Ecosystem Based Management:

Biodiversity, Resilience, and Beyond

Alaska Fisheries Science Center

Phillip R. Mundy* (NOAA)

Beyond Arctic Biodiversity Conservation; Ecosystem Stewardship and Resilience

Arctic Biodiversity Congress

Trondheim, Norway

2 December 2014

Ecosystem-Based Management in the Arctic

SOURCES: CBD, BePOMAr, UN, WWF, ESA, others

ARCTIC COUNCIL

Twelve Recommendations

Report submitted to Senior Arctic Officials
by the Expert Group on Ecosystem-Based Management
May 2013

EBM (EA) is a system of knowledge concerning the ecosystem and its systems. EBM embodies what is known about how to shape human behavior in ways that minimize interference with continuing *operations of the ecosystem.* **What kinds of knowledge?**

Six elements of the Ecosystem Approach (PAME EA-EG)

1. **Identify the ecosystem**
2. **Describe the ecosystem**
3. **Set ecological objectives**
4. **Assess the ecosystem**
5. **Value the ecosystem**
6. Manage human activities

The system of knowledge

The regulatory process

What does EBM have to do with biodiversity and resilience?

The operational ecosystem is intrinsically *resilient* due to the integrity of its systems. The integrity of systems may be observed by measuring *biological diversity,* structural complexity, and the spatial and temporal continuity of the flow of carbon and energy, among other descriptive attributes.

EBM (EA), has the attributes characteristic of ***effective resource governance.***

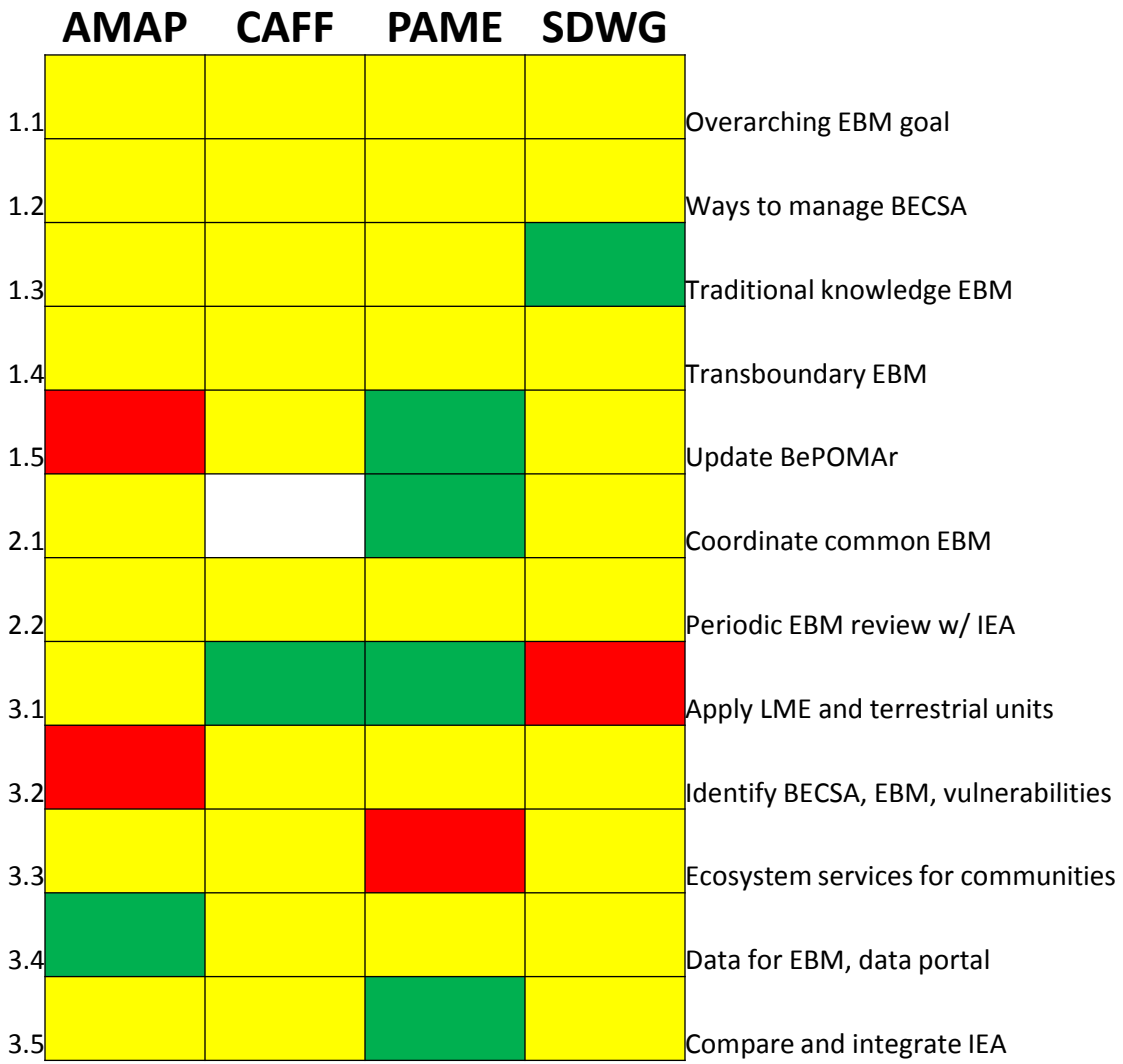
- It is **participatory**. The ability to shape human behavior requires the participation of the humans who take actions affecting within the ecosystem.
- It requires **constant learning** so that the system of knowledge can remain effective at shaping human behavior in the face of uncertainties imposed by **drivers of a change** in the ecosystem.
- It is constantly challenged to establish the **legitimacy** of its knowledge, by demonstrating consistency with *traditional knowledge* and the *best available scientific information.*
- It confers the ability to **operationalize policy integration across sectors and scales.**

Status of Implementing Twelve EBM Recommendations in the Arctic Council

High priority or lead
Medium priority, collaborate
Low priority or outside mission

Responses from AMAP, CAFF, PAME, SDWG to EBM Recommendations

ACSAO-CA03 Yellowknife EXEC 4.3 Oct 2014



EBM is fundamental to implementing recommendations of the Arctic Biodiversity Assessment.

