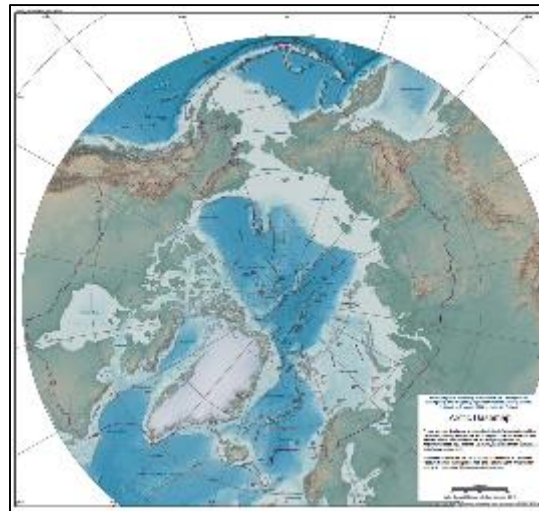


# Ecologically or biologically significant areas in the Arctic: spatial and temporal overlaps with expected increases in energy exploration

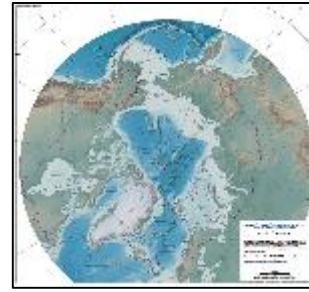
*Practices in ecological characterization and monitoring in relation to energy exploration and development*

CAFF Congress  
3 December, 2014



Patrick Halpin & Jesse Cleary  
Marine Geospatial Ecology Lab, Duke University, USA

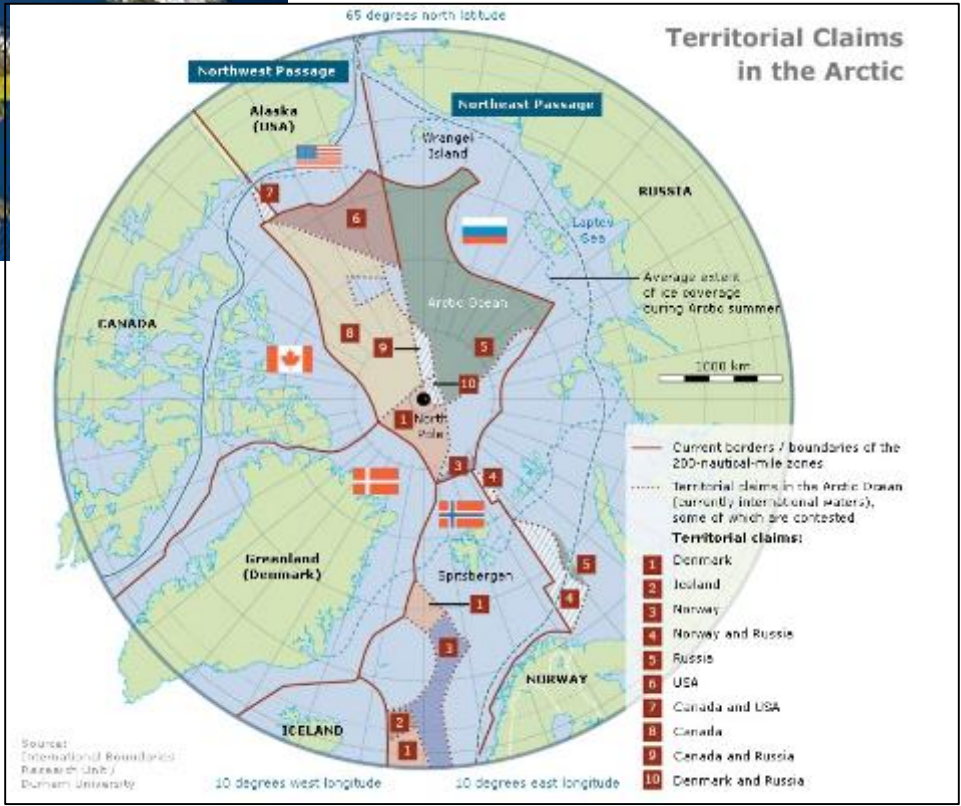
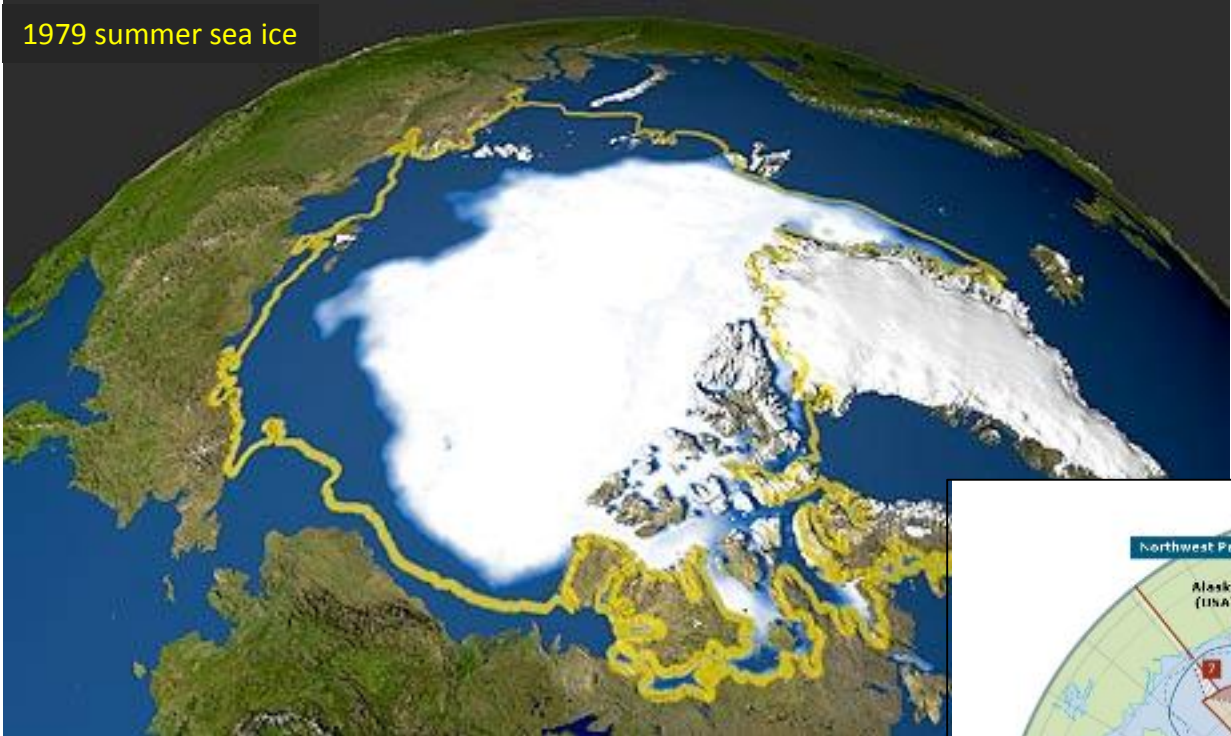
# Topics



- Overview
- International marine biodiversity processes;
  - Areas described as meeting the UN CBD EBSA criteria;
- Space-Time overlaps
  - Oil & Gas exploration
  - Shipping
  - Fisheries
- Example: Regional dynamic management
  - BOEM / NOAA-NMFS monitoring
- Issues and implications.

