

The Distributed Biological Observatory: an expanding change detection array for the Beaufort Sea and beyond



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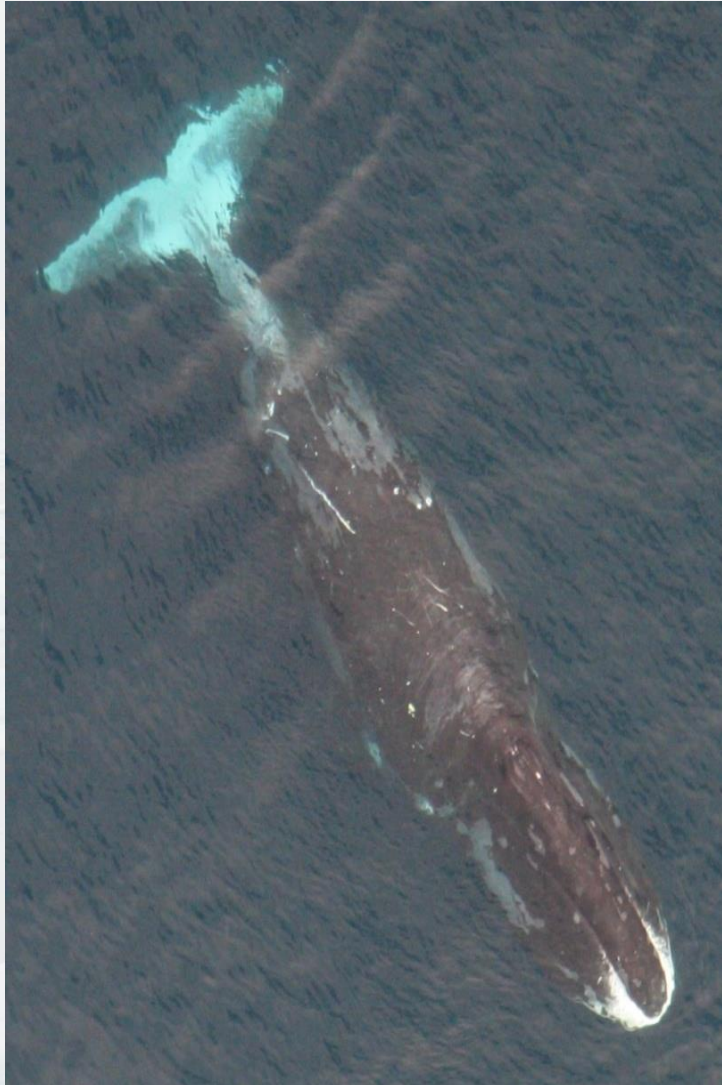


University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

US-Canada Northern Oil and Gas Research Forum

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Outline



- The **Distributed Biological Observatory**: motivation and timeline
- **IARPC DBO Collaboration Team**: extending sampling to the Beaufort Sea
- The **Arctic Marine Pulses (AMP)** model: putting the pieces together in the Pacific Arctic
- **International Partnerships**: working towards a Pan-Arctic DBO

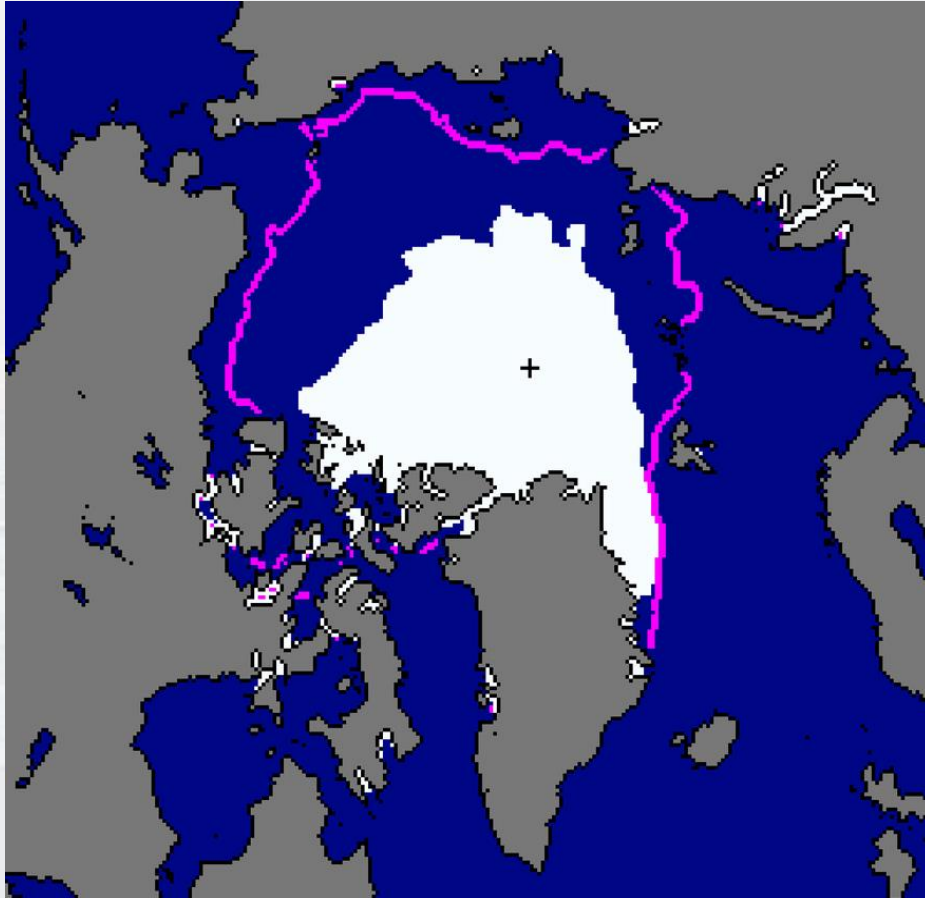
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Bowhead Whale in the Beaufort Sea