Ecosystem-based management

3. Advance and advocate ecosystem-based management efforts in the Arctic as a framework for cooperation, planning and development.

Climate change

2. Incorporate resilience and adaptation of biodiversity to climate change into plans for development in the Arctic.

Identifying and safeguarding important areas for biodiversity

6. Develop guidelines and implement appropriate spatial and temporal measures where necessary to reduce human disturbance to areas critical for sensitive life stages of Arctic species outside protected areas

7. Develop and implement mechanisms that best safeguard Arctic biodiversity under changing environmental conditions, such as loss of sea ice, glaciers and permafrost.

Addressing individual stressors on biodiversity

Improving knowledge and public awareness

An example where what we currently do in biodiversity management and conservation doesn't really work because we are not thinking about the problem in the right way, or policy instruments are not able to accommodate better solutions

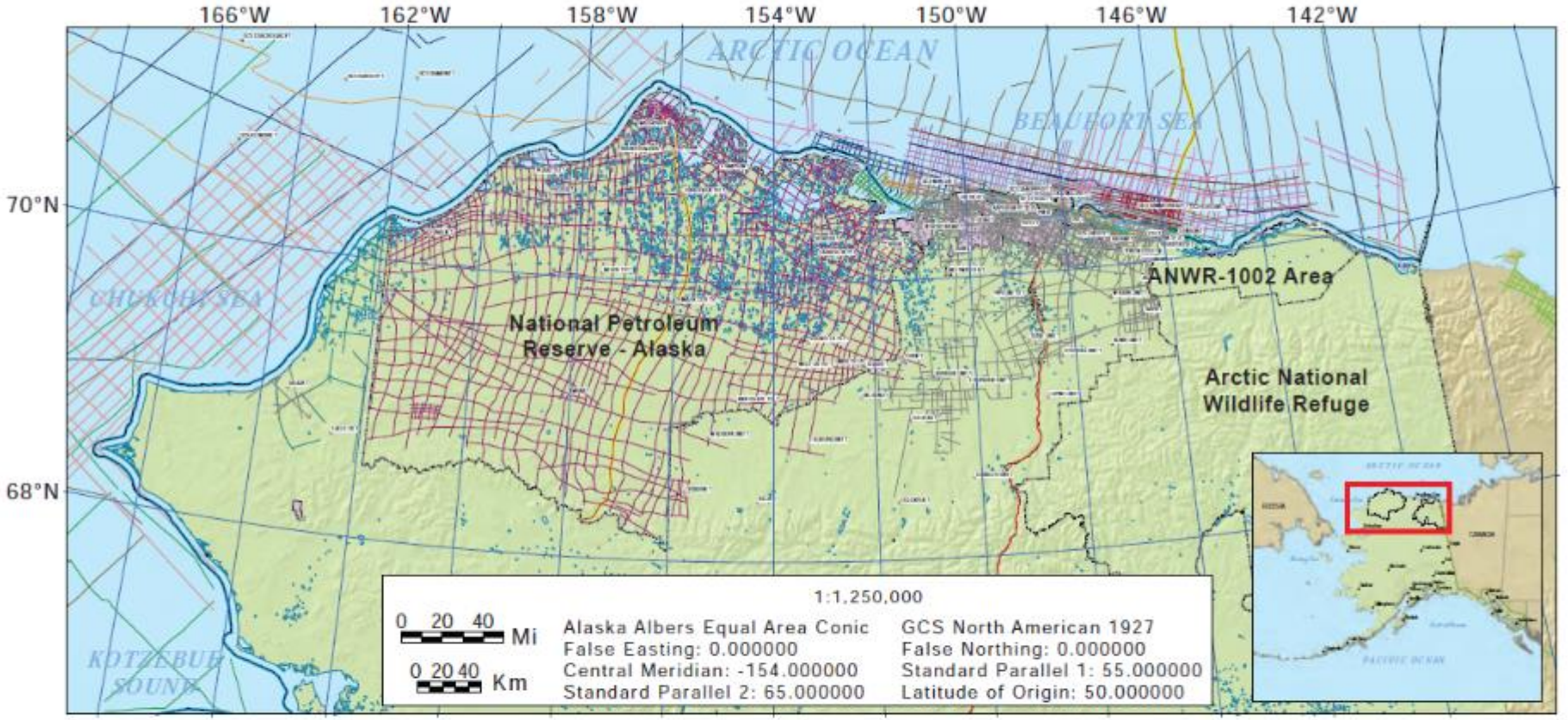


Figure 2–1. Map compilation showing transects (colored lines) of individual 2-D seismic surveys of the Alaska North Slope and offshore. The line colors correspond to different seismic datasets. The seismic data from these transects are publicly available. More information on these surveys, and a corresponding map for the spatial distribution of commercially available 2-D and 3-D seismic data, are available from State of Alaska (2008a).

Holland-Bartels and Pierce eds 2011
http://pubs.usgs.gov/circ/1370/pdf/circ1370.pdf

Lack of a coordinated approach to EBM Implementationin the US Beaufort

- **US Federal BOEM (DOI) NOAA OAR, NMFS,** NOS, NESDIS (DOC), NASA, NSF, EPA, DOD (Army Corps of Engineers) & Native Corps & State and local government
- **Private: Shell Oil, Conoco Phillips, BP**
- **International Arctic Science Committee**, Pacific Arctic Group; Academic and government, North Pacific States
- **Non-governmental Organizations, NGOs** – World Wildlife Fund, Audubon, Oceana, et al., Alaska Ocean Observing System; Inuit Circumpolar Conference, Aleut International Association
- **Arctic Council Working Groups & Programmes**, CAFF, AMAP, PAME

Getting beyond biodiversity?

