

# Highlights from the Distributed Biological Observatory (DBO) Workshop, March 27

Development of a Distributed Biological Observatory (DBO) in the Pacific Arctic and potential for pan-Arctic system studies



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Pacific Arctic Group and the IASC AOSB: Marine Working Group  
Seoul, Korea  
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# The Goal of the Workshop

**The workshop is organized by the Pacific Arctic Group and the AOSB/Marine Working Group of IASC. During the workshop we:**

- reviewed the data collected during the 2010 DBO pilot project and preliminary analyses
- evaluated interest to expand the DBO concept to a pan-Arctic biological observation network
- data standardization and management issues
- plans for DBO occupation in 2011

## **10:00-10:30 Introduction: What and why a DBO? The DBO 2010 Pilot Program and Beyond** (*Jackie Grebmeier*)

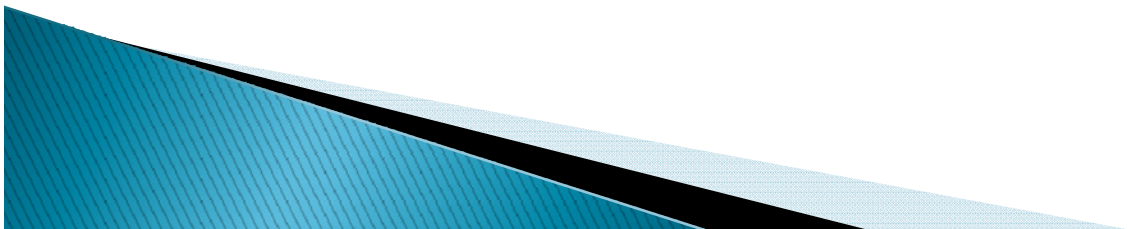
## **10:30-12:30 Data analysis and integration: DBO 2010 Pilot Program**

Presentations and discussion of initial joint analysis

- “DBO Sea ice time series analysis” (*Karen Frey*)
- “Seasonal variation of water masses in the Chukchi Sea results of DBO pilot study in 2010” (*Motoyoh Itoh and Robert Pickart*)
- “Evolution of water masses and nitrate in Barrow Canyon during the summer 2010: Preliminary results from the DBO Pilot Study” (*Robert Pickart via Jackie Grebmeier*)
- “Plankton and benthic collections coincident with seabird and marine mammal surveys during DBO 2010” (*Jackie Grebmeier et al.*)
  - Identify other analyses with use of existing data or with additional multi-year data and/or hotspot areas

**12:30-13:45 Lunch Break**

**13:45-15:30 Program Expansion and external outreach and interfaces**



## 13:45-15:30 Program Expansion and external outreach and interfaces

- Discuss the benefit and approaches to expanding the concept to cover other areas of the Arctic
- Examples of DBO-types studies in other areas of the Arctic:
  - “Multidisciplinary long-term studies at the Arctic deep-sea observatory HAUSGARTEN” (*Michael Klages*)
  - “Some visions on DBO type studies from a Swedish perspective” (*Leif Anderson*)
  - “Biological observations in Norway and some thoughts on the DBO strategy” (*Marit Reigstad*)
  - Others?
- Discussion on how do we develop a pan-Arctic network of DBO transects and sites?
  - Relation of the DBO planning to the CBMPs Marine Expert Monitoring Groups (MEMG) “Circumpolar Marine Biodiversity Monitoring Plan” (*Kathy Crane*)
  - Ways forward to develop the DBO into an observations network within the SAON framework (*John Calder*)

