

Distributed Biological Observatory (DBO)

Linking Physics & Biology in the Arctic

DBO in the IARPC Marine Ecosystem Collaborative Team Activities

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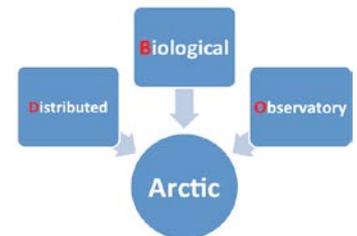
4th DBO Data Workshop

November 9, 2017

Seattle, Washington, USA



<https://www.iarpccollaborations.org/>



Distributed Biological Observatory (DBO)

Timeline

- **2009** – Biology-Sea Ice Workshop, development of Pilot DBO plan
- **2010-2014** – DBO **Pilot Phase**, sampling coordinated by the Pacific Arctic Group (PAG)
- * **2012** – **Interagency Arctic Research Policy Committee (IARPC) DBO Collaboration Team: *Sea Ice and Marine Ecosystems* theme**
- * **2012** – NSF Arctic Observing Network (AON) program provides \$support to sample DBO regions 1-5
- **2012-2015** – **IARPC DBO CT Completes Milestones**, including expansion of sampling into the Beaufort Sea and development of guidelines for the periodic assessment of the physical and ecological state of the Pacific Arctic marine environment
- **2015-2024** – **Implementation Phase, 8 DBO regions and initiation of a decadal Pacific Arctic Regional Marine Assessment (PARMA) (**Moore and Grebmeier, Arctic, in press**)**; also current development of Atlantic DBO and other regions
- * **2017-2021** – **DBO included in IARPC MECT** (co:chairs: Auad, Dickson, Grebmeier)
- * **2017 onwards** – **NSF AON and NOAA ARP core field \$support, with BOEM, NASA, NPRB, DOI USFWS and USGS DBO studies within ongoing programs**

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



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

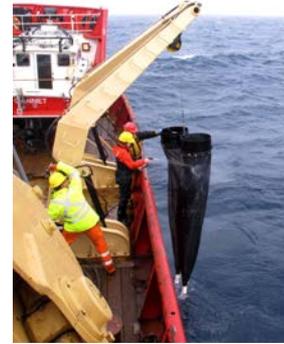
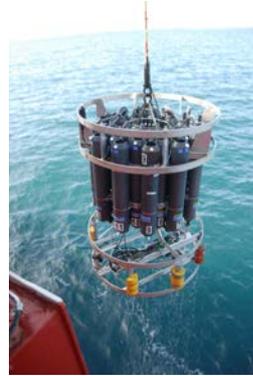
- DBO sites (red boxes) are regional **“hotspot” transect lines and stations** located along a latitudinal gradient (DBO1-5) and longitudinally (DBO6-8)
- DBO sites exhibit high productivity, biodiversity, and/or overall rates of change
- DBO sites serve as a **change detection array** for consistent monitoring of biophysical responses
- Sites occupied by **national and international entities** with shared data plan



Distributed Biological Observatory Standardized Sampling

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 standard surveys (no additional ship time)
- Marine mammal watches & surveys (no additional ship time)



Second tier ship-based sampling:

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

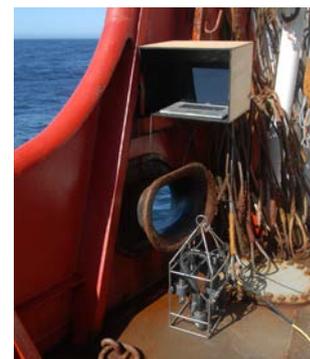
Shipboard measurements

- Record underway measurements from the seawater loop, meteorological sensors, sounder, and navigation information

Distributed Biological Observatory Additional Sampling

Examples of additional sampling on various DBO cruises in 2017 (national and international):

- Optical studies for satellite calibration
- Colored dissolved organic matter (CDOM) and dissolved organic carbon (DOC), alkalinity
- Sea ice tracers (e.g., Oxygen-18)
- Ocean acidification and carbon cycling
- Phytoplankton growth rates (primary production)
- Lower trophic production studies
- Epifaunal and fish biodiversity studies
- Benthic camera for videos of benthos
- Genetics for microbial, meiofaunal, macrofaunal, and epifaunal studies
- Moorings and saildrones, gliders
- Contaminants and potential HABs impacting various trophic levels



Notably, DBO sampling embedded in larger process-study cruises

Performance element 4.3.1 Continue Distributed Biological Observatory (DBO) sampling in regions 1-5 and make data publicly available through upload of metadata to the Earth Observing Laboratory/DBO data portal.