- **Placing the conservation of biodiversity in the context of the ecosystem approach to management.**
- **Biodiversity is an essential part of the system of knowledge of the ecosystem approach to management**

EBM (EA) is a system of knowledge concerning the ecosystem and its systems. EBM embodies what is known about how to shape human behavior in ways that minimize interference with continuing *operations of the ecosystem.* **What kinds of knowledge?**

Six elements of the Ecosystem Approach (PAME EA-EG)

1. **Identify the ecosystem**
2. **Describe the ecosystem**
3. **Set ecological objectives**
4. **Assess the ecosystem**
5. **Value the ecosystem**
6. Manage human activities

Biodiversity as component of the system of knowledge

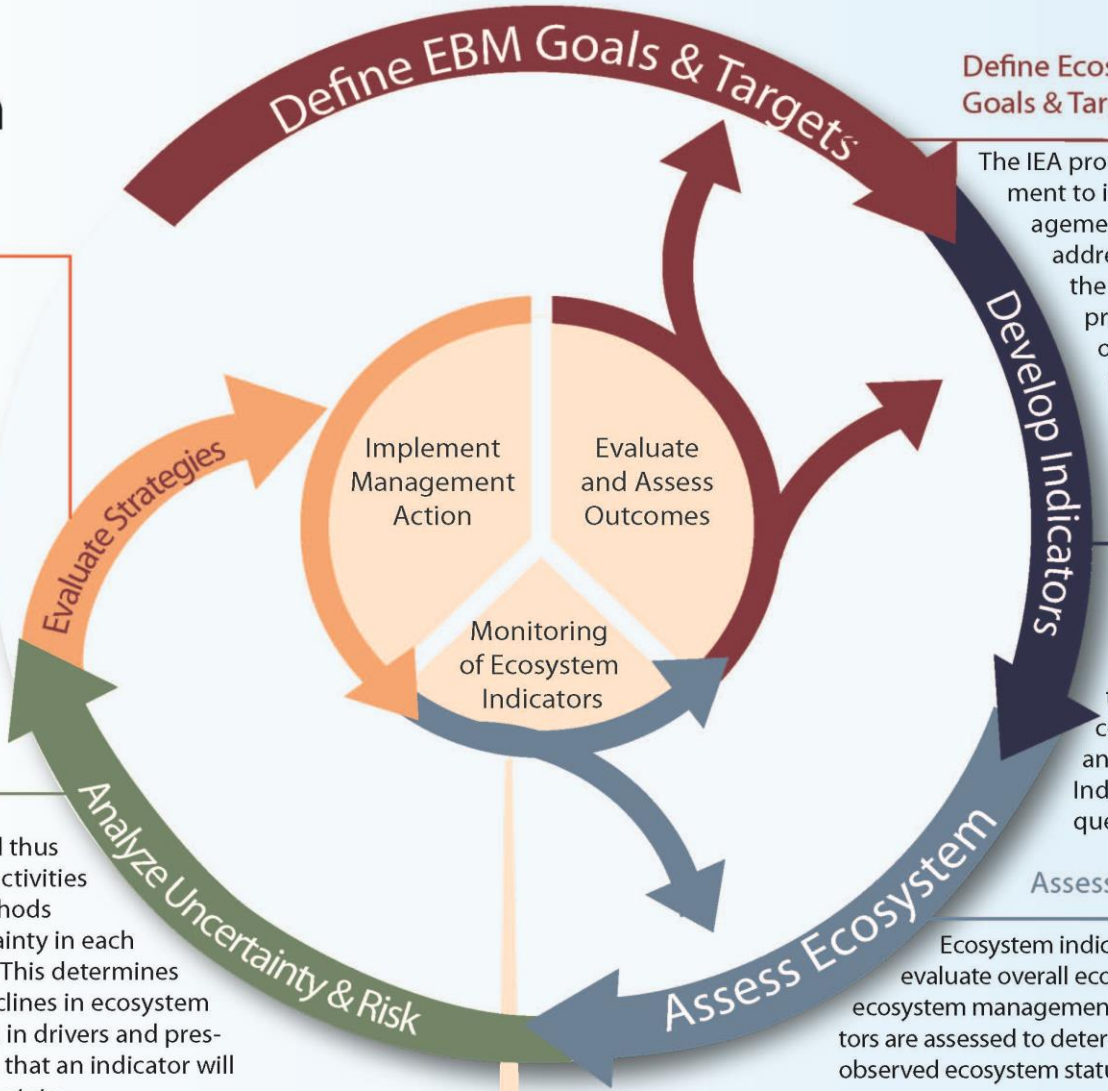
The regulatory process

The End

Examples of interim products of an IEA

Region		Select examples of implementation progress	Key Management Topics
California Current		• Two IEA reports, including all steps within IEA process (2011, 2013) • Ecosystem considerations report delivered to PFMC (2011) • Integration of IEA science into management discussions (e.g. Sanctuaries, Puget Sound, Sacramento River)	• Climate • Fisheries • Energy
Northeast US Shelf		• Development of multi-species and ecosystem models • Indicator development using DPSIR • Development of spatial tools for EBFM • Semi-annual production of Ecosystem Advisory report • Bi-annual Ecosystem Status report	• Fisheries • Wind energy • Protected species • Climate • Recreation and Tourism • Shipping
Gulf of Mexico		• Demonstration project with GMFMC SEDAR process to provide ecosystem considerations in Stock Assessments • Ecosystem Services Risk Assessment • Ecosystem Assessment Management Report for 4 estuarine ecosystems • Development of digital trophic database and Data Atlas • Ecosystem Status report (2013)	• Commercial Fishing • Energy • Population • Recreation and Tourism • Shipping
Alaska Complex		• Annual ecosystem considerations chapter provided to NPFMC • Ecosystem indicator selection process through multi-stakeholder workshops • Development of metrics to represent condition of ecosystems; help establish reference points and comparisons across ecosystems (part of Risk Assessment)	• Fisheries • Climate • Energy
Pacific Islands		• Studies on effects of ocean circulation on larval retention • Development of “reef” and “coastal” ecosystem model to understand energy flows and interactions • Studies on human dimensions in ecosystem functions in Kona Coast (incl. Indicator development, Identification of drivers and pressures, communication and networking with managers) • Cetacean habitat modeling • Annual Kona IEA research cruise	• Shared use resources • Aquaculture • Climate change and Kona Sentinel Site

The NOAA IEA Approach



Management Strategy Evaluation

MSE is useful to help resource managers consider the system trade-offs and potential for success in reaching a target which helps make informed decisions. It uses simulation through ecosystem modeling to evaluate the potential of different management strategies to influence the status of natural and human system indicators and to achieve our stated ecosystem objectives.

