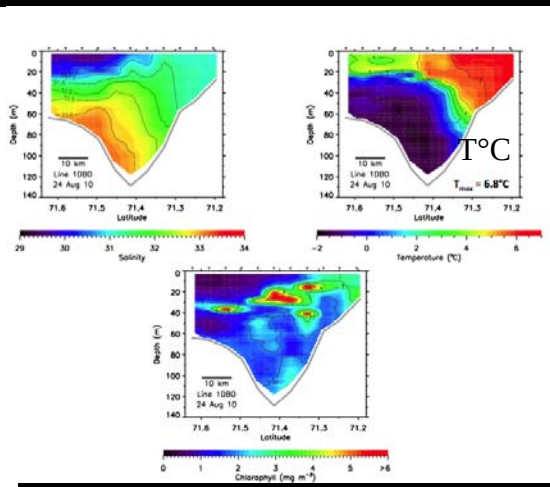
Examples of DBO Hydrographic Data 2010



Barrow Canyon

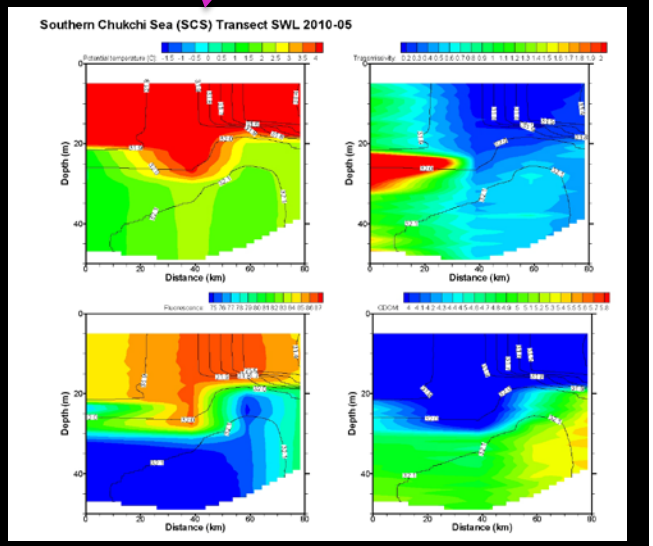


Robert Pickart-USCGC Healy July 2010

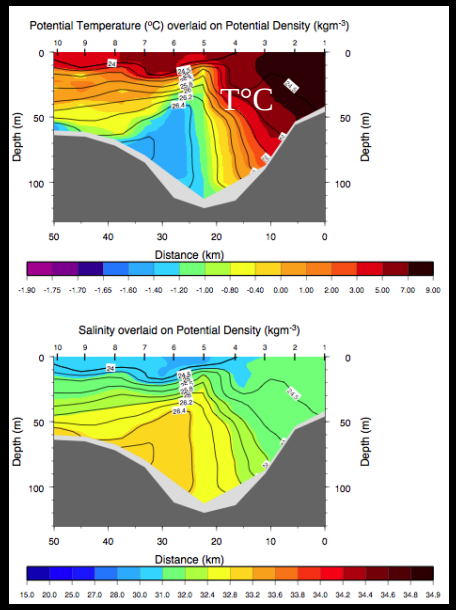


Carin Ashjian-Annika Marie, August 2010

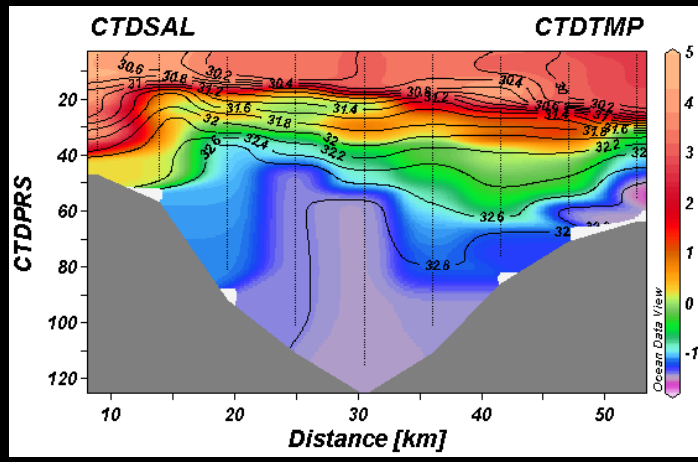
SE Chukchi Sea



Svein Vogle-CGCS Sir Wilfrid Laurier-July 2010

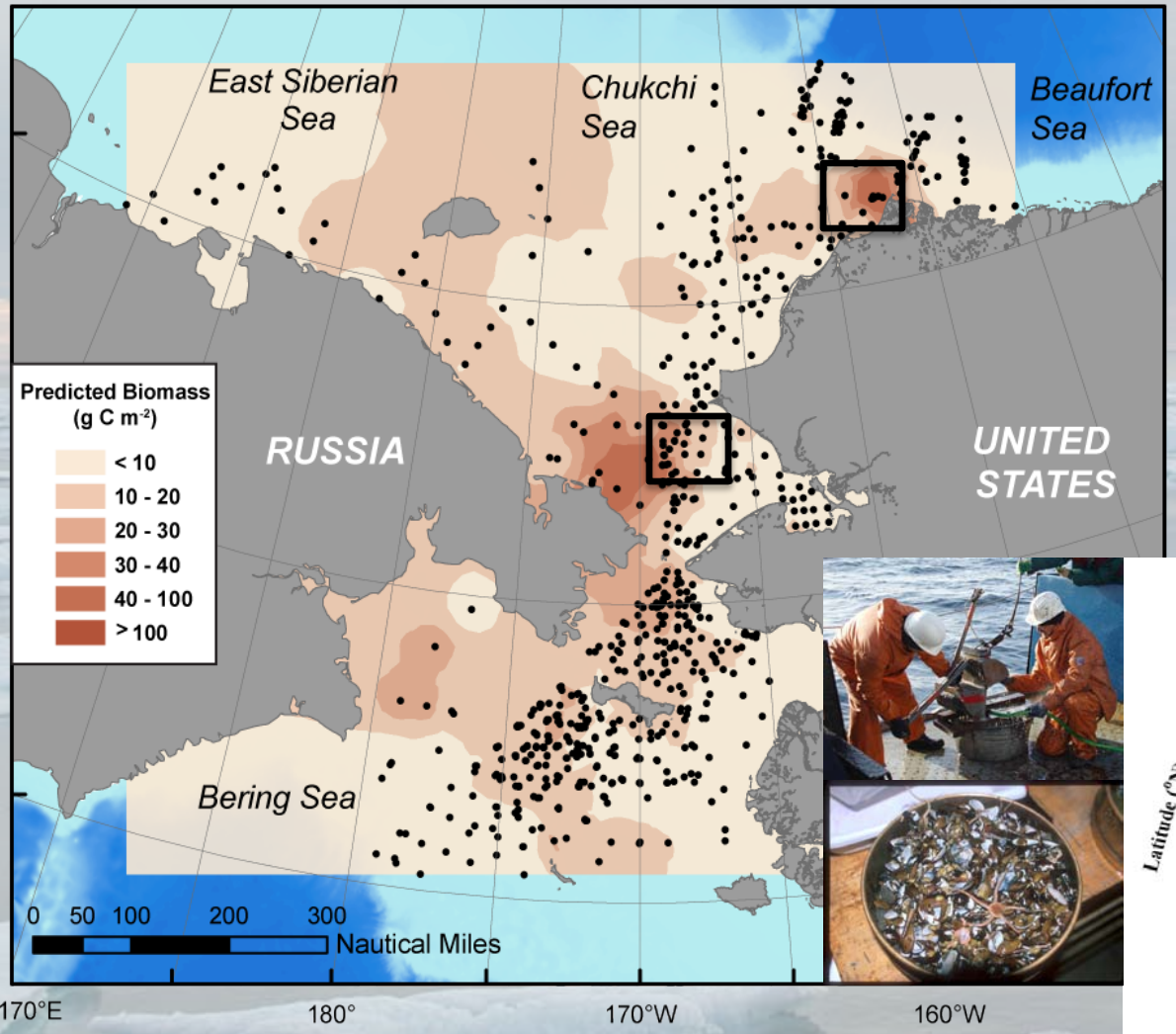


Robert Pickart-USCGC Healy Sept 2010

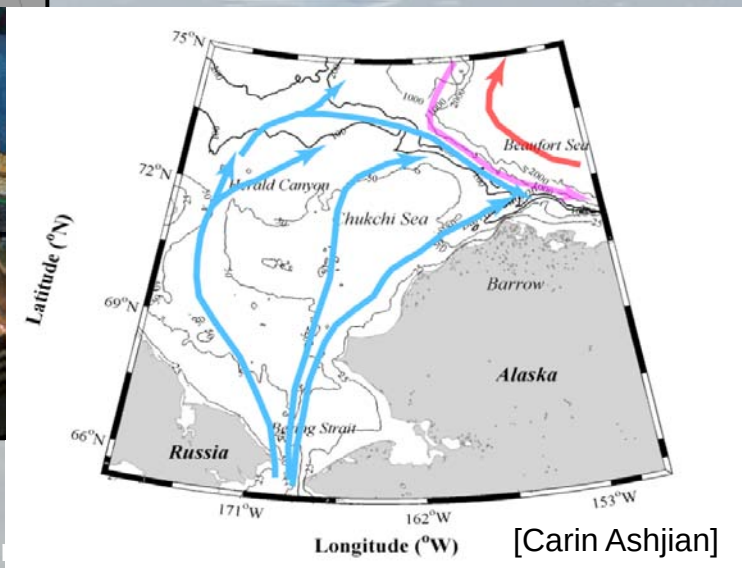


Motoyo Itoh--RV Mirai October 2010

Rich benthic communities on the western side of the Bering/Chukchi Sea system 1970-2010