Photo credit: J. Craig George

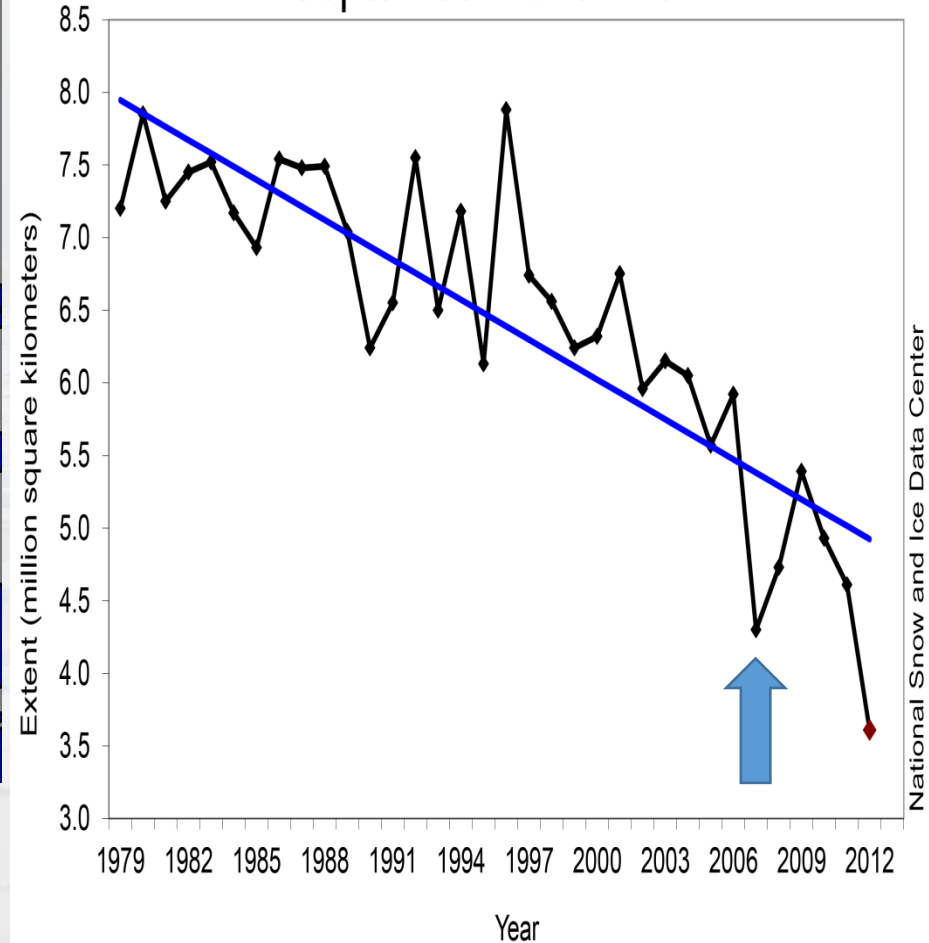
DBO Motivation = the Sea Ice 'Shock' of 2007

2012 = Record Minimum; ~50 % Reduction in Area



Note: 75% Reduction in Volume!

Average Monthly Arctic Sea Ice Extent September 1979 - 2012



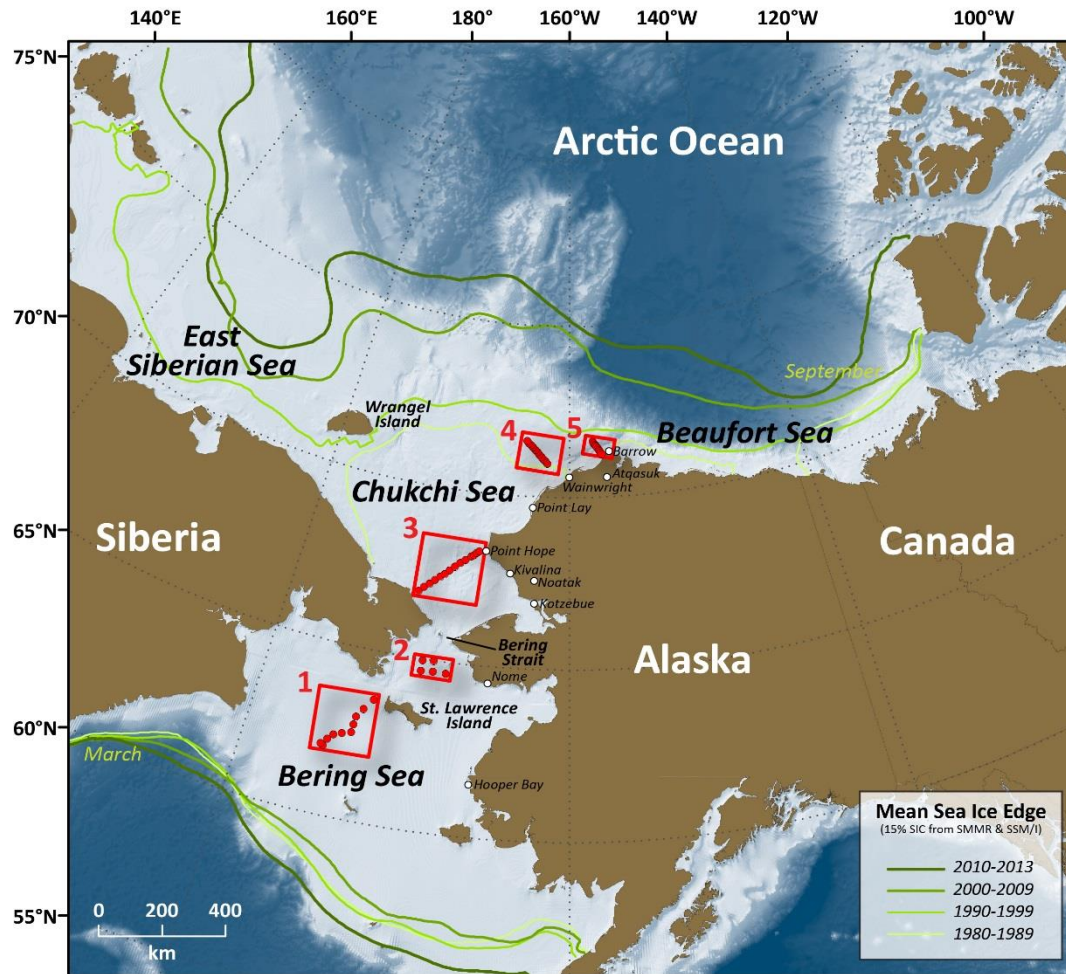
Distributed Biological Observatory (DBO)