Analyze & Evaluate Uncertainty & Risk

Ecosystem analyses and models evaluate risk to the indicators and thus the ecosystem posed by human activities and natural processes. These methods incorporate the degree of uncertainty in each indicator's response to pressures. This determines incremental improvements or declines in ecosystem indicators in response to changes in drivers and pressures and to predict the potential that an indicator will reach or remain in an undesirable state.

Define Ecosystem Management Goals & Targets

The IEA process involves manager engagement to identify critical ecosystem management goals and targets to be addressed through and informed by the IEA approach. The rest of the process is driven by these defined objectives. Engagement is continual throughout the entire IEA process.

Develop Ecosystem Indicators

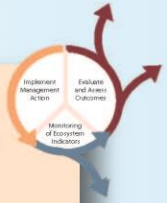
Indicators represent key components in an ecosystem and allow change to be measured. They provide the basis to assess the status and trends in the condition of the ecosystem or of an element within the system. Indicators are essential for all subsequent steps in the IEA approach.

Assess Ecosystem

Ecosystem indicator data are assessed together to evaluate overall ecosystem status and trends relative to ecosystem management goals & targets. Individual indicators are assessed to determine the underlying cause for the observed ecosystem status & trends.

Taking, Monitoring, and Assessing Action

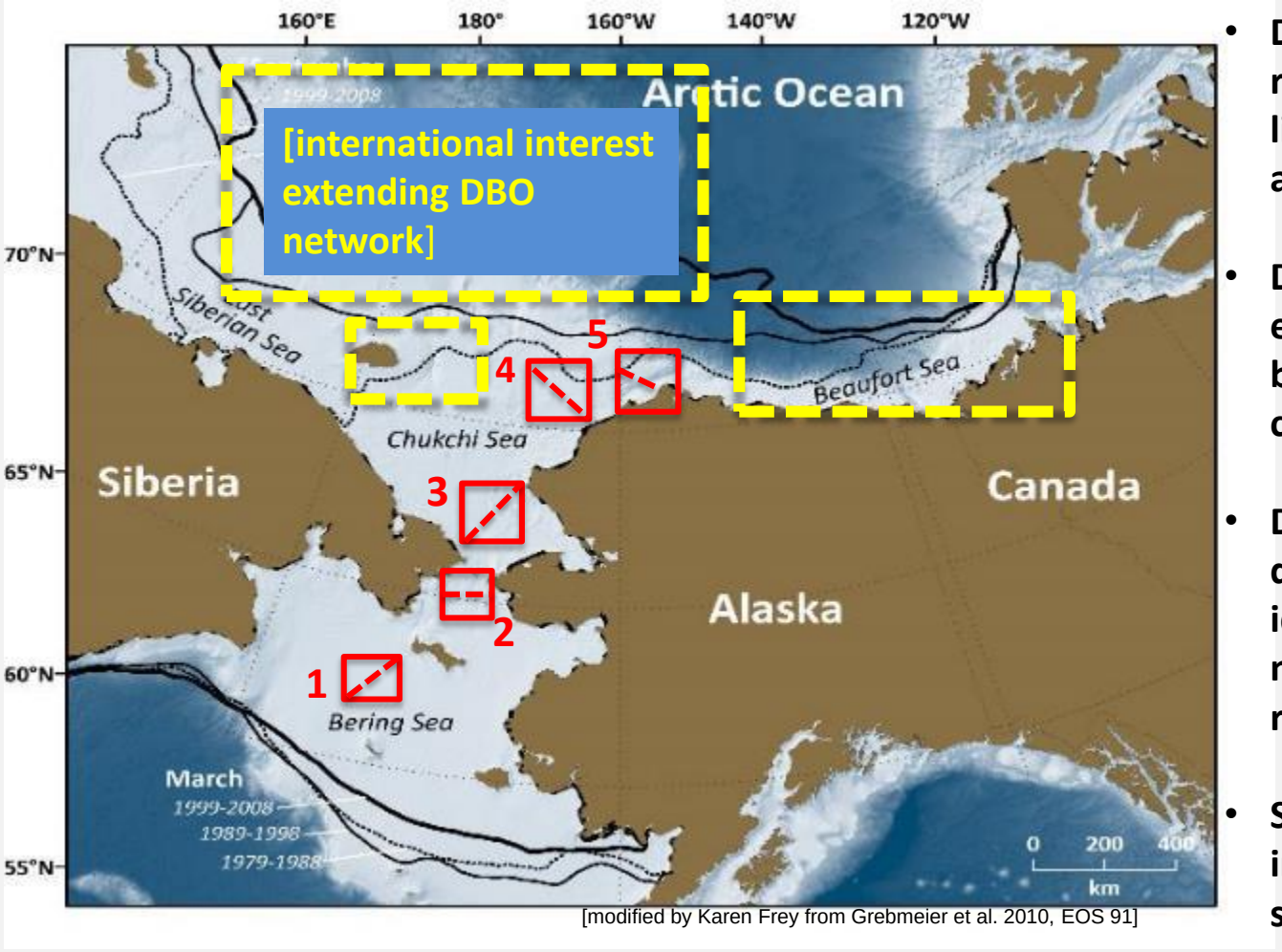
Based on the MSE, an action is selected and implemented. Monitoring of indicators is important to determine if the action is successful; if yes, the status, trends, and risk to the indicators continue to be analyzed for incremental change; otherwise as part of adaptive management, the outcomes need to be assessed and evaluated to refine goals and targets or indicators towards achieving objectives.