# changing environment – changing interests

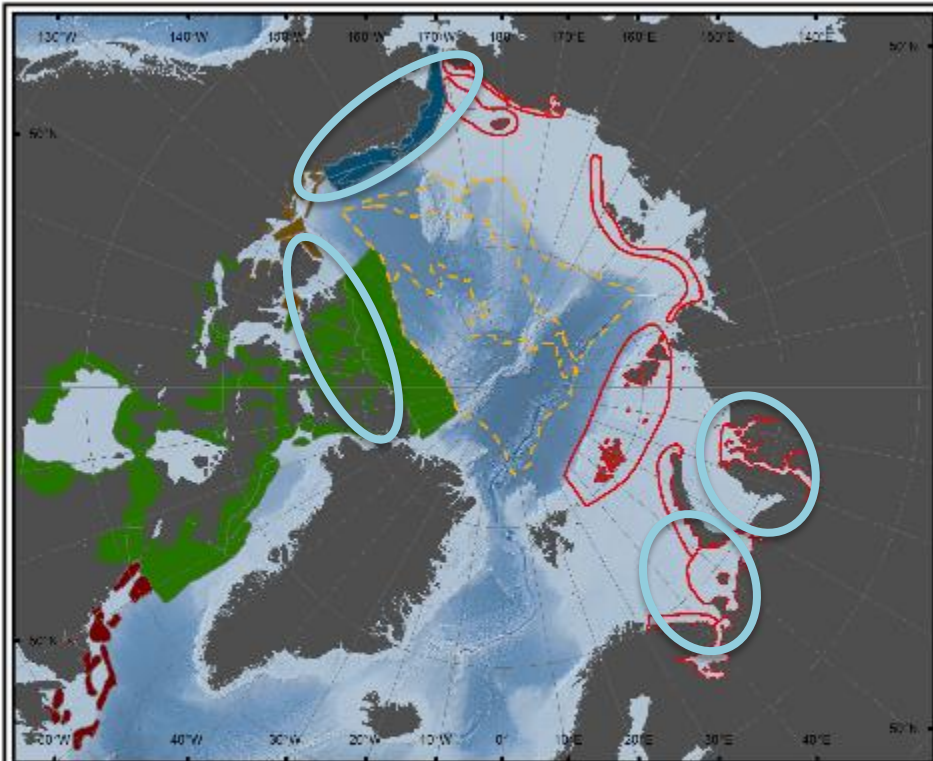
1979 summer sea ice



# Areas of oil & gas potential vs. ecological importance

Ecologically or Biologically Important Areas

Oil & Gas Potential

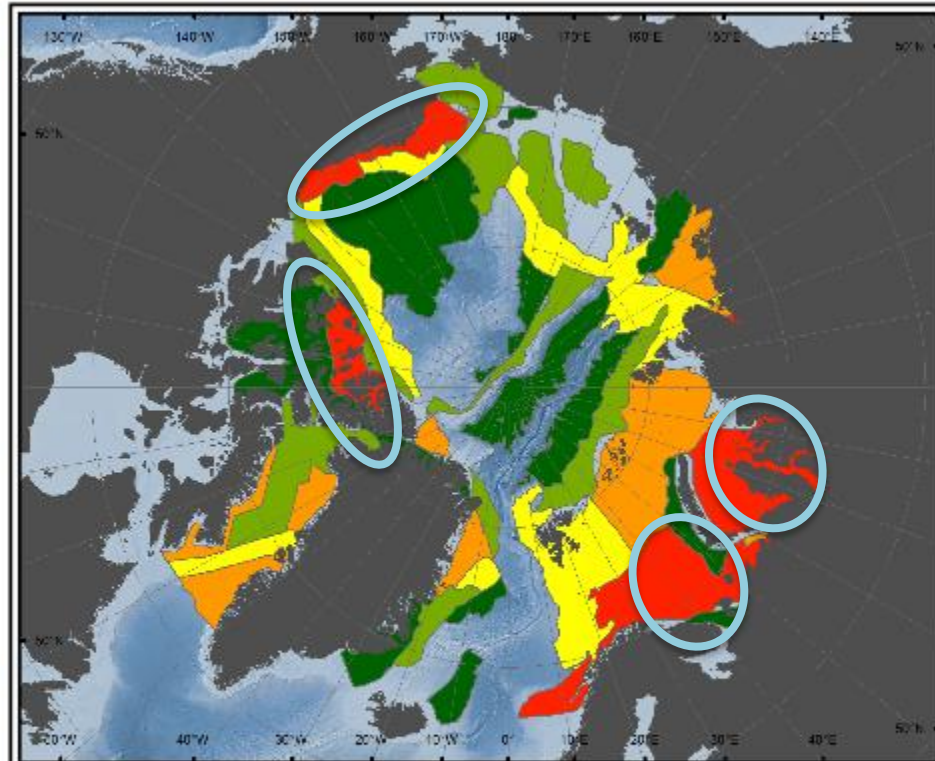


**CBD EBSA process**  
 Spatially Stable EBSA  
 Spatially Dynamic EBSA

**Canadian EBSA process**  
 Newfoundland / Labrador  
 Beaufort / N. Foxe Basin  
 Canadian Arctic

**US Biologically Important Areas - Cetaceans**  
 Bowhead, Beluga, Gray whales

Marine Geospatial Ecology Lab, Duke University (2014)



**Oil and Gas Potential**  
 ~10%  
 10% - 30%  
 30% - 50%  
 50% - 100%  
 100%

Marine Geospatial Ecology Lab, Duke University (2014)

*USGS 2008/2011. Circum-Arctic Resource Appraisal: Estimates of undiscovered oil and gas north of the Arctic Circle.*

*"Assessment units (AUs) in the Circum-Arctic Resource Appraisal (CARA) color-coded by assessed probability of the presence of at least one undiscovered oil and/or gas field with recoverable resources greater than 50 million barrels of oil equivalent (MMBOE).*

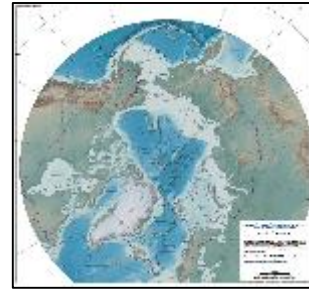
# Identifying ecologically or biologically important areas in the Arctic

## Issues that will influence ocean resource planning in the Arctic

- Significant spatial & temporal overlaps between areas of ecological importance & areas of high value for exploration...
- Significant variability in knowledge...
- Shifting baselines...
- New conditions and new trajectories...
- ...

***This spatial and temporal overlap is going to require dynamic ocean management***

# Topics



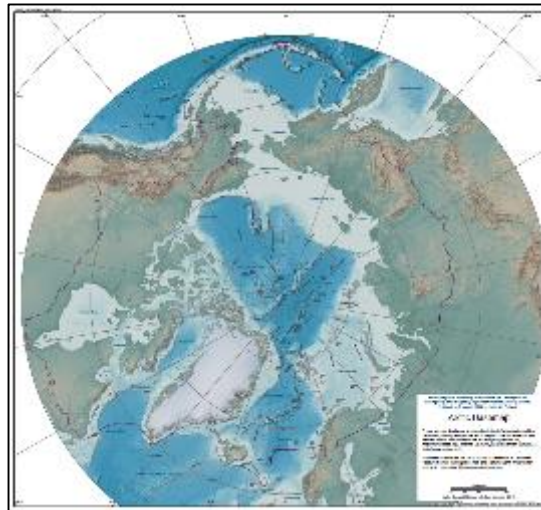
- Overview
- **International marine biodiversity processes;**
  - Areas described as meeting the UN CBD EBSA criteria;
- Space-Time overlaps
  - Oil & Gas exploration
  - Shipping
  - Fisheries
- Example: Regional dynamic management
  - BOEM / NOAA-NMFS monitoring
- Issues and implications.