- **"foot prints"** of high benthic biomass reflect pelagic-benthic coupling and export of carbon to sediments
- infaunal dominated by amphipods, bivalves, polychaetes, and sipunculids



[updated from Grebmeier et al. 2006a]

[Carin Ashjian]

2010 DBO International Pilot Project (edit)

DBO 2010 Data Parameter Matrix (SE Chukchi Sea-SECS) and Barrow Canyon (BC)									
Cruise (DBO PI Lead)	**Period**	**CTD***	**Chlorophyll-extractions**	**Nutrients**	**Algae-Ice/Phyto-plankton: size, biomass, composition**	**Zooplankton: size, biomass, composition**	**Benthos: size, biomass, composition**	**Seabird surveys**	**Marine Mammal surveys**
Healy 1001 (Pickart)	June-July (both)	x	x	x	x				
Sir Wilfrid Laurier (Vagle)	July (both)	x	x	x		x	x	x	
Araron (Chung)	July								
Moana Wave (Grebmeier)	July-Aug (both**)	x	x	x	x	x	x	x	x
Xuelong (He)	July-Aug	x	x	x	x	x	x***		
Annika Marie (Ashjian)	August (BC)	x	x	x	Lugols samples for microplankton	x		x	x
Alaskan Enterprise (Napp/CHAOZ)	Aug-Sept (BC)	x				x			x
Khromov (Woodgate)	Aug (SECS)=RUSALCA CS line	x	x	x	x	x		x	x
Healy 1003 (Pickart)	Sept (BC)	x		x					
Mirai (Itoh)	Oct (BC)	x	x	x		x (hotspot)			
*=T, S, plus some cruises transmissivity, fluorescence (chlorophyll), CDOM, dissolved oxygen, pH									
**=all water column, plankton and benthic data at "hotspot" sites only; seabird and marine mammal survey throughout									