For more information visit: www.noaa.gov/iea

- 6-22 August 2008
- Charter vessel F/V *Ocean Explorer*
- Bottom trawl
  - 83-112 (1.5”mesh liner)
  - Net height, spread, bottom contact
- Acoustic-trawl
  - Calibrated ES-60 at 38kHz
  - Marinovich mid-water net
- CTDs
- Bongo nets for zooplankton (333 and 150 micron)
- Strip transects for seabirds
- Opportunistic observations of marine mammals

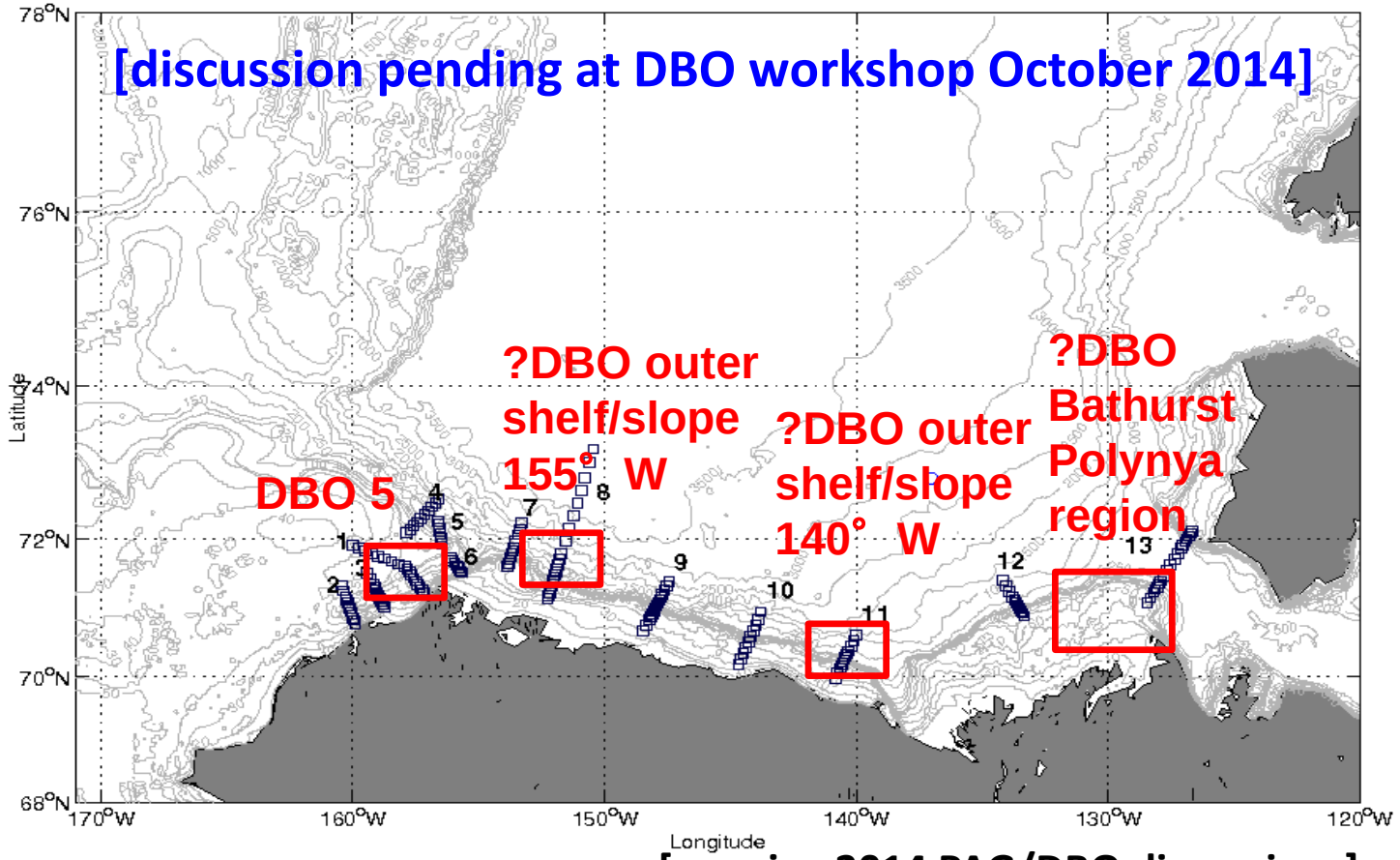
Linking Physics to Biology: the Distributed Biological Observatory (DBO)



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

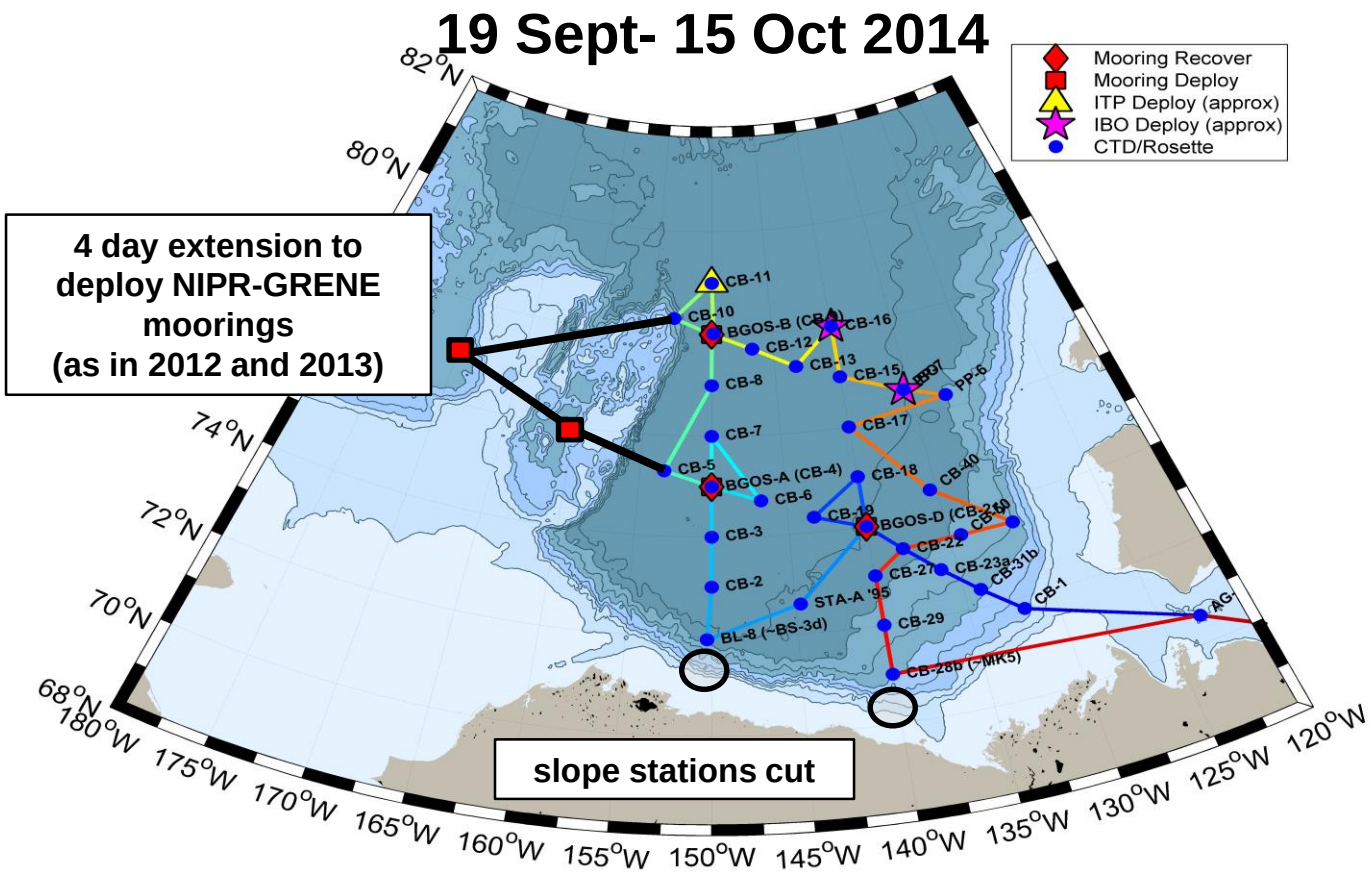
- DBO sites (red boxes) are regional "hotspot" transect lines and stations located along a latitudinal gradient
- DBO sites are considered to exhibit high productivity, biodiversity, and overall rates of change
- DBO sites will serve as a change detection array for the identification and consistent monitoring of biophysical responses
- Sites occupied by national and international entities with shared data plan