# *What are EBSAs and why are they important for the Arctic?*

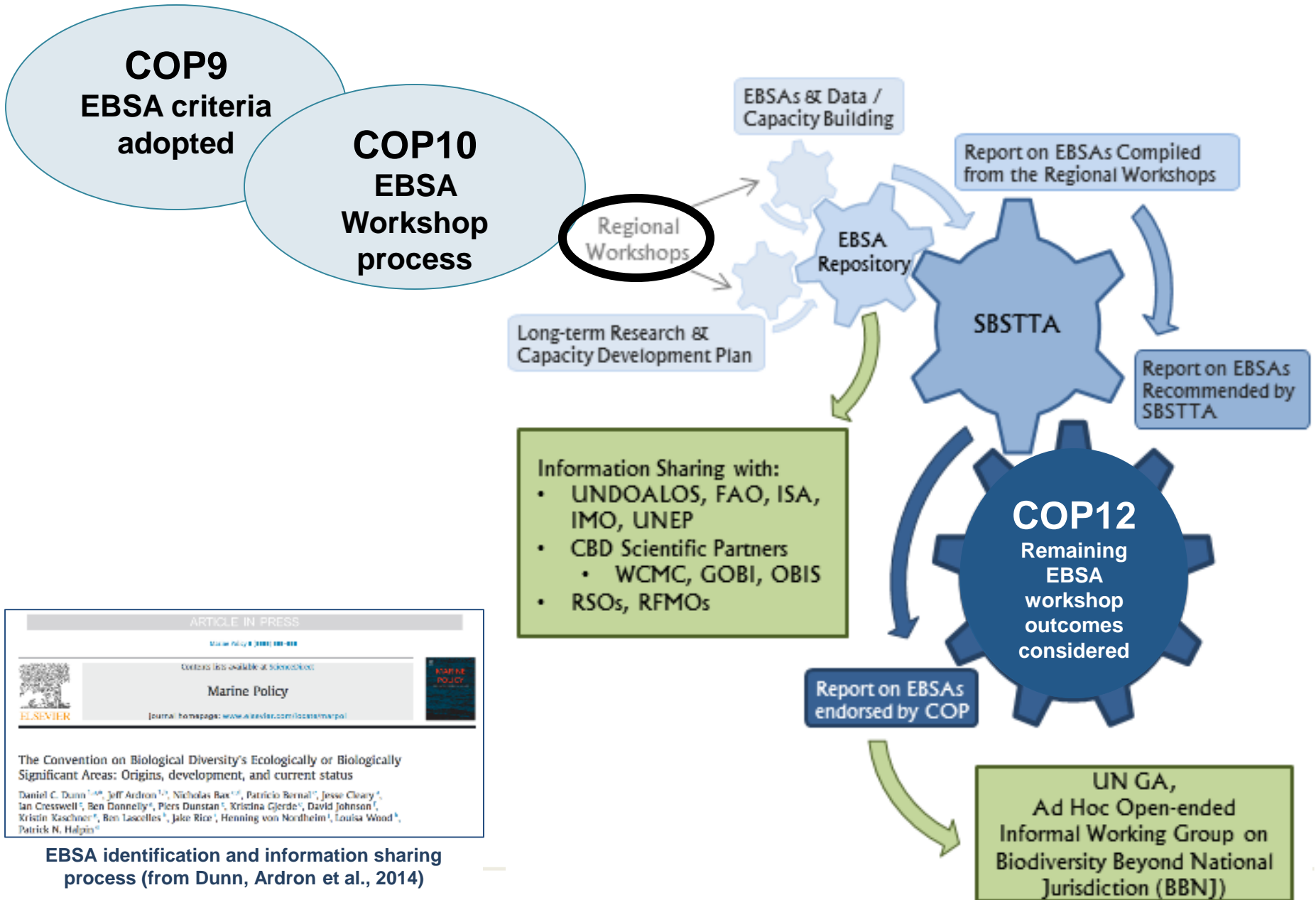
EBSAs are areas described as meeting the UN Convention on Biological Diversity Ecologically or Biologically Significant Area criteria

These areas can be described within or beyond national jurisdiction (EEZ or ABNJ)

These areas are important for ocean resource use and future spatial planning in the Arctic because they identify regional & global standing



# The EBSA Process



ARTICLE IN PRESS

Marine Policy 8 (2008) 888–918

Contents lists available at ScienceDirect

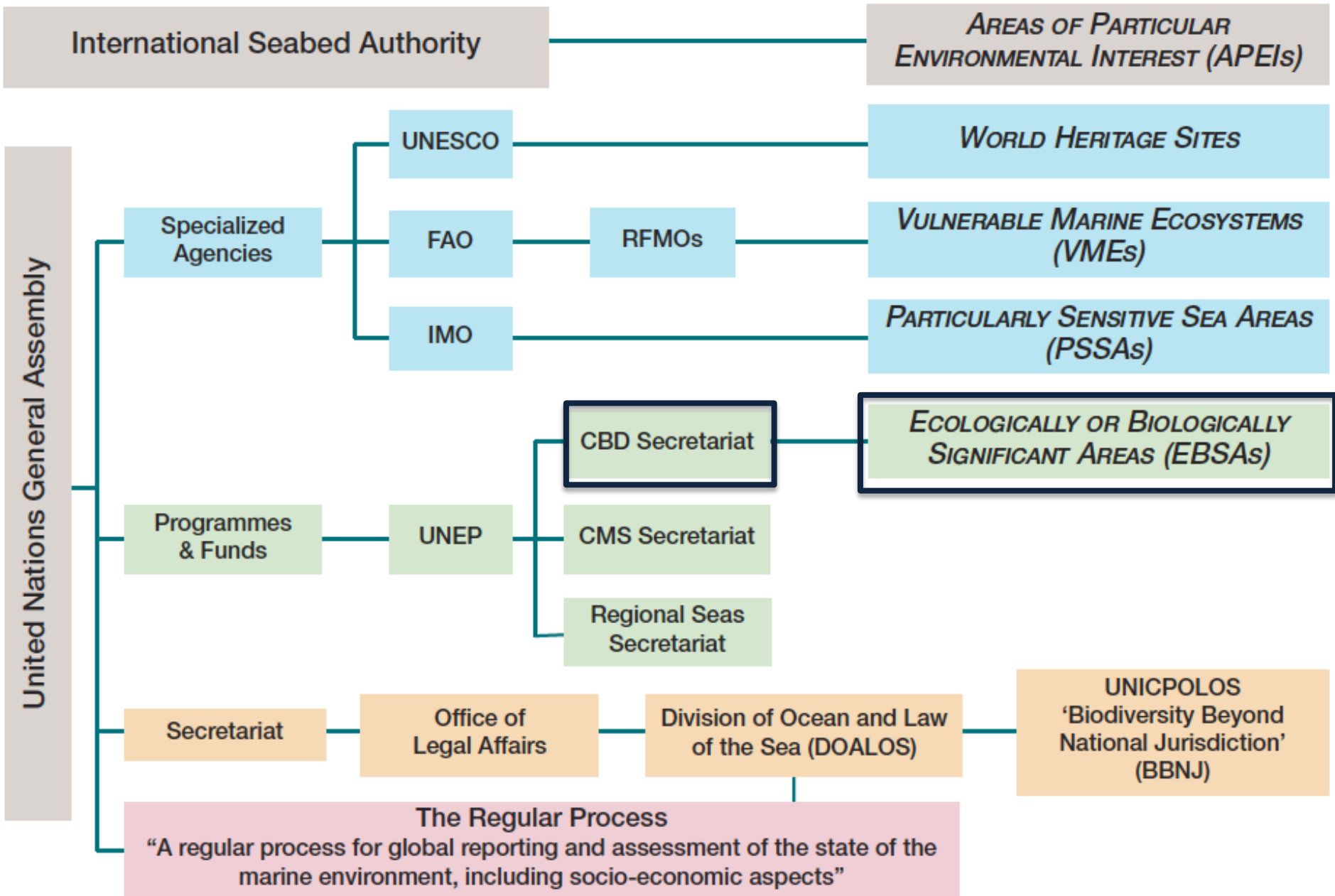
Marine Policy

Journal homepage: [www.elsevier.com/locate/marpol](http://www.elsevier.com/locate/marpol)

The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status

Daniel C. Dunn<sup>1,\*</sup>, Jeff Ardron<sup>1,2</sup>, Nicholas Bax<sup>1,3</sup>, Patricia Bernal<sup>4</sup>, Jesse Cleary<sup>5</sup>, Ian Cresswell<sup>6</sup>, Ben Donnelly<sup>6</sup>, Piers Dunstan<sup>7</sup>, Kristina Gjerdø<sup>8</sup>, David Johnson<sup>9</sup>, Kristin Kaschner<sup>10</sup>, Ben Lascelles<sup>11</sup>, Jake Rice<sup>12</sup>, Henning von Nordheim<sup>13</sup>, Louisa Wood<sup>14</sup>, Patrick N. Halpin<sup>15</sup>