## 15:30-15:45 Coffee Break

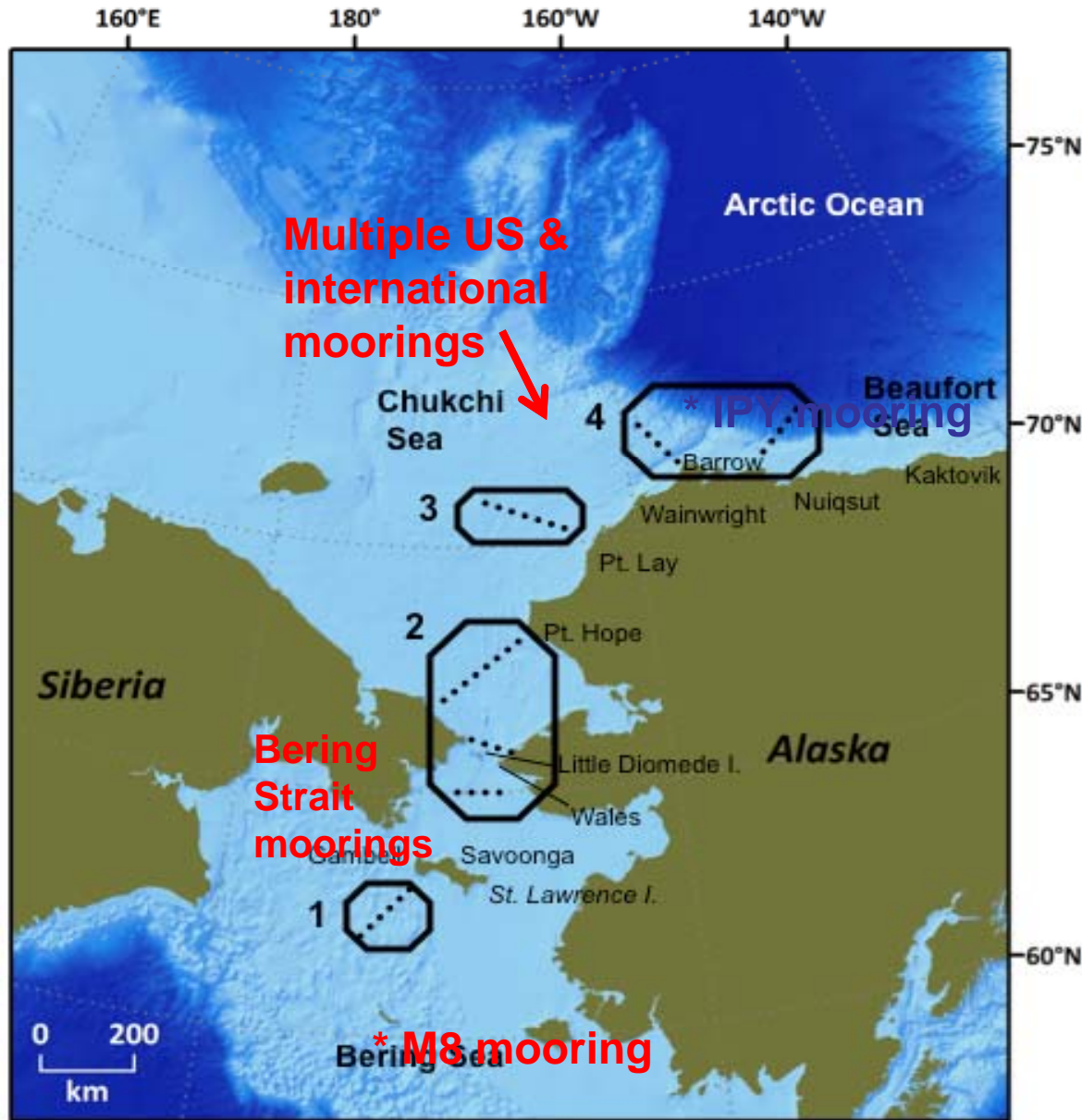
## 15:45-17:30 Review data sharing, identify gaps, and future direction

- Review draft DBO data templates (*Grebmeier*)
- Discuss concept of integrated databases (*Grebmeier*)
- PAG DBO Ship plans for 2011 (*National members*)





# DBO- Repeated Oceanographic Sampling



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]

# “Vision” for Distributed Biological Observatory

Core standardized ship-based sampling:

- CTD, ADCP measurements
- 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)