Possible Beaufort DBO lines overlain on past Bob Pickart AON cruise lines



[ongoing 2014 PAG/DBO discussions]

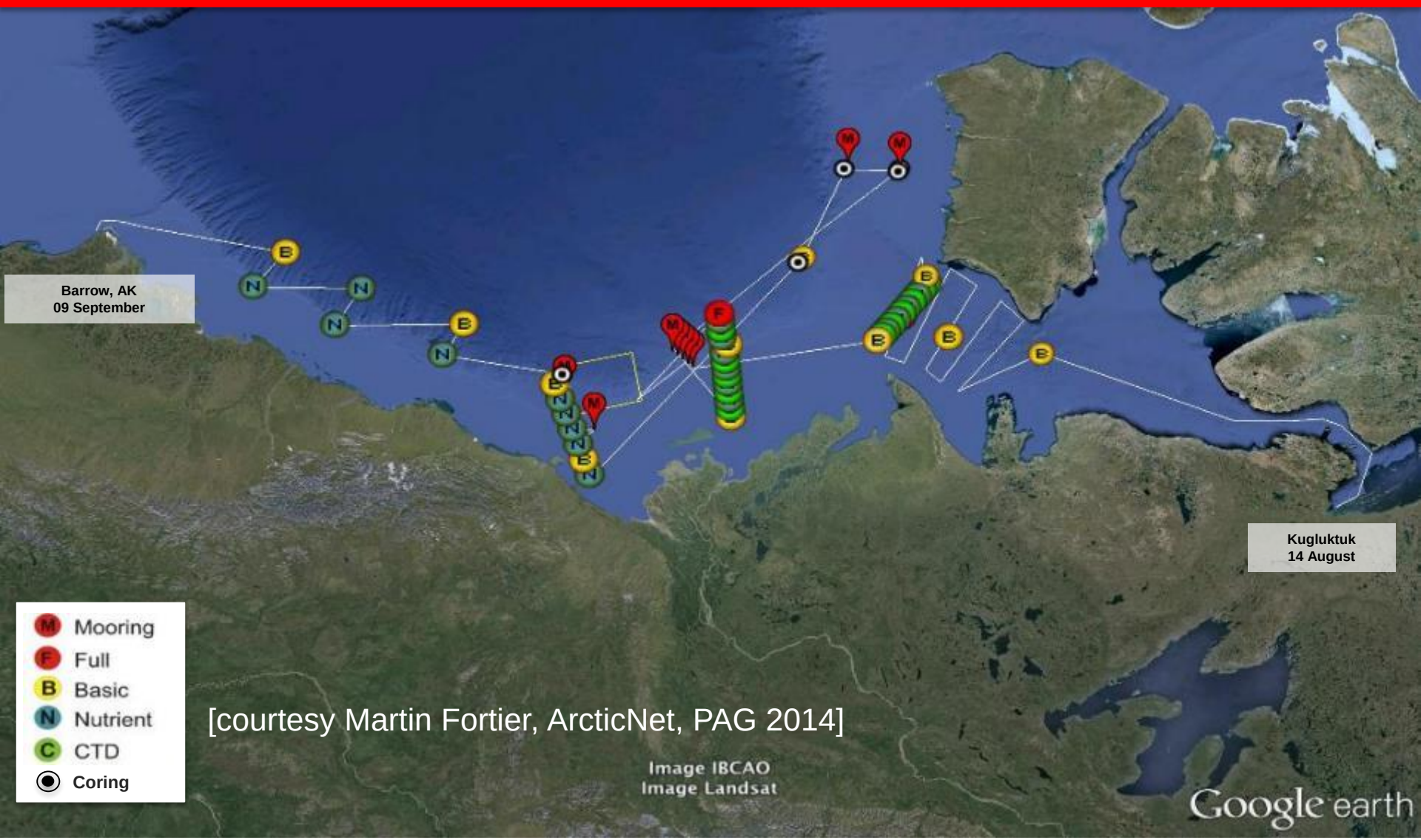
JOIS/AON-BGOS



[courtesy Bill Williams, DFO, PAG 2014]