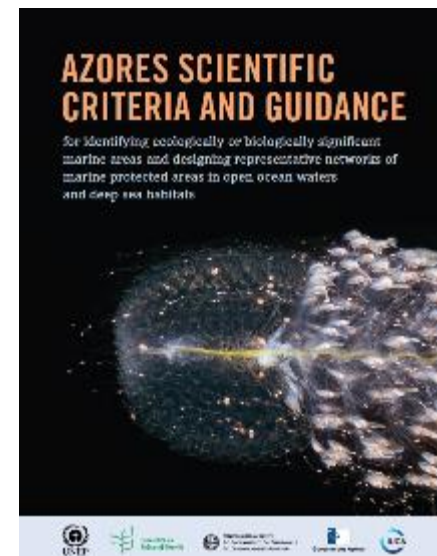
EBSA identification and information sharing process (from Dunn, Ardron et al., 2014)



# Ecologically or Biologically Significant Areas (EBSAs): Criteria

***EBSAs are not MPAs!***

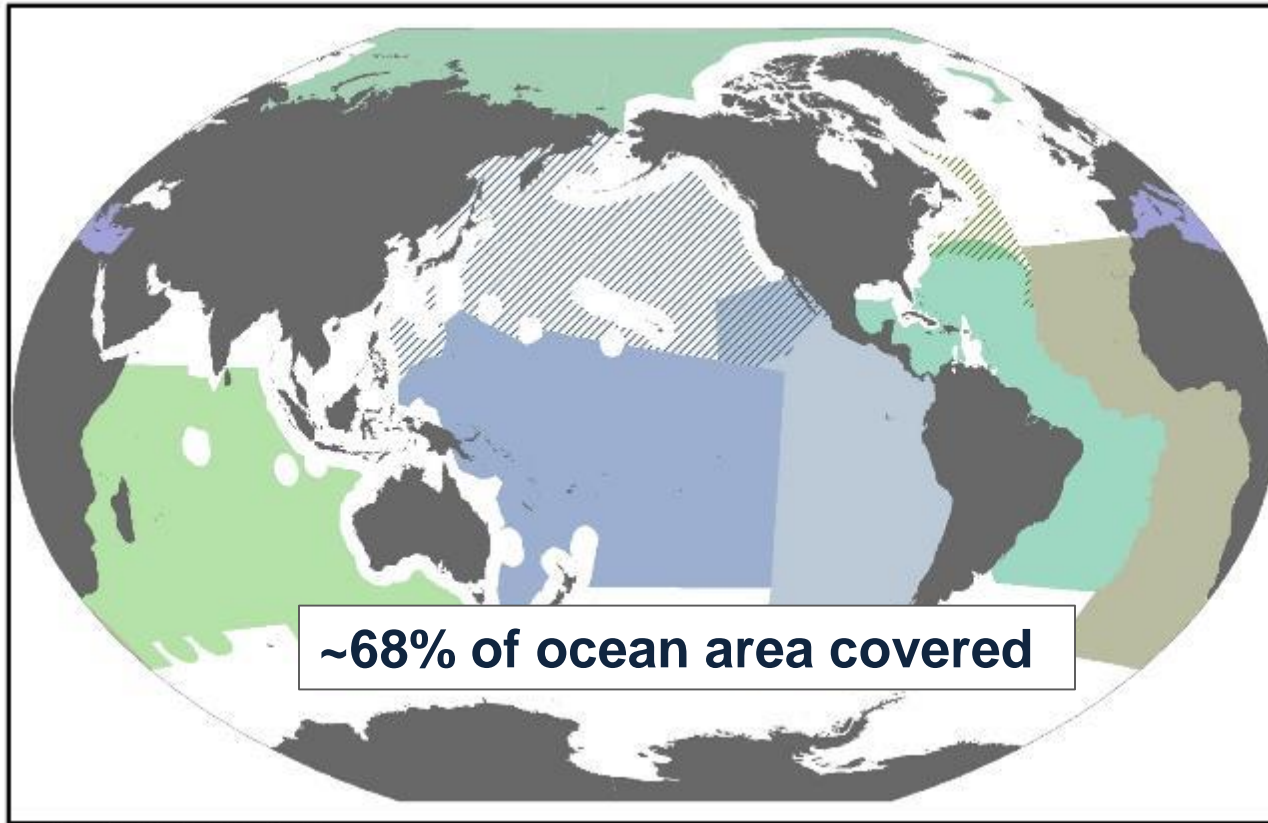
1. Uniqueness or rarity
2. Special importance for life history of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, slow recovery
5. Biological productivity
6. Biological diversity
7. Naturalness



2008 COP9 criteria established

# Regional EBSA Workshops

Synthesis of best available **scientific** and **technical information** to support expert scientific judgment on description of areas meeting the EBSA criteria



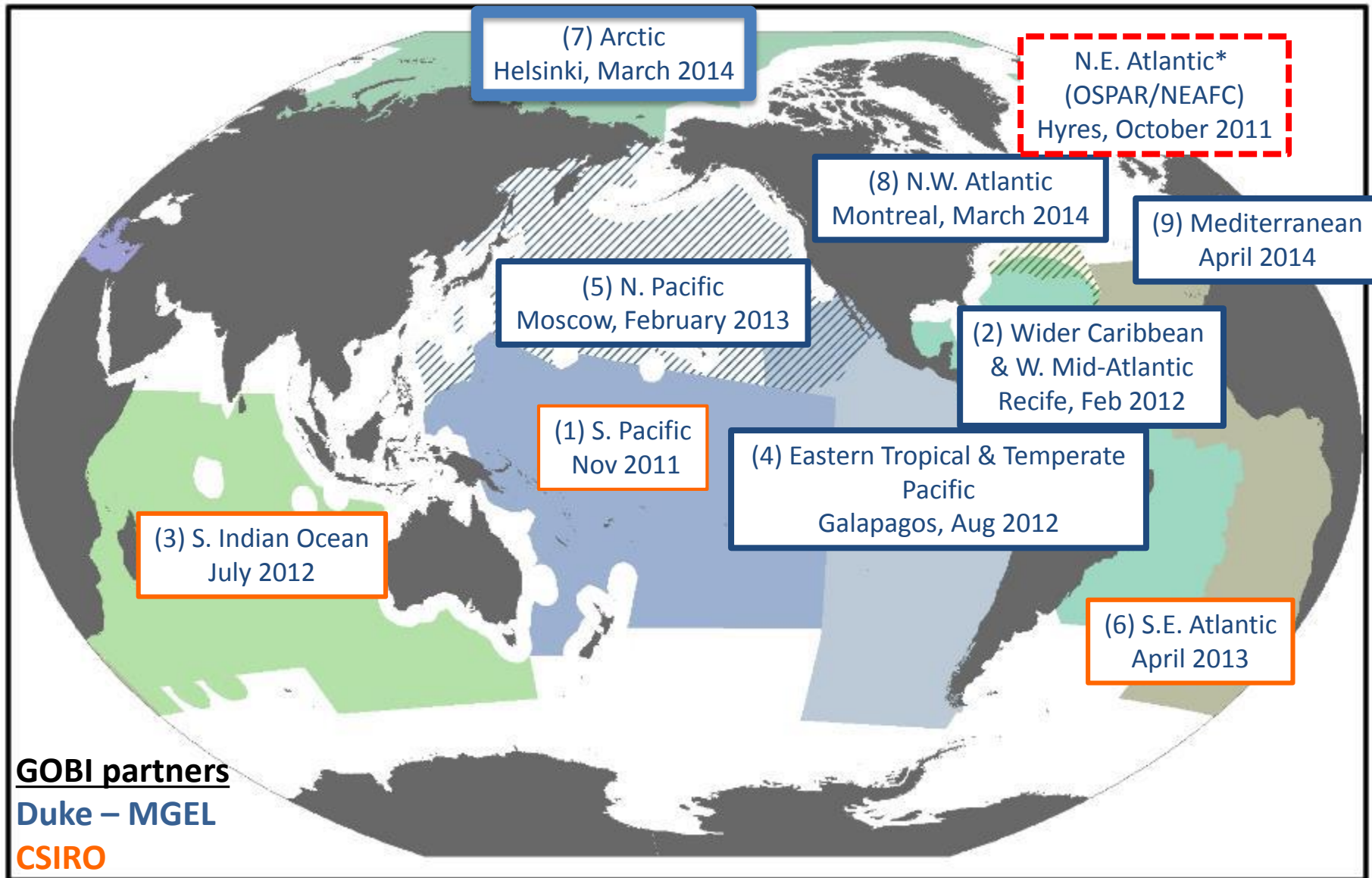
Marine Geospatial Ecology Lab, Duke University (2014)