Timeline

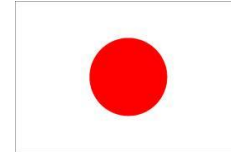
- **2009** – Biology-Sea Ice Workshop, development of Pilot DBO plan
- **2010-2014** – DBO **Pilot Phase**, sampling coordinated by the Pacific Arctic Group (PAG)
- * **2012** – **Interagency Arctic Research Policy Committee (IARPC)**
DBO Collaboration Team: *Sea Ice and Marine Ecosystems* theme
- * **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, in press**)

Distributed Biological Observatory (DBO)

Pilot Phase: 2010-2014



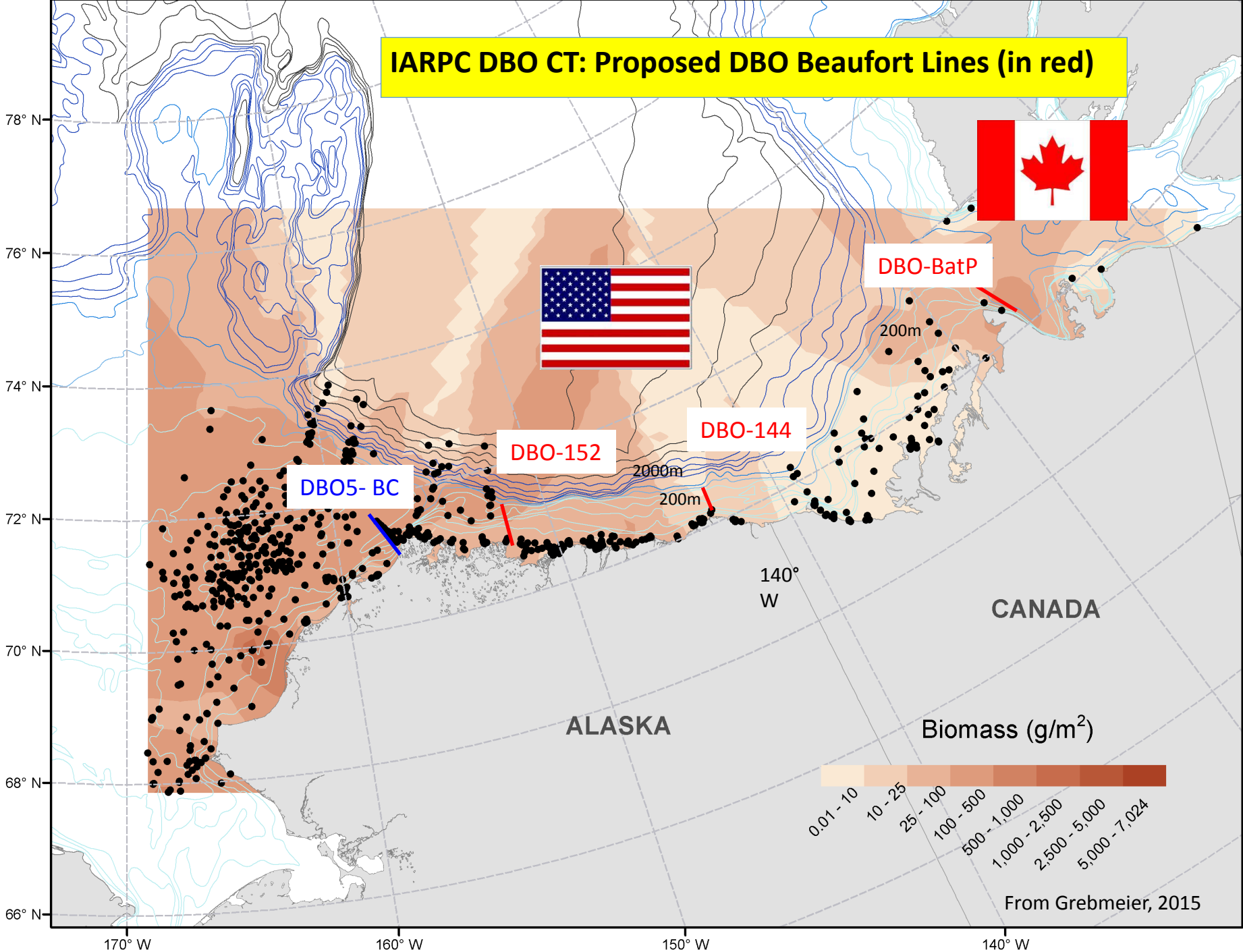
- DBO regions centered on “**hotspots**” located along a latitudinal gradient
- The DBO serves as a **change detection array**, via standardized sampling of biophysical processes
- Successful International sampling coordinated via the **Pacific Arctic Group**
- **2012:** IARPC Collaboration Team & NSF 5-year AON \$ support to sample DBO 1-5



Interagency Arctic Research Policy Committee DBO Collaboration Team (CT)



IARPC DBO CT: Proposed DBO Beaufort Lines (in red)