- Agency: [NASA](#), [NOAA](#), [NSF](#), [DOI-BOEM](#), [DOI-FWS](#)
- Aligns with 2016 Arctic Science Ministerial Deliverable: [4](#), [5](#)

Examples:

1. NASA provide up-to-date data and visualization of weekly sea ice cover, winds, chlorophyll a distribution, surface temperature and cloud cover in the study regions and the entire Arctic. Sea surface salinity, which is very relevant to the project, is now included as one of the parameters. The values have been validated in a recent study published in JGR Oceans (on line in September 2017).
2. NSF provides core research support for the annual July DBO cruise with Canadian colleagues on the CCGS Sir Wilfrid Laurier for DBO sampling in DBO regions 1-5. Both NOAA and USFWS also involved in upper trophic level surveys. Co-supported with scientists in DFO/Canada who also occupy DBO4 and DB lines in the Beaufort later in the season.
3. NOAA provides core research support for the Aug-Sept USCGC Healy 2017 and planned USCGC Healy 2018 cruises for both DBO sampling and NCIS (Northern Chukchi Integrated Study) process efforts.
4. BOEM through the AMBON (Arctic Marine Biodiversity Observing Network) project occupied DBO3 and DBO4 in 2015 and 2017 on RV Norseman II. NOAA, NSF and USFWS and previous Shell Oil supports science in AMBON.
5. NPRB Arctic Program projects occupy DBO2 and 3 lines in 2017-2019.

Performance element 4.3.2-Continue DBO coordination activities including annual workshops, via participation in the Pacific Arctic Group (PAG), and produce the first Pacific Arctic Regional Marine Assessment (PARMA) in 2018.

- Agency: [DOI-BOEM](#), [NOAA](#), [NSF](#)
- Aligns with 2016 Arctic Science Ministerial Deliverable: [4](#), [5](#)

Examples:

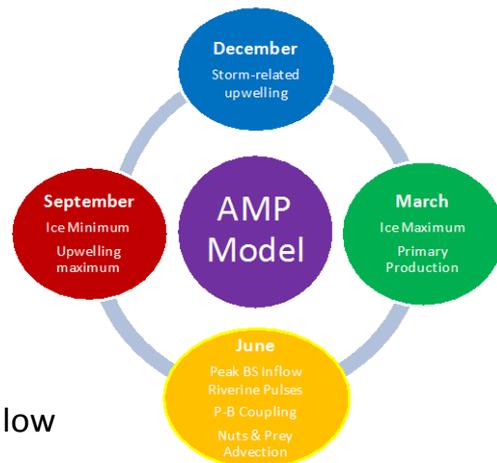
1. NOAA sponsored DBO data meetings, such as the upcoming 4th DBO data meeting in November 2017 in Seattle.
2. US and international agency support for scientists to attend DBO data workshopa.
3. International Arctic Science Committee (IASC) Marine Working Group (MWG) providing early career support for participants to the 4th DBO data meeting, similar to previous DBO data workshops.
4. New paper outlining the developent of the DBO project in journal Arctic (Moore and Grebmeier, 2017), including description of a 10 yr DBO implementation plan and the PARMA.
5. In discussions with the IASC MWG to coordinate the first Pacific Arctic Regional Marine Assessment (PARMA) in 2018).
6. Participantion in annual fall and spring PAG meetings for coordination of DBO studies.

Performance element 4.3.3-Build connections between DBO and existing community-based observation programs and encourage data sharing. For example, the DBO Implementation Plan discusses fostering connections to existing community-based observation programs in an effort to link offshore observations of biological change to local observations and Indigenous Knowledge.

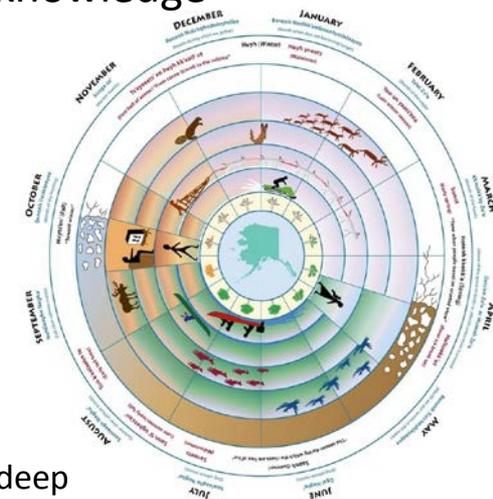
- Agency: [NASA](#), [NOAA](#), [NSF](#), [DOI-BOEM](#), [DOI-FWS](#)
- Aligns with 2016 Arctic Science Ministerial Deliverable: [4](#), [5](#)