9 CBD EBSA workshops: Nov 2011 - Apr 2014

A regional scientific expert process

# EBSA Workshops Areas 2011-2014

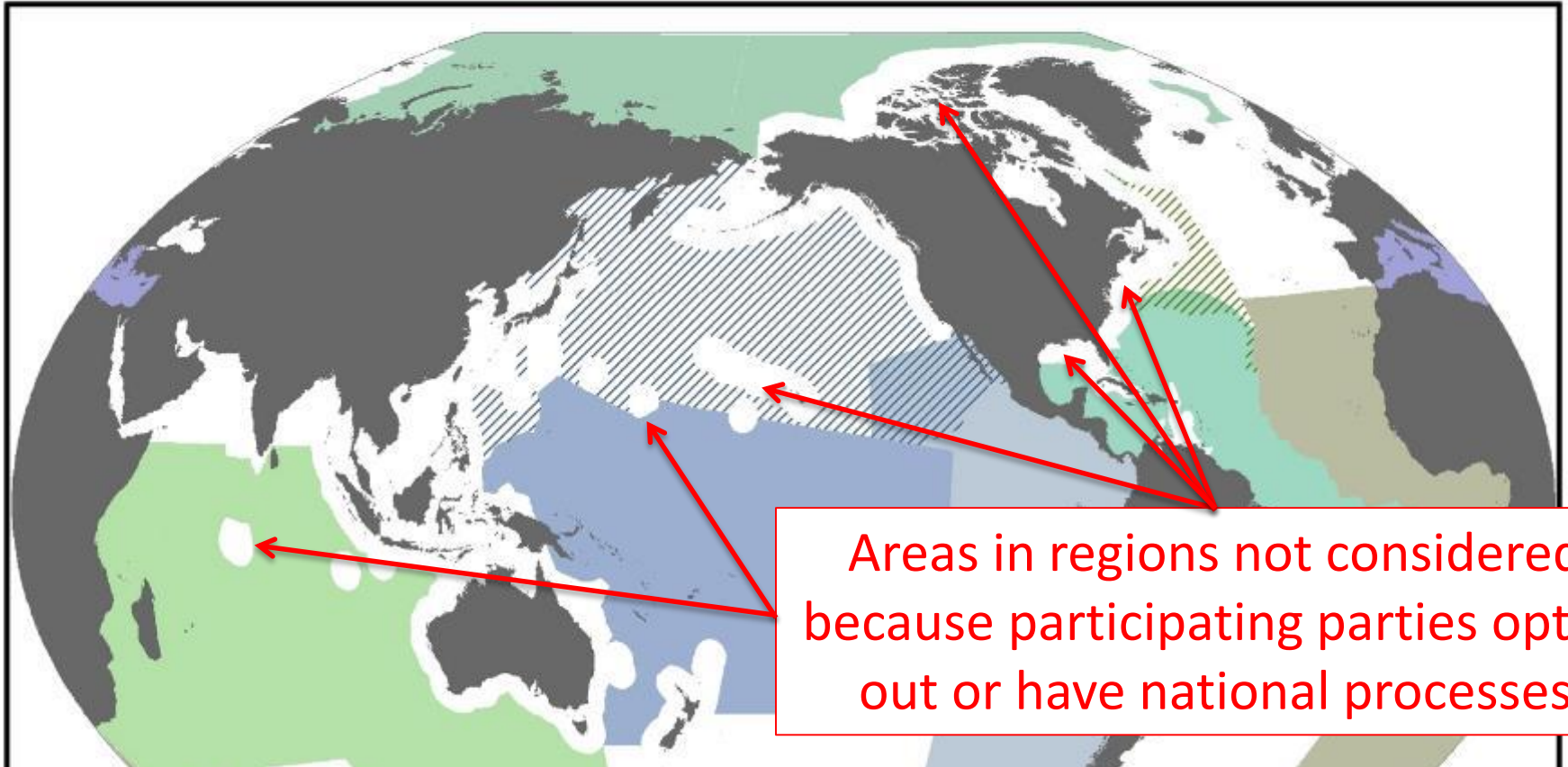


**GOBI partners**

**Duke – MGEL**

**CSIRO**

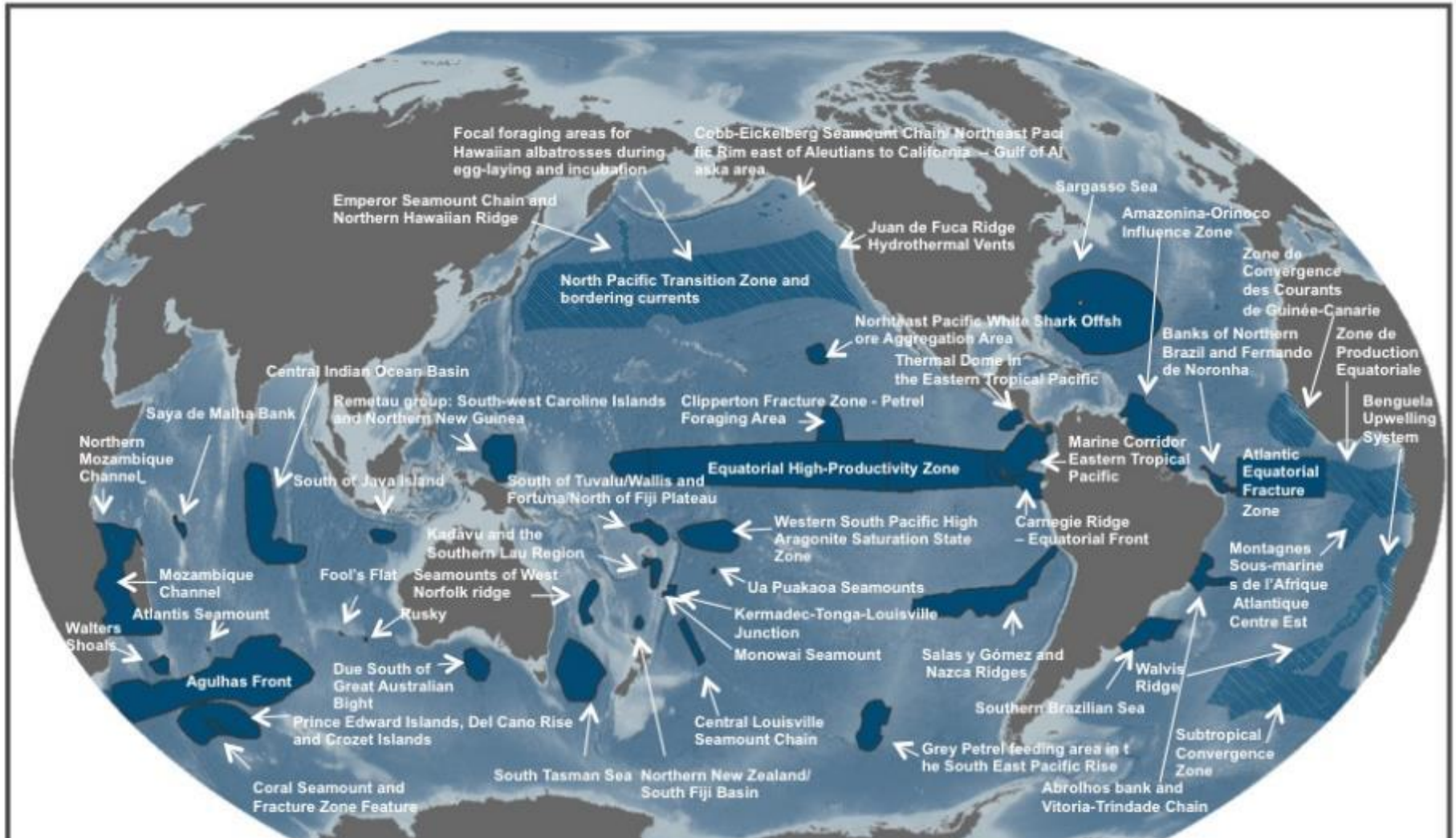
# ABNJ vs. EEZ



Areas in regions not considered because participating parties opted out or have national processes