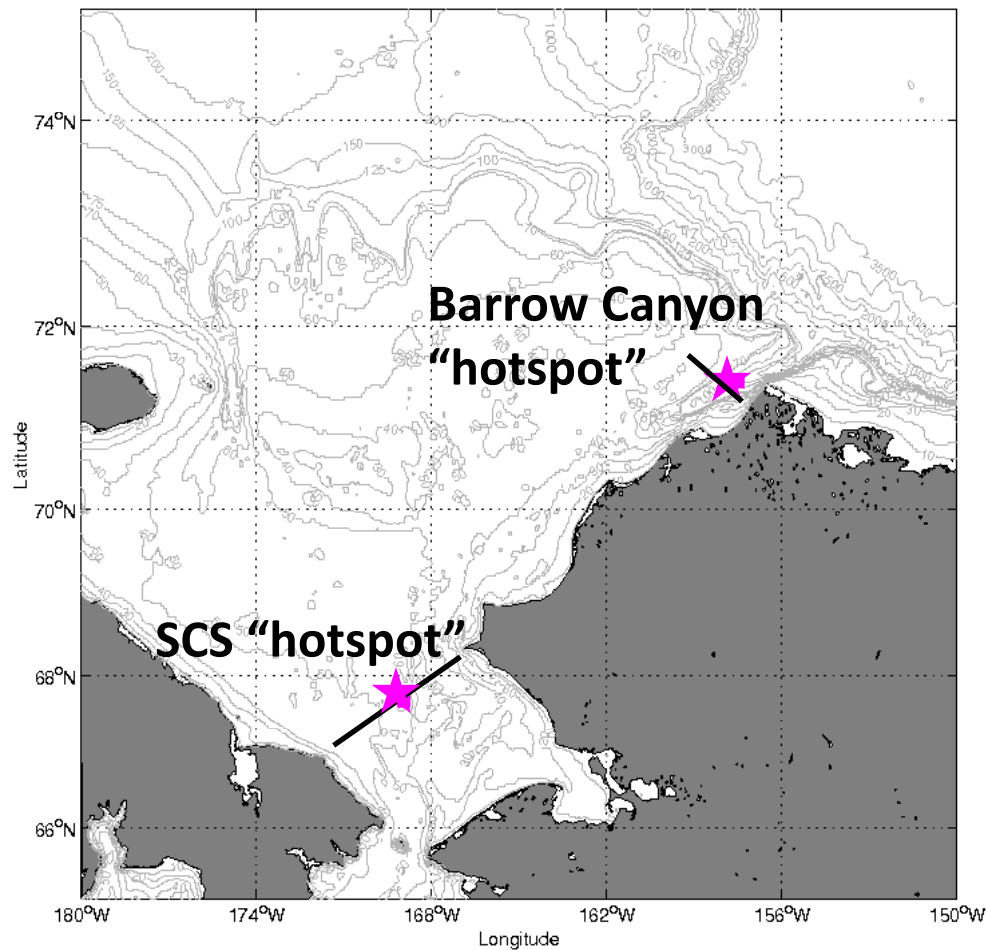
“Change detection array” – same measurements every year, process information in near real time <6 mos; detect regime shifts in rapid changes

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 for more data types collected, such as carbon components

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



Vessel	Country	PI
<i>Moana Wave</i>	USA	Grebmeier
<i>Alaskan Enterprise</i>	USA	Napp
<i>Xue Long</i>	China	He
<i>Mirai</i>	Japan	Itoh
<i>Laurier</i>	Canada	Vagle
<i>Healy</i>	USA	Arrigo
<i>Healy</i>	USA	Pickart
<i>Annika Marie</i>	USA	Ashjian
<i>Khromov</i>	Russia & USA	Woodgate

# 2010 DBO International Pilot Project

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					
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)=CS line	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									



# **SUMMARY: RESULTS AND ISSUES**

1. Over 80 participants involved in discussions, both status 2010 PAG DBO activities and potential pan-Arctic network
1. Success in 4-6 transect crossing at two of the DBO sites (SECS and BC), with occupation of northern Bering Sea DBO site
1. Physical and hydrographic season time slices (vertically and horizontally) indicating changes in Pacific winter and summer water seasonally as well as heat and freshwater flux; current flow and water mass location has impacts on nutrient fields seasonally. Repeat hydrography provides important information on 0-30 m depth scale and DBO format can evaluate seasonal variation (summer, autumn, although transitions to/from winter periods would be valuable), but physical information can be captured by moorings
1. Biological data indicate separation of both zooplankton and benthos on spatial domains latitudinally; plankton community composition tracks water mass and benthos tracking carbon deposition; fish, marine mammals and seabirds focus on “hotspots” of prey base and migrate to those locations (if can physiologically), thus DBO tracking status and changes in predator-prey connectivity a foci of the program