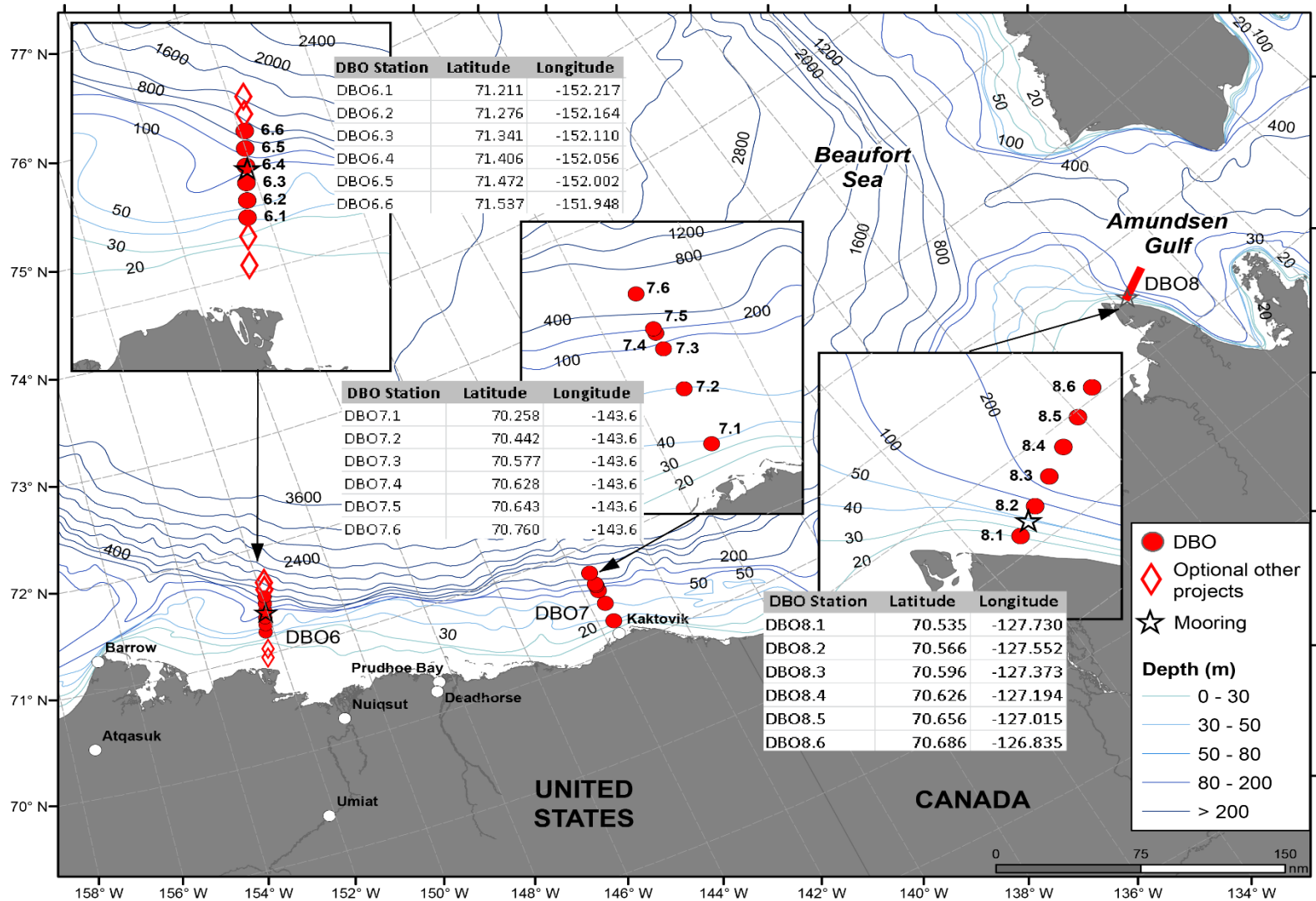


IARPC DBO CT: background and justification for selection of 152° W and 144° W transect lines

- Extent of influence of Bering Sea (=Pacific origin) Water on the Beaufort Shelf; i.e., *ecotone boundary*
- Known regions of upwelling that are linked to steep bathymetric profiles
- Historical knowledge of biological “hotspots”
- Patterns in benthic biomass and primary productivity based on OCSEAP surveys, ANIMIDA II, [US-Canada Trans-boundary Fish Surveys](#)
- Recent physical, oceanographic and biological data from NSF/SBI, BOEM, NASA, others