**Issue:** interpretation of the global collection of EBSA sites must be interpreted in light of what areas were or were not considered in the process

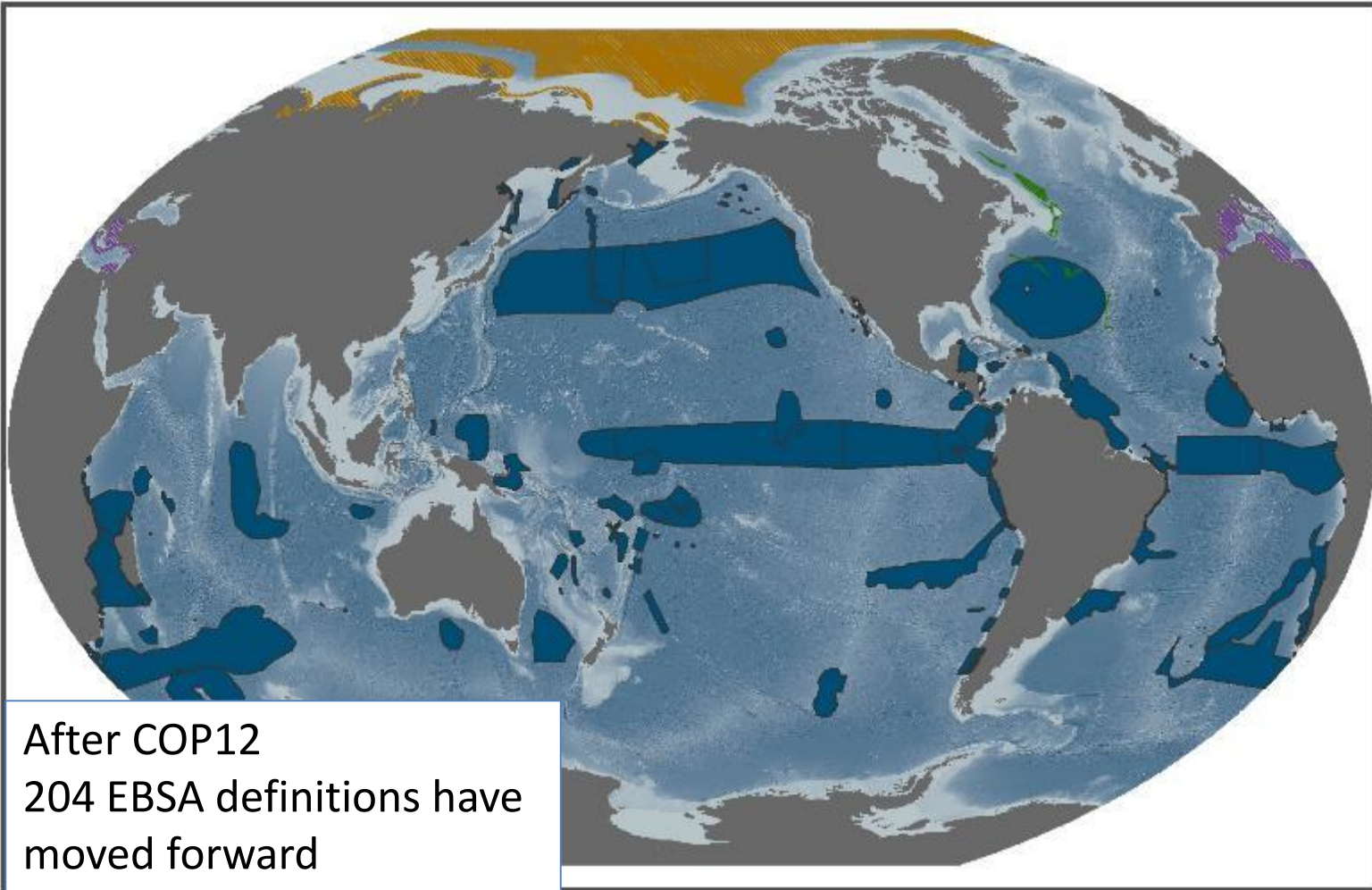
Areas meeting CBD Scientific Criteria for Ecologically or Biologically Significant Marine Areas (EBSAs, annex 1 to decision IX/20) : areas in ABNJ



Disclaimer: This is an information ONLY for the presentation. Some information on the map is yet to be finalized. This is NOT for QUOTATION or Distribution.

# Areas meeting CBD Scientific Criteria for Ecologically or Biologically Significant Marine Areas (EBSAs, annex 1 to decision IX/20) : areas in ABNJ

207 areas described as EBSAs



After COP12  
204 EBSA definitions have  
moved forward

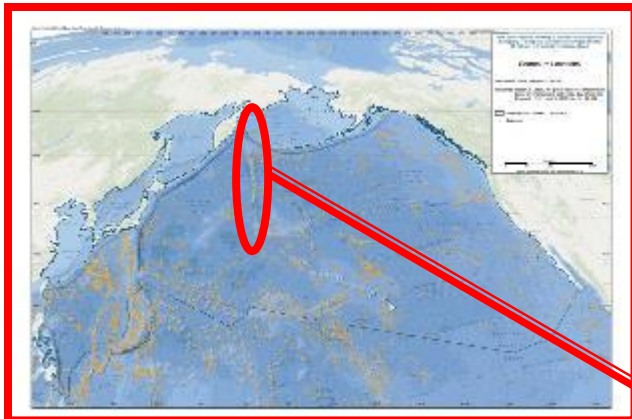
Manne Banspala | Ecology Lab, Duke University (2014)

Disclaimer: This is an information ONLY for the presentation at the SBSTTA 18 Plenary Event. Some information on the map is yet to be finalized. This is NOT for QUOTATION or Distribution.