# Lessons Learned from 2010 DBO Pilot Program

## POSITIVE

- The concept can work (4-6 cruises by 4 nations depending on DBO line); immediate data sharing is advantageous
- The more occupations the better to help sort out seasonal vs interannual variability; provides important data 0-30 m depth not available by moorings
- The information can help with the interpretation of individual studies by providing a temporal context
- Lower trophic taxa data (phytoplankton, zooplankton and benthos) shared amongst DBO cruise leads for first-order statistical analysis for defining Communities and potential component shifts, species “invasions” north
- Data can be used to look at temporal variation, latitudinal variation (time and space scales)
- Also look at variation sampling and analytical techniques between labs

# Lessons Learned from 2010 DBO Pilot Program

## CHALLENGES:

- Requires coordination and commitment (national and international)
- Need for spatial resolution of water sampling (e.g., nutrients, and yes we also need ammonium, phosphate and silica)
- Post-cruise analysis biological sorting time
- Standardization of gear and analytical capability
- Collection of standard parameters sites on a regular basis
- Data quality and processing, standardization; sharing issues (data policy)
- Dedicated funding for core DBO shiptime support and/or incremental funding to existing g programs; support for data collection and analysis

# DBO: Pacific to Pan-Arctic

- Presentations on Swedish, Norwegian and Germany observing plans; positive for further discussions on DBO concept transects and standard multidisciplinary measurements
- Information provided on developing Svalbard Integrated Observing System (SIOS), as well as other Arctic (Atlantic side) transect and observing plans
- Community Time Series (Polar Front, KongHau, Rijpfjord), mooring arrays
- Ecosystem surveys in Fram Strait and Barents Sea
- Interest expressed to include marine biological and geochemical observations into an observatory mode associated with SIOS; need for long-term funding
- Challenges seen to make DBO (Pacific or Atlantic side):
  - Compilation of data in one database
  - Ownership, management, central location
  - Harmonization of methods, depth collections based on different strategy, traditions, already time series collections with own methods
  - Identification and agreement of a few KEY-stations where a DBO strategy for sampling is used
- the deep-sea observatory “Hausgarten” developed around a biological diversity theme that is also tied to surrounding scientific activities; deep sea observatory has shallow to deep station locations; now moving toward cabling and nodes for science data transmission

# Issue 1-DBO data plan

## 1. Need standardization of methodology

Physical parameters (T, S, ADCP)

Chemical parameters (nutrients)

Biological parameters (chl, phyto, zoop, benthos ID, abundance, biomass, composition)

**ACTION: Task physical and biological working groups to report on this issue at fall PAG meeting**

## 2. Need common data format and decision where data and metadata will reside

All data sets need metadata file, initial posting on DBO webpage

Each component needs listing type of data collection, methodology, point of contact

**ACTION: Need DBO data working group to develop a DBO data policy; membership by reps physical and biological working groups**

3. Data plan to include timeline for data for DBO use by countries, open access to scientific community; **suggested need for data manager** at some point can interface with national data centers where raw data archived

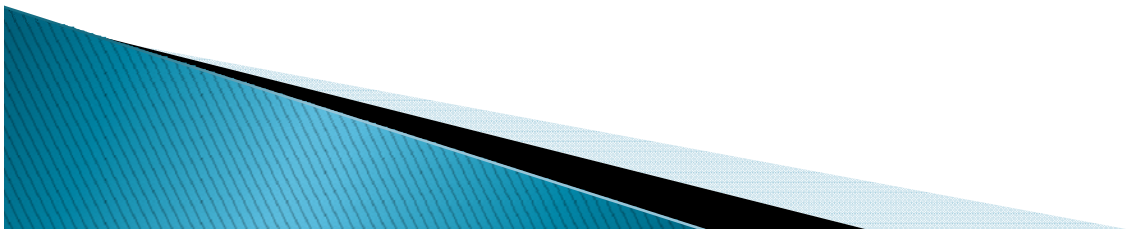
4. Issue of publication of international DBO data: data working group to interaction with national member representatives and international groups (e.g., CBMP, SAON, others?) on data issues