CCGS AMUNDSEN
Canadian Research Icebreaker

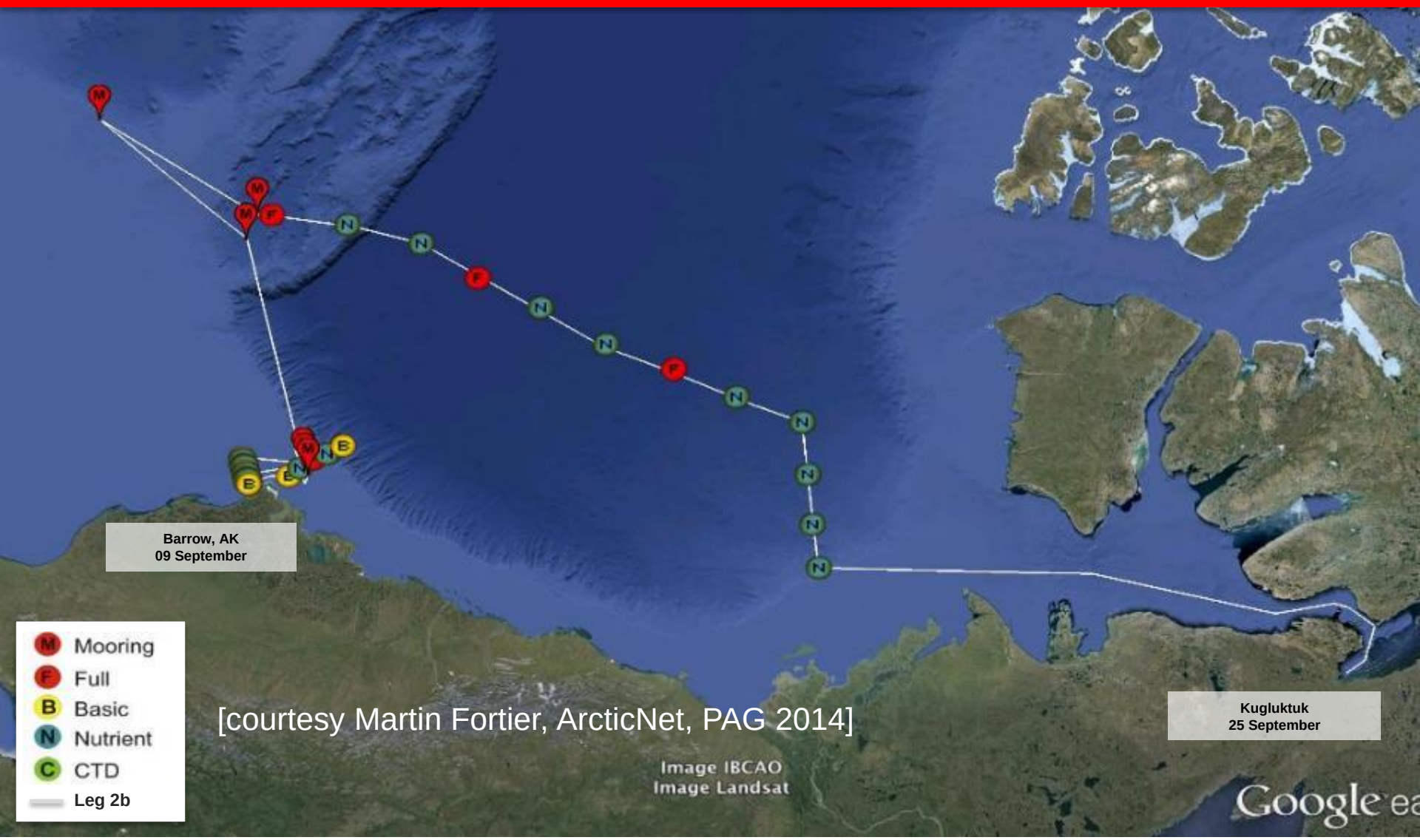
Leg 2a (26d)



[courtesy Martin Fortier, ArcticNet, PAG 2014]

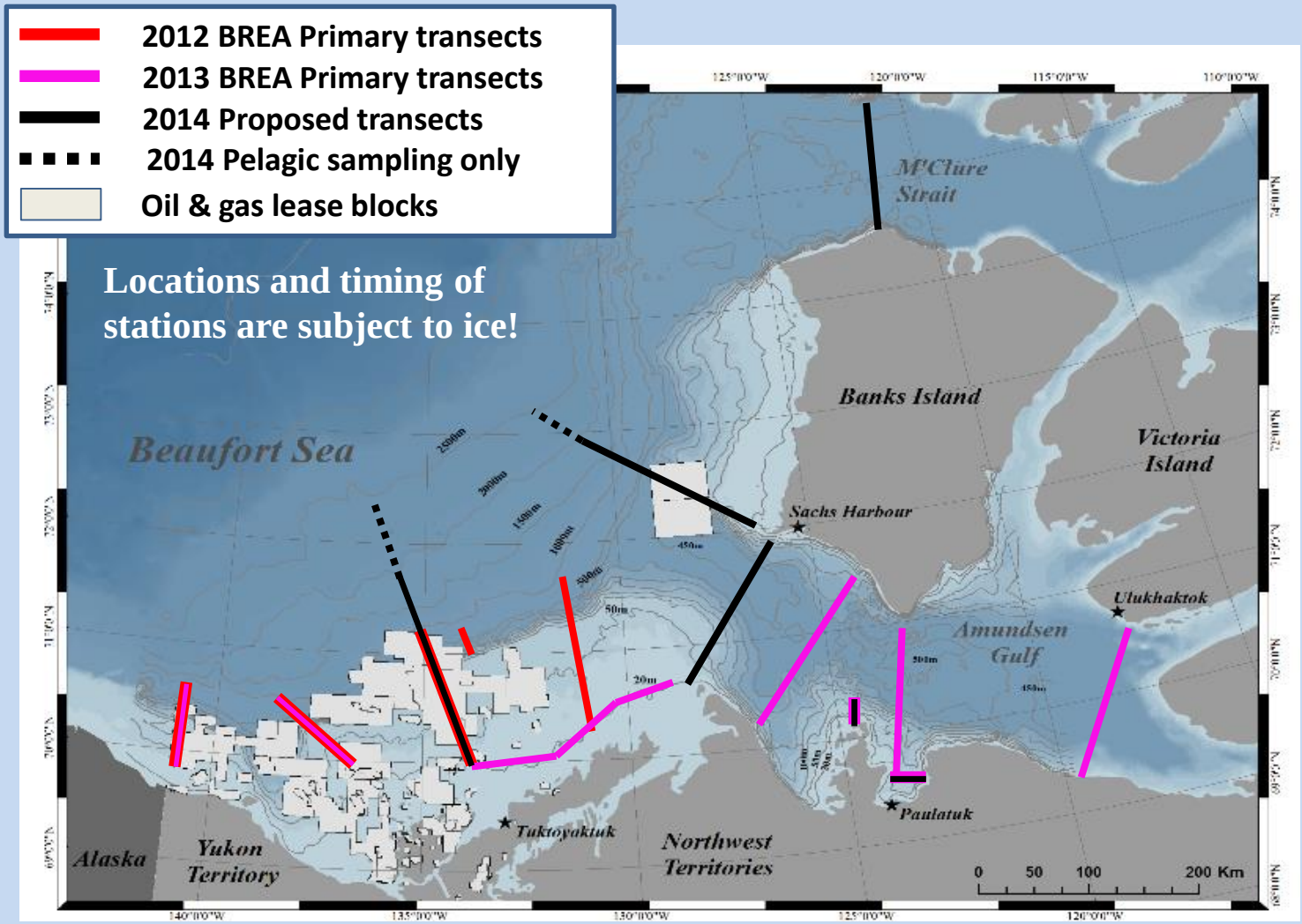
CCGS AMUNDSEN
Canadian Research Icebreaker