# Fixed vs. dynamic features defining EBSAs

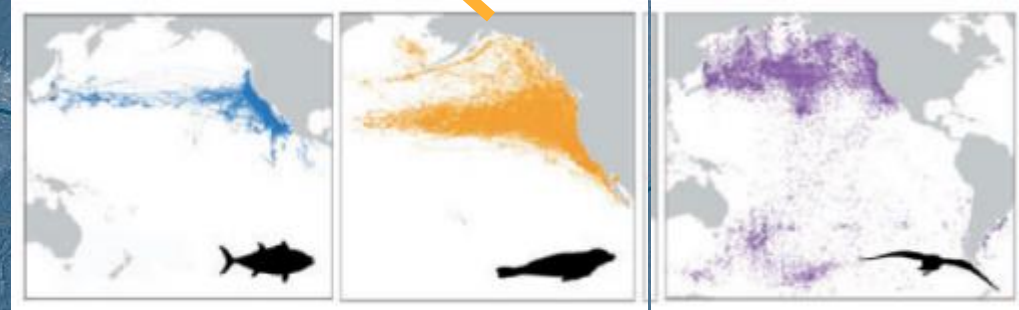
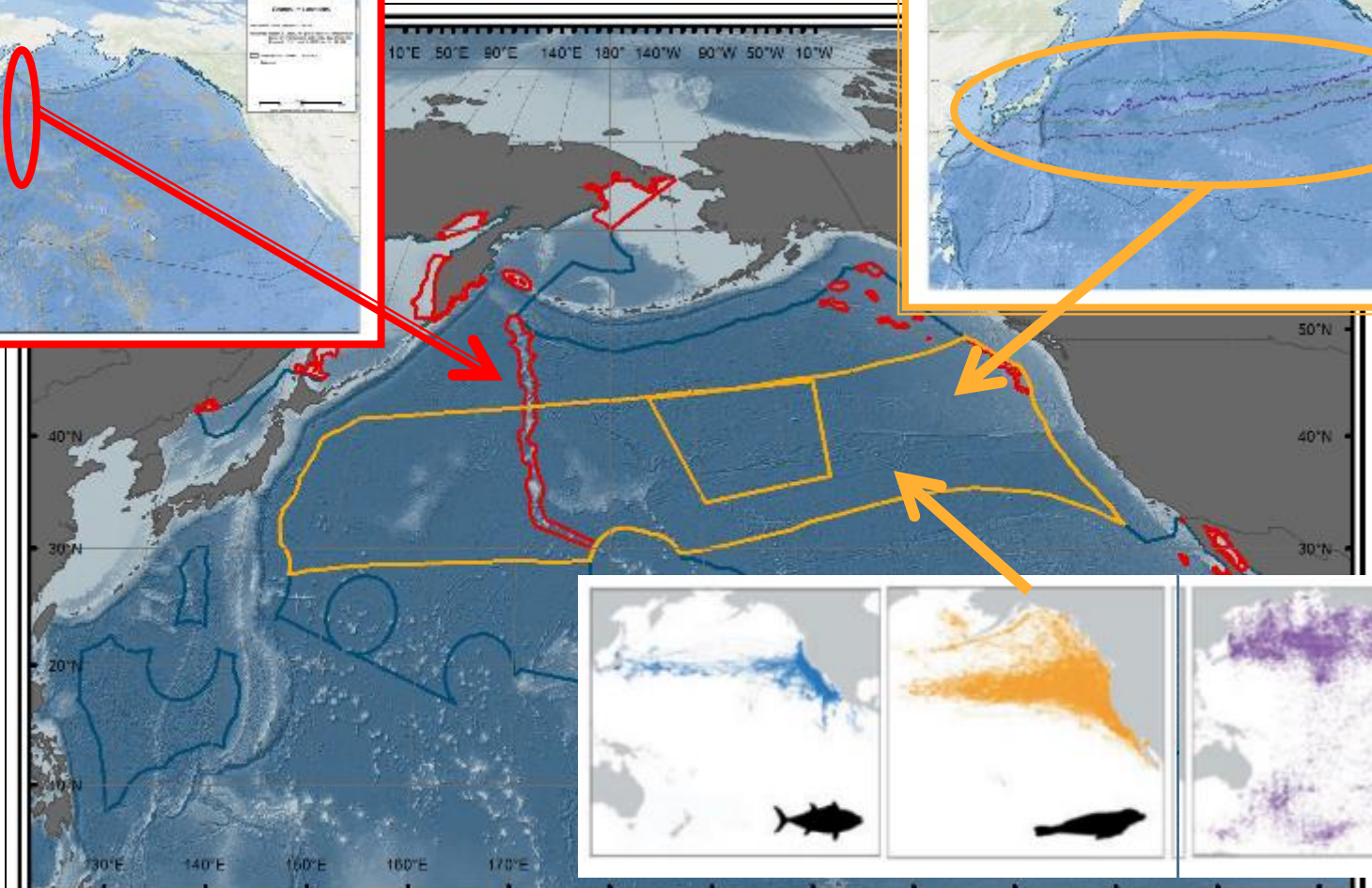
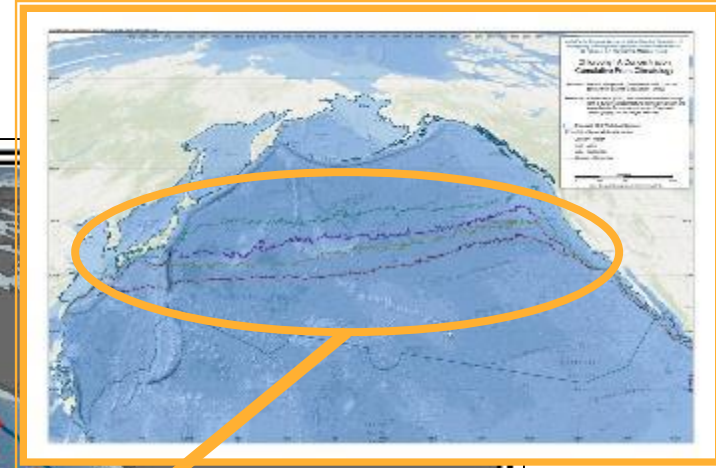
**Fixed:**

Emperor Seamount Chain

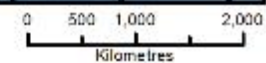


**Dynamic:**

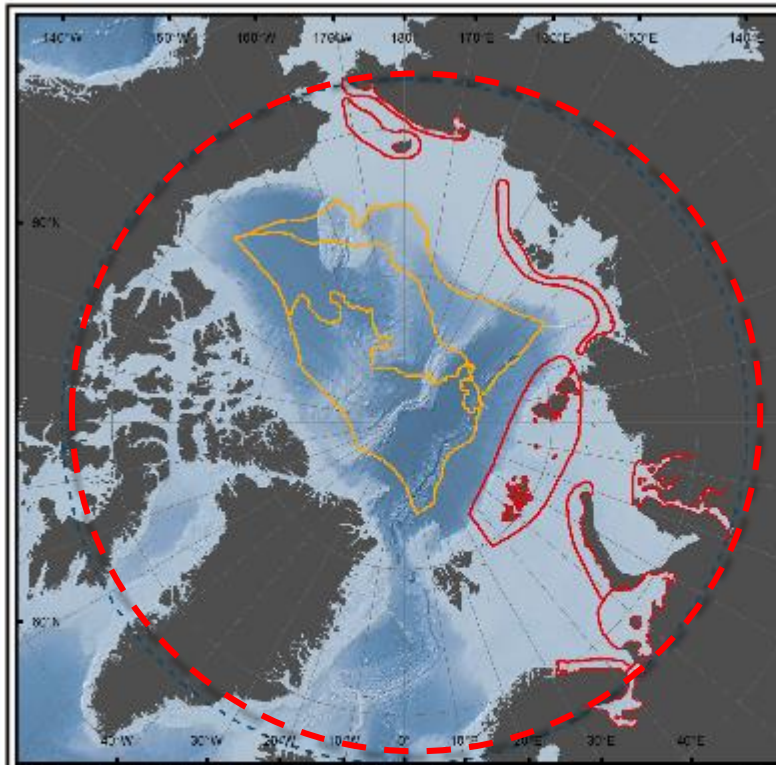
North Pacific Transition Zone



**Areas Described to Meet the EBSA Criteria**



# Arctic EBSA regional workshop: Helsinki 2014



## Areas Meeting EBSA Criteria

- Spatially Stable EBSA
- Spatially Dynamic EBSA

Arctic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs)  
3 March - 7 March 2014 in Helsinki, Finland