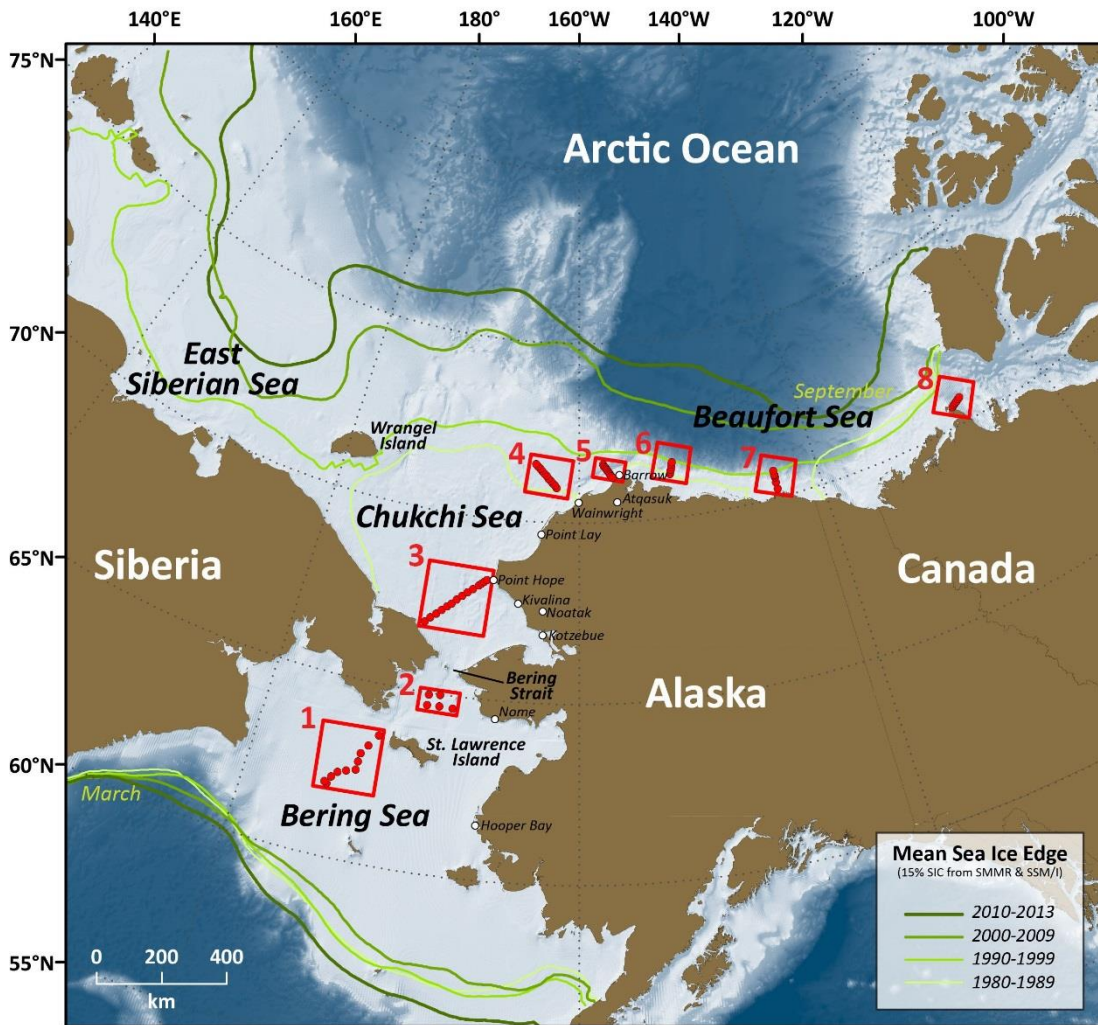
Beaufort DBO Regions 6, 7, 8

[Note: moorings in Regions 6 & 8]



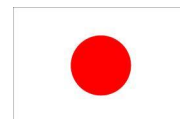
Distributed Biological Observatory (DBO)

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



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

- Eight DBO Regions
- Data Policy Approved by International Partners
http://dbo.eol.ucar.edu/data_policy-dbo.html
- NASA – DBO Satellite Data Visualization Portal
<http://neptune.gsfc.nasa.gov/csb/index.php?section=270>
- AOOS – DBO Work Space
- Data Sharing Site established through NSF at EOL/UCAR:
dbo.eol.ucar.edu; (now NCEAS)