Leg 2b (16d)

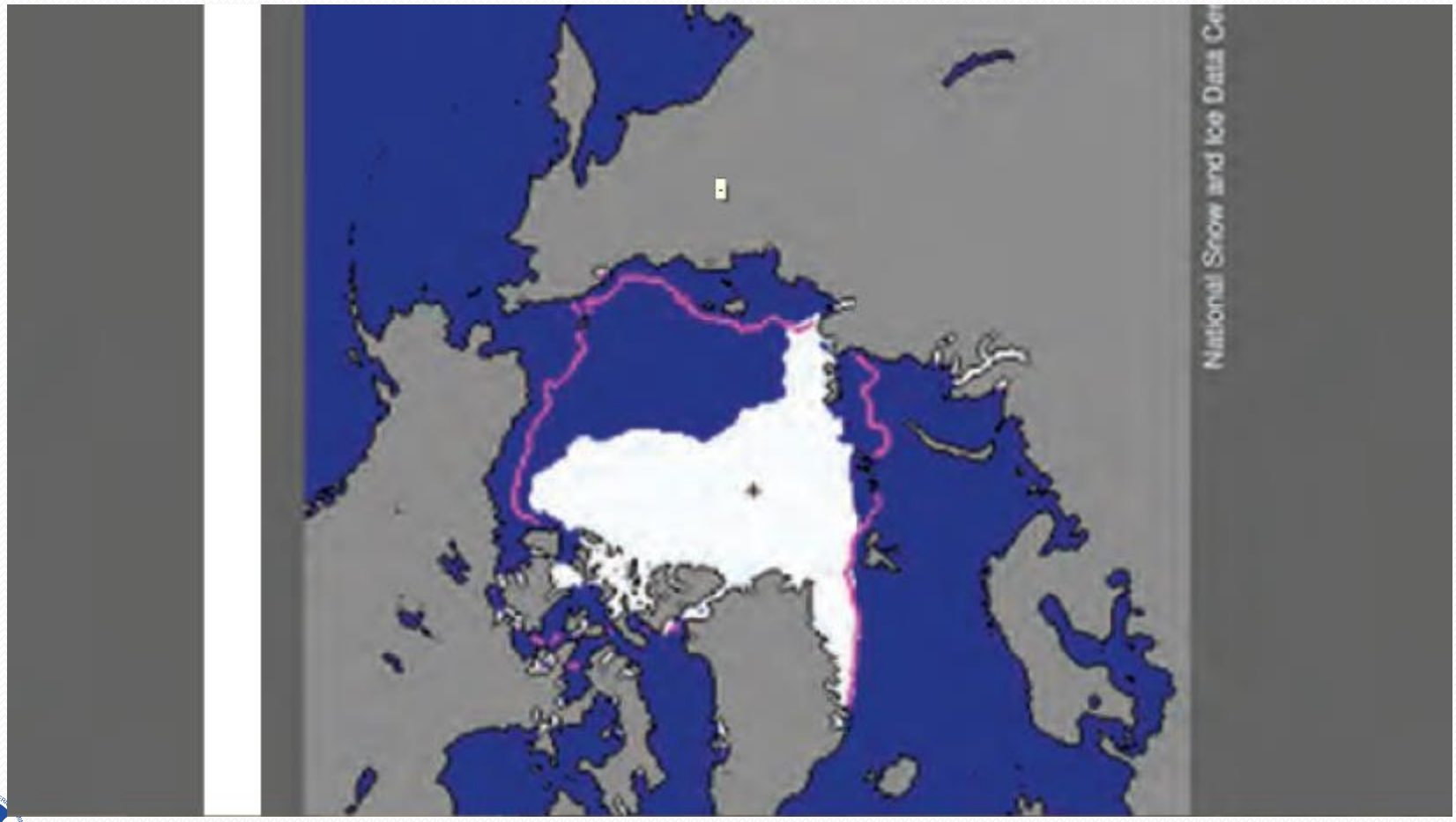


[courtesy Martin Fortier, ArcticNet, PAG 2014]

Beaufort Sea Marine Fishes Sampling 2012 - 2014



[courtesy Bill Williams, DFO/PAG 2014]


National Snow and Ice Data Ce

Published Studies

- >>
- >> Beaufort Sea and Oceanography: 27 hits [1995-2013]
- >> Beaufort Sea and Biology: 18 hits [1991-2014]
- >> Beaufort Sea and IPY: 19 hits [2008-2014]
- >> Beaufort Sea and Physical Oceanography: 5 hits [1995-2012]
- >> Beaufort Sea and Biological Oceanography: 7 Hits [1995-2013]
- >> Beaufort Sea and Geological Oceanography: 0; Beaufort Sea and Geological:
- >> 21 hits [1989-2013]
- >> Beaufort Sea and Fauna: 28 hits [1989-2013]
- >> Beaufort Sea and Fish: 82 hits [1984-2014]
- >> Beaufort Sea and Ichthyology: 0
- >> Beaufort Sea and Benthic Ecology: 12 hits [1989-2013]
- >> Beaufort Sea and Fisheries 16 hits [1994-2014]
- >>
- >>