**ACTION: DBO data working group to report on status at fall PAG 2011 meeting**

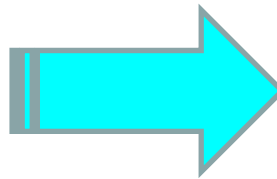


## Issue 2: Concept of integrated databases and how it might be achieved

1. PAG webpage
  - where list DBO data policy
  - list type of DBO data sets being collected
  - load matrix on a DBO website, with highlight box to click to metadata
2. DBO data sets into common observatory data portal, but need keep original data QA/QC at scientist level
  1. Issues of timing of release to scientific community timeline, in principle rapid release “observatory mode”
  2. Suggestion for need DBO data manager
  3. Joint analyses of data



Circumpolar Marine  
Biodiversity Monitoring Plan



**Sustaining Arctic  
Observing Network (SAON)**

The SAON *vision* is that users should *have access to free, open & high quality data that will realize pan-Arctic & global value-added services & provide societal benefits.*

To attain that vision, SAON's *goal* is to enhance Arctic-wide observing activities by facilitating partnerships & synergies among existing 'building blocks', & promoting sharing & synthesis of data & information.

**The CBMP MEMG directly supports the SAON vision & goal using the Circumpolar Marine Biodiversity Monitoring Plan as a tool to achieve this**



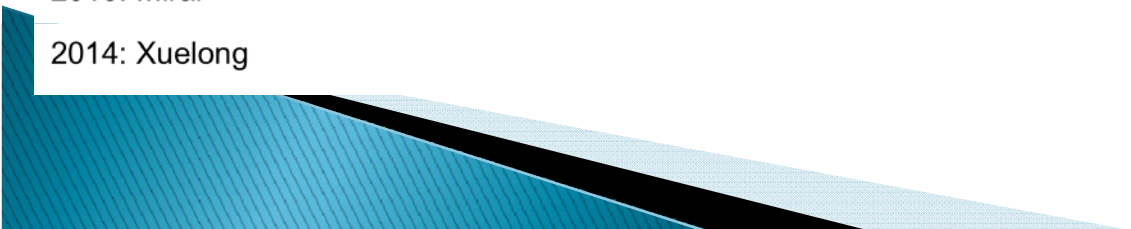
# 2011 DBO International DBO Project

Dates (2011) /Port calls	Ship	Project	PAG contact	Chief Scientist
June 25-July 29 Dutch to Kodiak	USCGC Healy	ICESCAPE (NASA)	Robert Pickart <a href="mailto:rpickart@whoi.edu">rpickart@whoi.edu</a>	Kevin Arrigo <Kevin.arrigo@healy.polarscience.net>
July	Sir Wilfrid Laurier	C30	Robert Fudge	TBD
July –August (Dutch Harbor)	RV Araron (DBO-SCS)	Korean Expedition	Kyung Ho Chung (KOPRI)	TBD
August -Sept	TBD	Chukchi Acoustics, Oceanography, and Zooplankton Study (CHAOZ) (NOAA)	Jeff Napp/Sue Moore	TBD
July	Khromov	RUSALCA	Kathy Crane	Rebecca Woodgate
August	Annika Marie	AON project	Carin Ashjian	Carin Ashjian <cashjian@woi.edu>
September	Healy	AON project	Robert Pickart	Robert Pickart <a href="mailto:rpickart@whoi.edu">rpickart@whoi.edu</a>

2012: Araron, Khromov, Xuelong

2013: Mirai

2014: Xuelong



# Questions and comments?

Financial support from the US National Oceanic and Atmospheric Administration, the National Science Foundation, and international science partners in the Pacific Arctic Group (PAG)



## Slide 17

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**JG1** Jackie Grebmeier, 1/11/2011

**JG2** Jackie Grebmeier, 1/11/2011