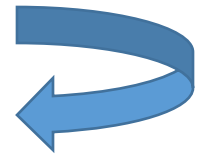


Distributed Biological Observatory Standardized Sampling Protocols



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



BEAUFORT REGIONS: 2015–DBO 6,7,8; 2016-DBO 6; 2017-DBO 6 & 8



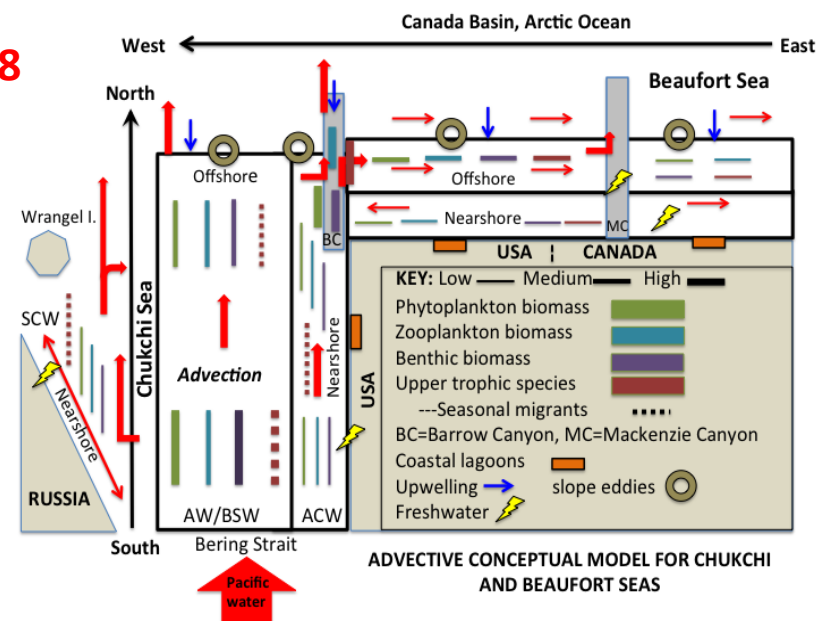
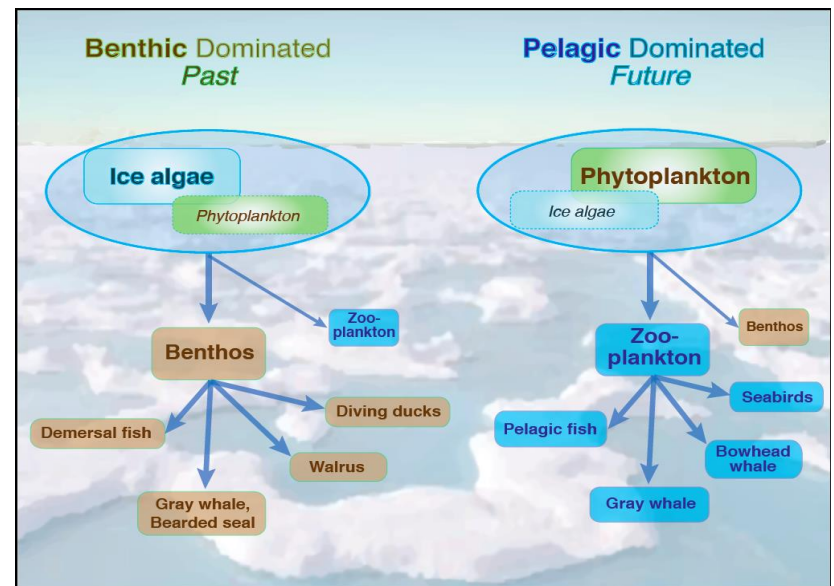
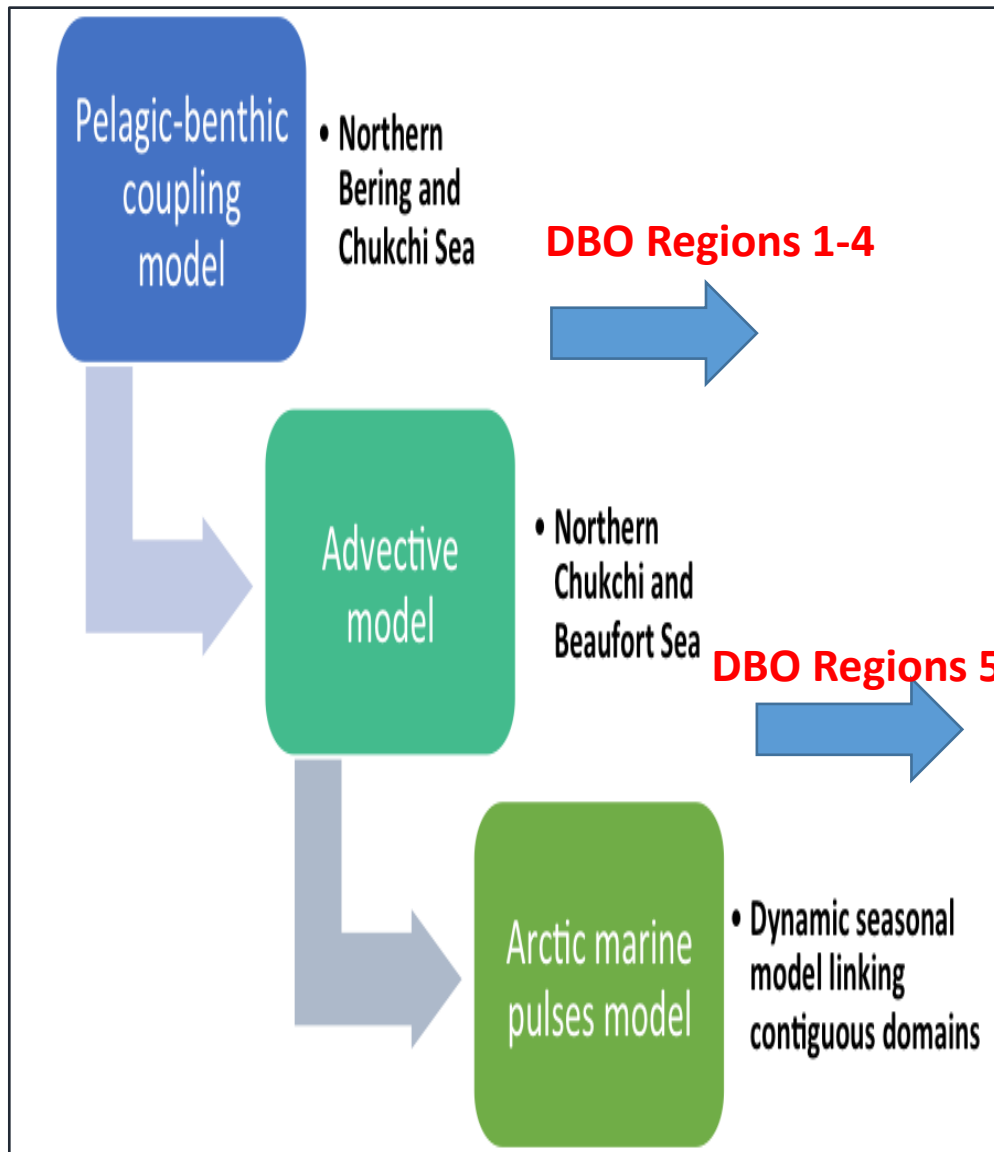
Region 6 & 7: ship sampling -- NSF, BOEM, NOAA, NPRB + long-term mooring (NSF/WHOI)