DBO 2011 International DBO Project

Dates (2011) /Port calls	Ship	Project	PAG contact	Chief Scientist
July 15 (Dutch Harbor),-Aug	USCGC Healy	ICESCAPE (NASA)	Robert Pickart rpickart@whoi.edu	Kevin Arrigo <Kevin.arrigo@healy.polarscience.net>
July –August (Dutch Harbor)	RV Araron (DBO-SCS)	Korean Expedition	TBD	Kyung Ho Chung (KOPRI)
August -Sept	TBD	Chukchi Acoustics, Oceanography, and Zooplankton Study (CHAOZ) (NOAA)	Jeff Napp/Sue Moore	Mooring lead: Tom Weingartner <weingart@ims.uaf.edu>
August	Annika Marie		Carin Ashjian	Carin Ashjian <cashjian@woi.edu>
September	Healy		Robert Pickart	Robert Pickart rpickart@whoi.edu

Bob Pickart-next ppt of preliminary hydrographic DBO results , then back to my ppt for data discussions and action for future

Draft DBO data templates

1. DBO matrix, with highlight box to click to go to raw data and perhaps composite maps
2. Data templates:
   - T, S, CTD (cnv files)
   - Chemical parameters-see matrix (e.g., nutrients, DO)
   - Biological parameters-see matrix (e.g., chl, phyto, zoop, benthos ID, abundance, biomass, size)
3. Need examples templates
   - 2010 CTD data format: Bob Pickart (cvn files)
   - Masterstn file (Grebmeier)-separate file (xls)
   - Specific data files (need examples from different members)-jg example
   - Readme files as metadata (jg file)

4. Timeline for data for DBO use by countries?

Grebmeier-Example Masterstn.xls file

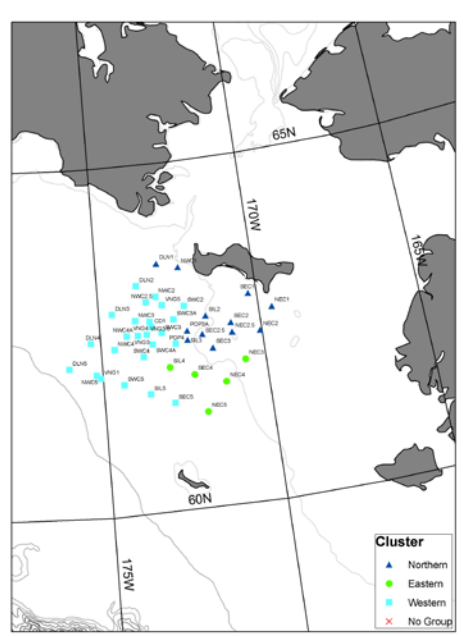
Cruise			Date	Latitude (°N	Longitude (°W	Bottom	ottom wat	ottom wat	Bottle Depth	Bottom water	Bottom water	Bottom wate
	Stn	Stn.	Arrived	Dec deg	Dec deg	Depth	CTD	Rosette	CTD Pressure	Temp	Salinity	Silicate
	#	Name	m/dd/yyy	°	°	(m)	Cast #	Bottle #	(dbars)	(°C)	(psu)	(umol/L)
HLY0601	1	NEC5	5/9/06	61.389	-171.947	62	1	1	57.0	-1.691	31.460	11.63
HLY0601	2	SEC5	5/9/06	61.564	-172.899	66	1	1	64.9	-1.700	31.700	13.38
HLY0601	3	SIL5	5/9/06	61.720	-173.604	62	1	1	66.8	-1.726	31.882	22.44
HLY0601	4	SWC5	5/10/06	61.887	-174.375	67	1	1	71.5	-1.722	31.966	17.43
HLY0601	5	VNG1=SLIP1	5/10/06	62.007	-175.069	73	1	1	76.9	-1.708	31.976	15.23
HLY0601	6	NWC5=SLIP2	5/10/06	62.053	-175.190	75	1	1	78.0	-1.727	32.006	21.06
HLY0601	7	DLN5	5/11/06	62.166	-176.011	95	1	1	89.4	-0.254	32.328	53.05
HLY0601	8	NWC4=SLIP3	5/11/06	62.399	-174.583	68	1	1	67.7	-1.691	31.950	24.97