Examples:

1. "The Arctic Marine Pulses Model: Linking Annual Oceanographic Processes to Contiguous Ecological Domains in the Pacific Arctic" by Sue Moore is relevant to this PE (<http://www.iarpccollaborations.org/members/events/8927>).
2. Continue develop connections of conventional science mode with local community groups evaluating seasonal events by conventional science and indigenous knowledge



*Spatially broad/time shallow



**Spatially focused/time deep



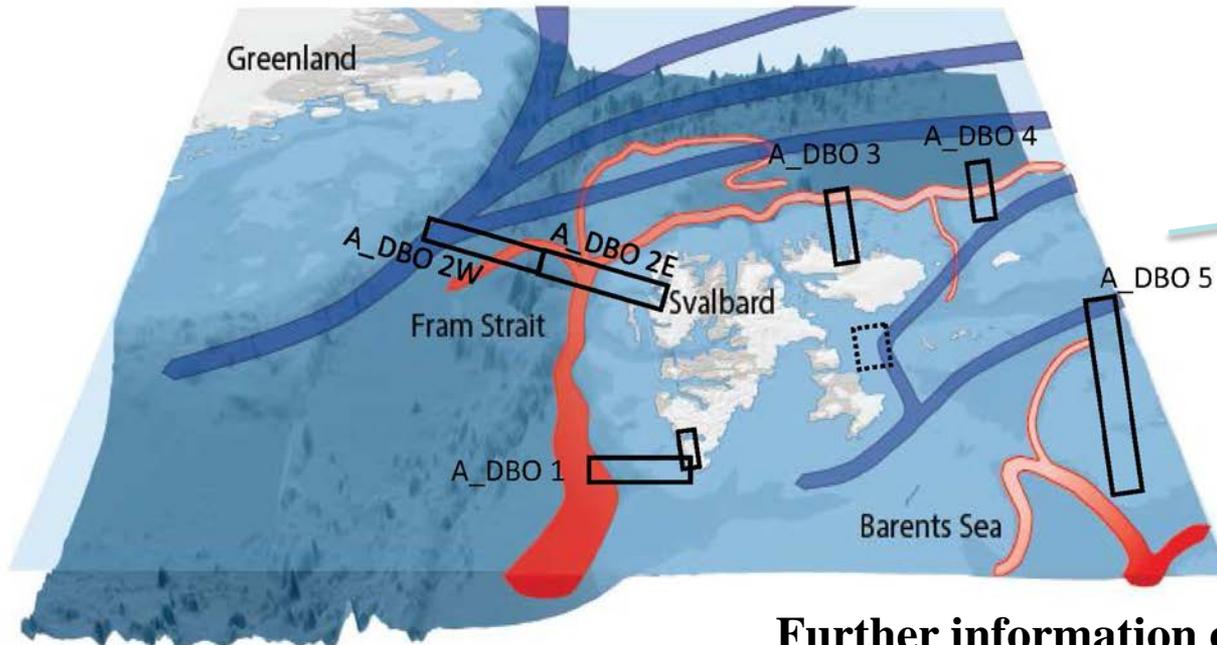
2017 ASSW

Working Towards an International Pan-Arctic DBO

Ex. Atlantic Workshop, November 2016



- Norway, Germany, Poland, UK, France, USA
- Physical oceanography, plankton, benthos, vertical flux, molecular studies
- moorings, time series, coordinating initiatives, planned initiatives



Potential Laptev Sea DBO line: Germany and Russia

Further information contact:
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Thank you for your attention.

Questions and comments?

Thank you to all Pacific Arctic Region science colleagues and DBO collaborators, field and laboratory technicians over the years for the time series efforts. Financial support for the science provided by the US NOAA, NSF, BOEM, NASA, and ongoing national and international science partners in the Pacific Arctic Group.

<http://arctic.cbl.umces.edu>

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

<http://pag.arcticportal.org>

<http://neptune.gsfc.nasa.gov/csb/index.php?section=270>

https://www.eol.ucar.edu/field_projects/dbo

<http://arcticdata.io> (Arctic Data Center, then use DBO as search term)