Region 8: ship sampling + mooring – DFO/MPO

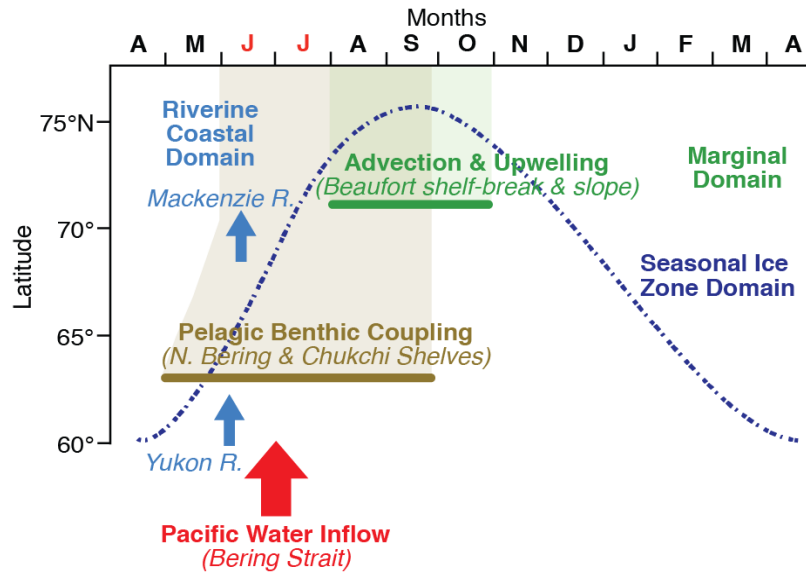
Building the AMP Model

Moore and Stabeno 2015; Grebmeier et al. 2015/PACMARS

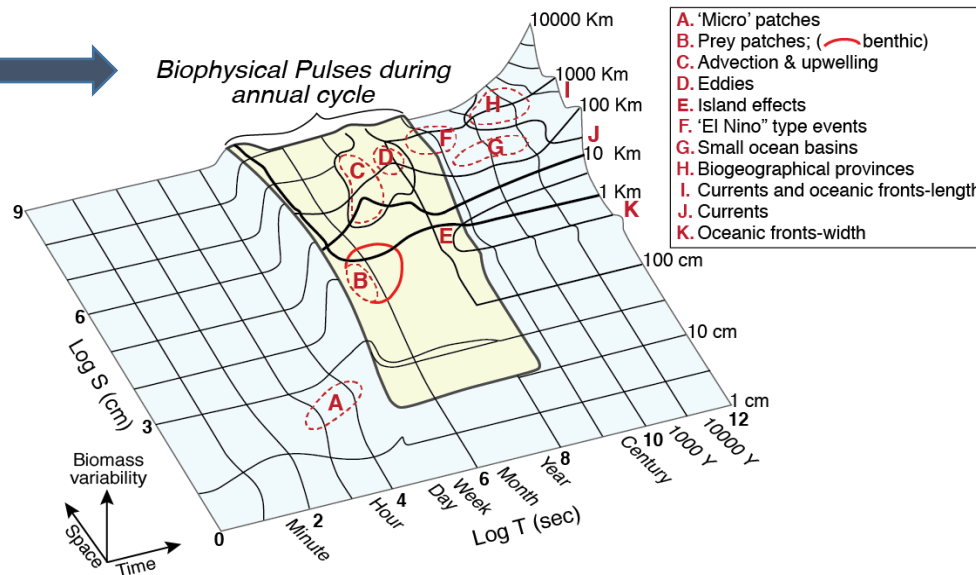


THE ARCTIC MARINE PULSES (AMP) MODEL

Arctic Marine Pulses (AMP) Model:
the Pacific Arctic Domain



Oceanographic Processes

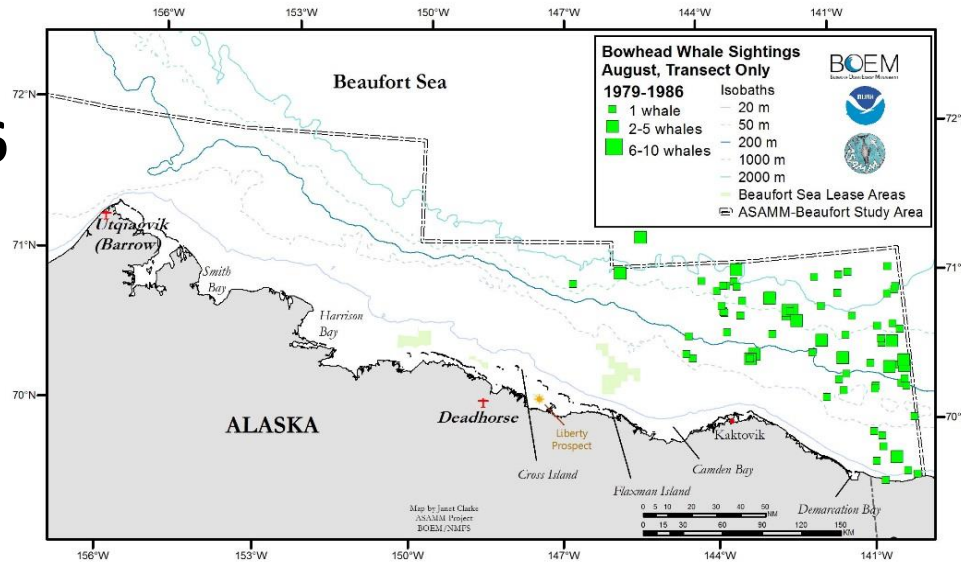


Importance of sampling Beaufort DBO Regions

Example: Upwelling & Bowhead Whales

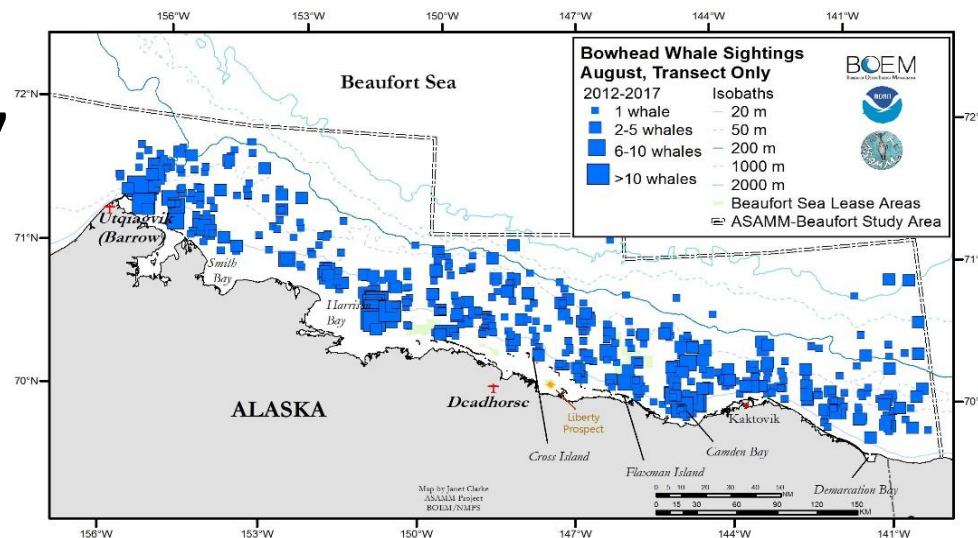
<https://www.afsc.noaa.gov/nmml/cetacean/bwasp/>