Water Column						Infaunal	Infaunal	Infaunal	Infaunal	Infaunal	Infaunal
Integrated Chl a	vv/XHC	Sed Chl a	Std Dev	Sed Chl a	Std Dev	Abundance	Biomass	Biomass	Taxa No.	annon-Wea	annon Wea
(mg/m²)		(mg/m²)	sed chl a	(µg/g)	sed chl a	#/m²	wet g/m²	gC/m²	#	Index	Evenness
14.32	vv	7.38	4.63	1.43	0.98	1710.000	276.823	8.526	36	2.57	0.72
10.71	vv	9.02	0.18	4.10	0.13	540.000	111.460	4.585	30	2.87	0.85
45.86	vv	7.50	1.33	2.80	0.12	1730.000	274.592	10.141	36	2.62	0.74
16.86	vv	6.25	1.08	2.17	0.87	2020.000	270.861	10.670	42	2.48	0.68
96.78	vv	4.17	1.18	1.10	0.22	1990.000	365.554	16.075	39	2.35	0.64
69.05	vv	5.76	0.96	1.48	0.49	1680.000	303.887	10.416	40	2.6	0.71
10.28	vv	8.86	0.51	4.47	0.22	882.500	224.115	6.115	43	2.71	0.72

Sediment Grain Size										Respiration co	
<0 phi	1 phi	2 phi	3 phi	4 phi	1_4phi	≥5 phi	Sed.	TOC	TON	C/N	O2UR
(%)	(%)	(%)	(%)	(%)	(%)	(%)	modal size	(mg/g)	(mg/g)		(mmol/m²/d
1.14	0.10	0.10	5.19	17.07	23.60	76.39	5	0.88	0.13	6.77	4.09
0.29	0.00	0.00	4.18	10.21	14.68	85.32	5	1.13	0.17	6.60	5.15
0.05	0.00	0.05	6.91	20.93	27.94	72.06	5	0.95	0.14	6.98	10.64
0.21	0.26	0.15	6.89	22.06	29.57	70.44	5	1.02	0.15	6.69	6.24
0.00	0.00	0.10	10.19	23.41	33.70	66.30	5	1.01	0.14	7.16	3.34
0.59	0.06	0.12	17.10	21.85	39.72	60.27	5	1.07	0.15	6.98	6.27
1.39	0.37	0.16	0.37	1.39	3.68	96.31	5	1.76	0.27	6.64	5.55
1.78	0.15	0.00	2.19	22.79	26.91	73.07	5	0.99	0.16	6.29	5.44

- with additional parameter-specific data sets
- need metadata (Readme file) to describe cruise, dates, sampling, analyses

Specific data file



-Infaunal taxa: abundance, biomass, dominant fauna
-Taxa files
-Sediment grain size
-Sediment chlorophyll
-Etc.

Cruise	Stn #	Stn. Name	Abundance (#/m²)	Biomass (g/m²)	Biomass (gC/m²)	Taxa (#)	Abundance: Top 3 (#/m²)	%	Biomass: Top 3 (g/m²)	%	Biomass: Top 3 (gC/m²)	%
HLY0601	1	NEC5	1710.000	276.823	8.526	36	*Nucula belloti*	30.0	*Nuculana radiata*	72.3	*Nuculana radiata*	44.6
							Leuconiidae	13.3	*Nucula belloti*	6.1	Melitidae	12.3
							Nuculana radiata	11.8	Melitidae	5.1	Nephtyidae	11.8
HLY0601	2	SEC5	540.000	111.460	4.585	30	*Nucula belloti*	19.9	*Macoma calcarea*	72.6	*Macoma calcarea*	61.8
							Ophiuridae	13.4	*Yoldia sp.*	7.7	Nephtyidae	11.9
							Macoma calcarea	8.3	Nephtyidae	6.8	*Yoldia sp.*	8.8
HLY0601	3	SIL5	1730.000	274.592	10.141	36	Capitellidae	23.8	Mytilidae	39.7	*Nucula belloti*	31.5
							Nucula belloti	22.0	*Nucula belloti*	29.9	Mytilidae	30.1
							Macoma calcarea	7.5	*Macoma calcarea*	13.4	*Macoma calcarea*	12.7
HLY0601	4	SWC5	2020.000	270.861	10.670	42	*Nucula belloti*	35.8	*Nucula belloti*	29.9	*Nucula belloti*	29.6
							Macoma calcarea	14.7	*Macoma calcarea*	21.6	*Macoma calcarea*	19.2
							Capitellidae	7.8	Ophiuridae	12.4	Maldanidae	18.2
									Maldanidae	10.3	Nephtyidae	13.4
HLY0601	5	VNG1	1990.000	365.554	16.075	39	*Nucula belloti*	42.0	*Nucula belloti*	35.6	Maldanidae	31.9
							Yoldia sp.	9.9	Maldanidae	20.0	*Nucula belloti*	31.6
							Maldanidae	7.2	*Nuculana radiata*	10.5	Rhynchocoela	10.0
HLY0601	6	NWC5	1680.000	303.887	10.416	40	*Nucula belloti*	33.8	*Nuculana radiata*	33.8	Maldanidae	25.2
							Lituolidae	9.7	*Nucula belloti*	18.5	*Nucula belloti*	21.0
							Lumbrineridae	7.3	*Macoma calcarea*	13.6	*Nuculana radiata*	18.7
									Maldanidae	12.3	*Macoma calcarea*	13.9

TITLE: Readme- HLY0601-JOSSMaster

P.I.(S): Jackie Grebmeier/Lee Cooper
Chesapeake Biological Laboratory

tel: +1 865.974.2592
fax: +1 865.974.7896
email: jgrebmei@utk.edu
website: http://arctic.bio.utk.edu and http://sbi.utk.edu

FUNDING SOURCE/GRANT NUMBER:
NSF OPP0125082

DATASET OVERVIEW:

This dataset contains measurements at each station of benthic parameters, including bottom water parameters (temperature, salinity, and oxygen, delta 18O), benthic chlorophyll-a values (bottom water chlorophyll-a, integrated water column chlorophyll-a, sediment chlorophyll-a), benthic faunal parameters (abundance, biomass (g/m2), biomass (gC/m2), number of taxa), sediment grain size values, TOC, TON, C/N, and sediment oxygen uptake rates. Samples included in this dataset were collected from May 11 - June 6, 2002, and July 19 - August 21, 2002 from the United States Coast Guard Icebreaker Healy (WAGB-20). Samples collected on the Healy were funded through the Shelf-Basin Interactions project, which is funded by both the National Science Foundation and the Office of Naval Research.

INSTRUMENT DESCRIPTION:

All water samples were collected using a rosette bottle system on a CTD.

A van Veen grab (0.1 m2 sediment grab), weighted with 32 kg of lead was used in the collection of surface sediment samples and fauna. All sediment grain size samples were collected from van Van grabs. Fauna were collected on 1 mm sieve mesh and preserved in 10% buffered formallin. TOC, TON, and C/N samples were also taken from van Veen grabs.

A multi (4 barrel) Haps corer (each core = 0.0133 m2) was used to collect sediment cores , which were used for sediment metabolism (respiration) measurements. For more information on the HAPS core, see: Kanneworff, E. & Nicolaisen, W. The "HAPS:" A frame supported bottom

Concept of integrated databases and how it might be achieved

1. PAG webpage where link data specific to DBO collections at one portal
2. Can maintain data sets at home site, but need meta data access on DBO site
3. Issue of QA/QC

Possible joint analyses of data in integrated databases

ACTION ITEMS: Lessons Learned from 2010

1. Overall transfer CTD data from one Chief Scientist to next in DBO time field sequence worked; Useful? Need post data on come DBO data portal?