1979-1986



Aerial Surveys of Arctic
Marine Mammals (ASAMM)
NOAA/MML

2012-2017

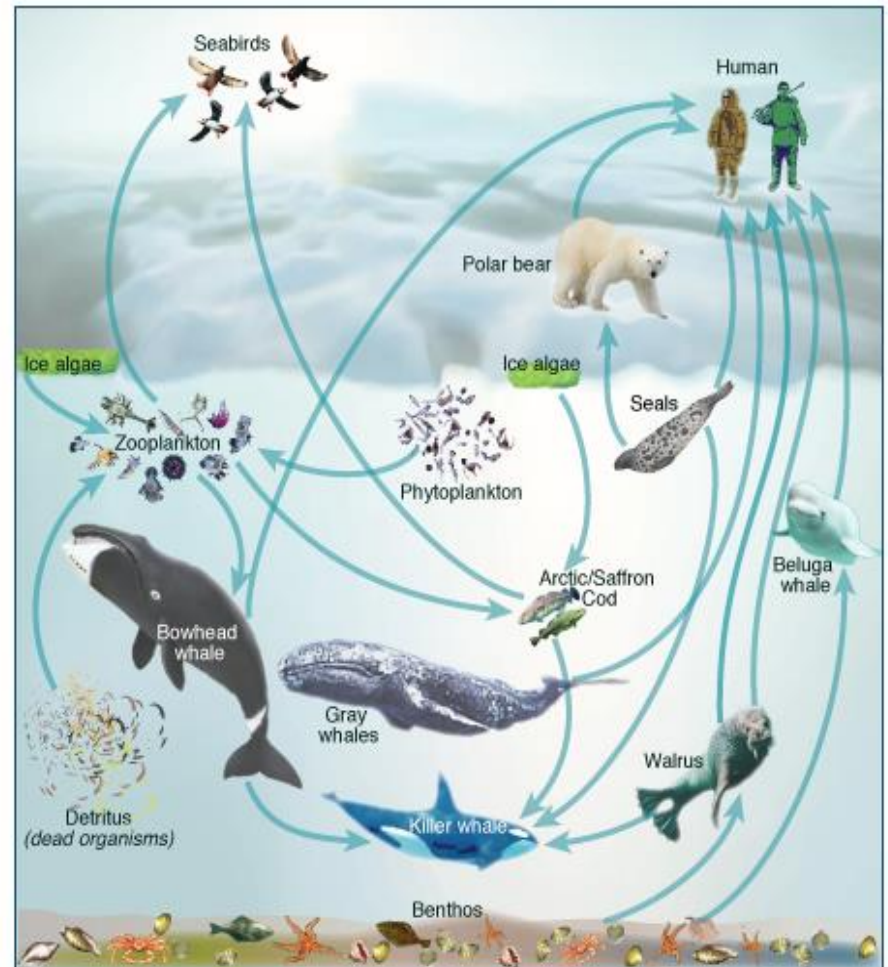




THE AMP MODEL

a Step Towards Linking Conventional Science and Inuit Knowledge?

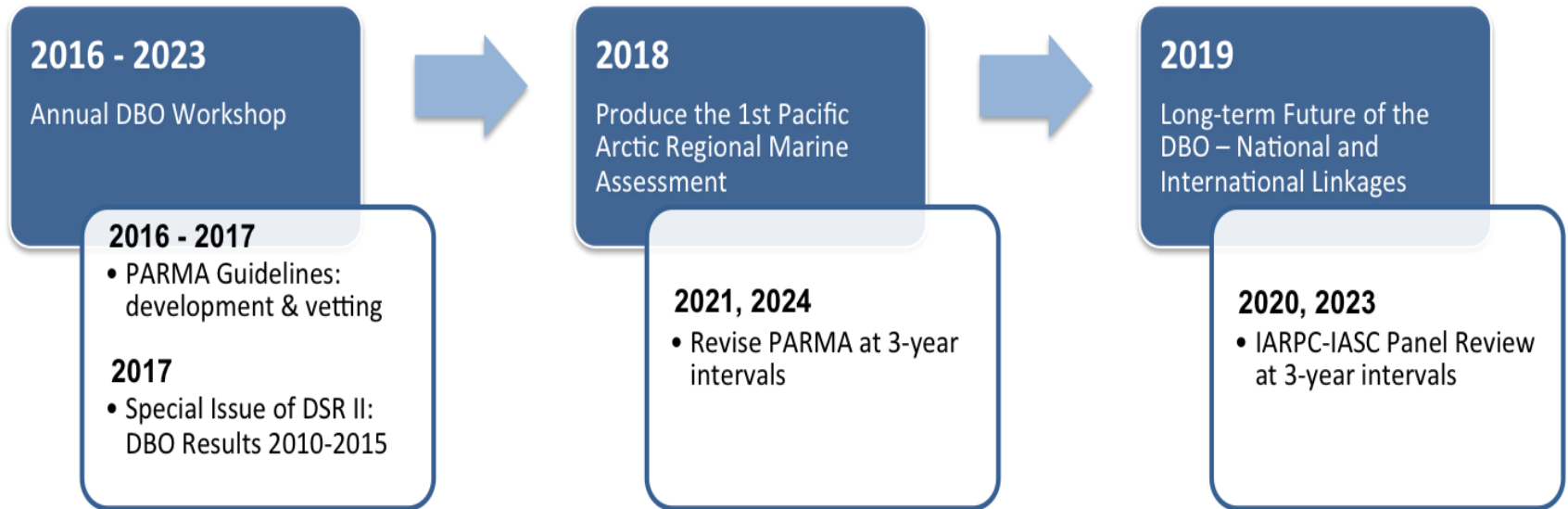
- Humans are at the apex of Arctic food webs and rely on marine resources for subsistence and culture
- The AMP Model emphasizes **temporal events** (pulses), which can link biophysical processes with human subsistence activities
- Goal = holistic assessment of ecosystem state and future trajectory



2017 ASSW: M. Reigstad Presentation



US DBO Coordination: IARPC Marine Ecosystems CT Pacific Arctic Regional Marine Assessment (PARMA: proposed timeline)



[Link to International Partners via PAG and IASC](#)

Thank You –



any Questions?



Beaufort Sea, September 2017