Marine Geospatial Ecology Lab



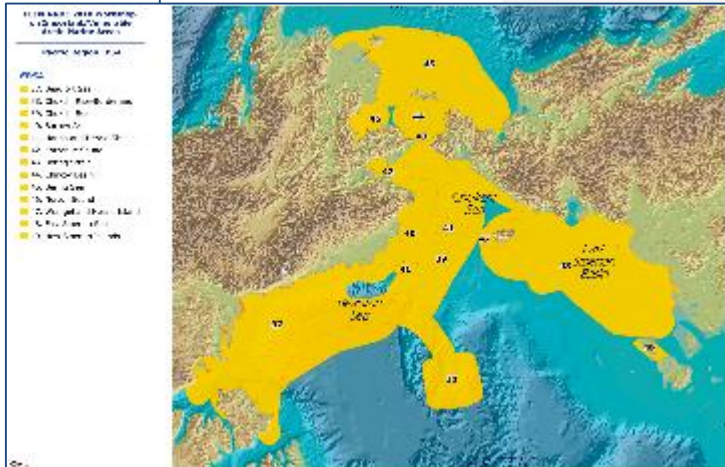
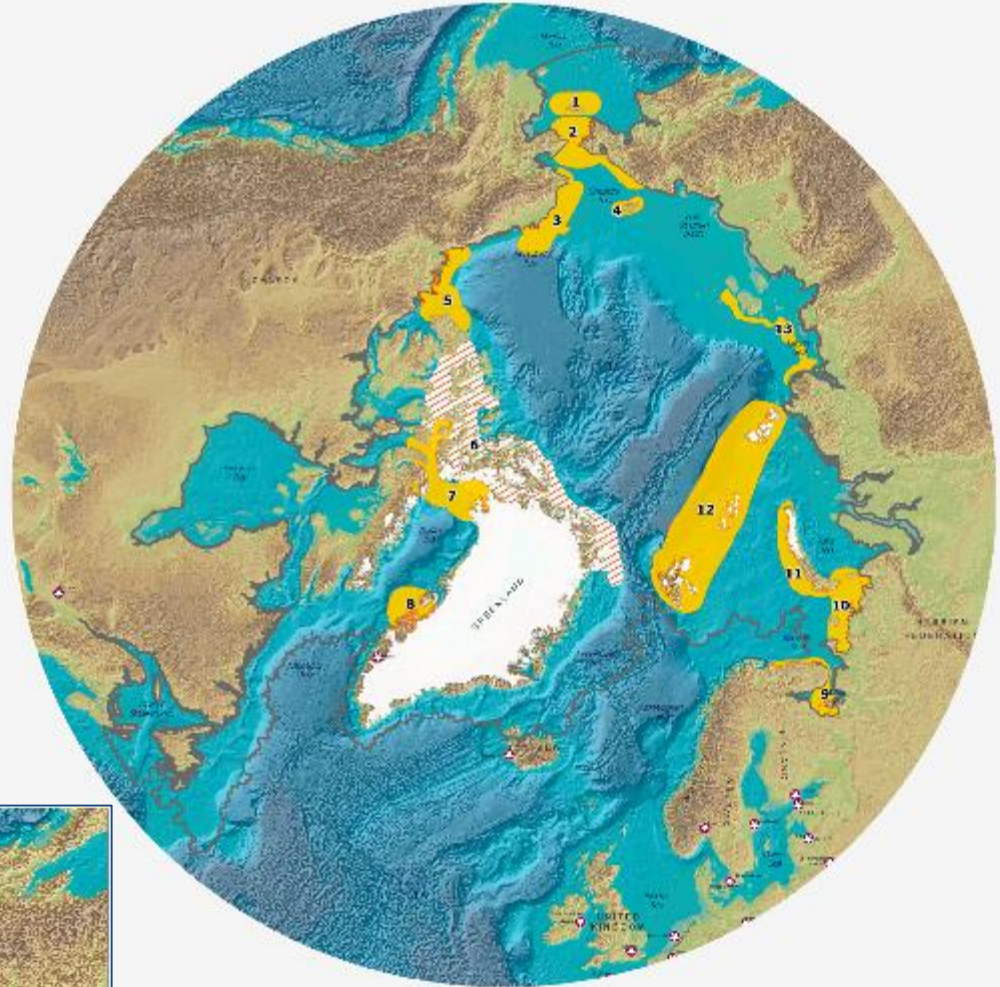
# Previous assessments: IUNC / NRDC 2010

IUCN-NRDC 2010 Workshop  
on Important/Vulnerable  
Arctic Marine Areas

## Super EBSA Overview

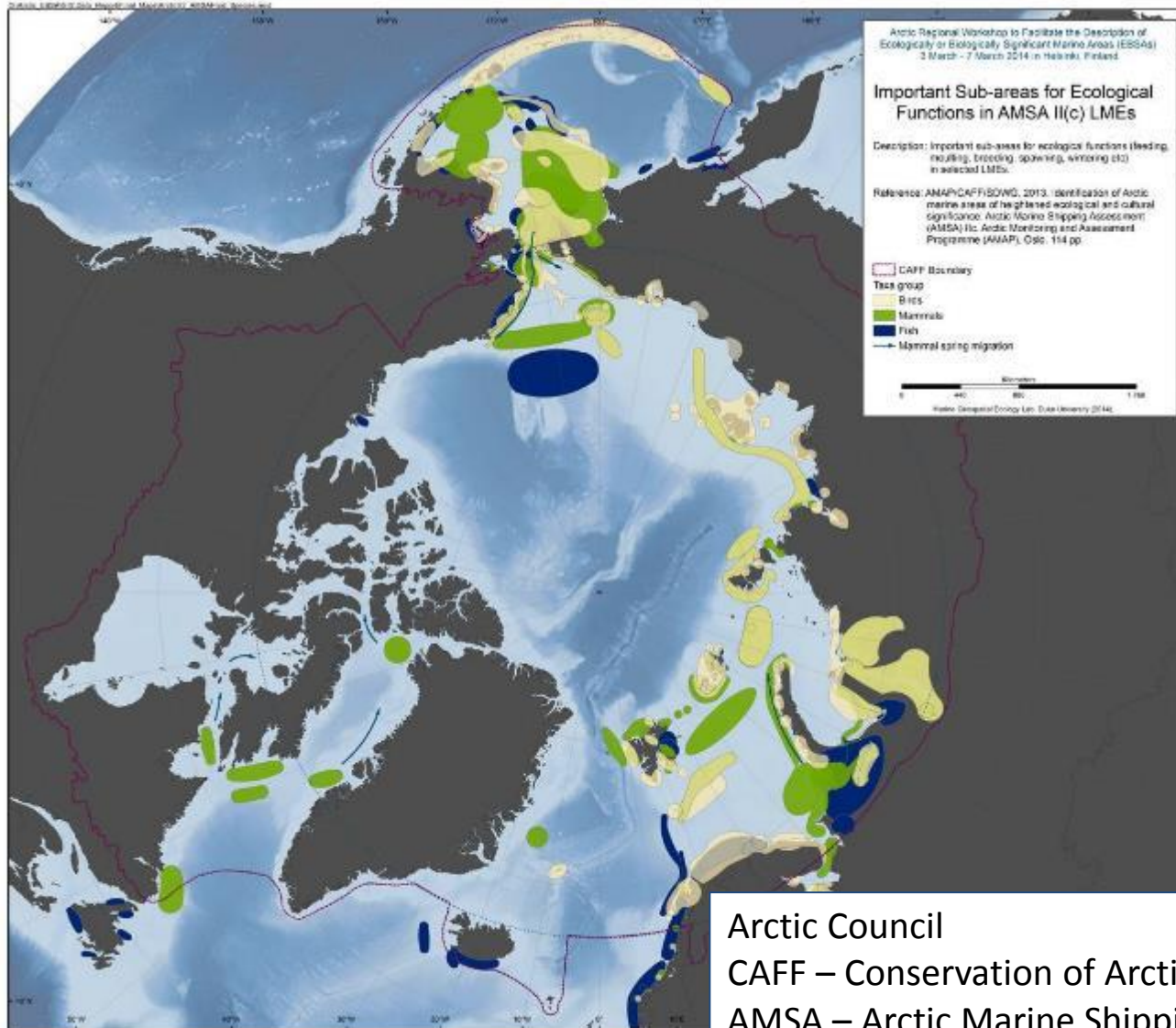
### Super EBSA

- 1. St. Lawrence Island
- 2. Bering Strait
- 3. Chukchi Beaufort Coast
- 4. Wrangel Island
- 5. Beaufort Sea Coast/Cape Bathurst
- 6. Polar Pack (Sept 2040 Projection)
- 7. North Water Polynya/Lancaster Sound
- 8. Disco Bay/Store Hellefiskebanke
- 9. White Sea/Barents Sea Coast
- 10. Pechora Sea/Kara Gate
- 11. Novaya Zemlya
- 12. High Arctic Islands and Shelf
- 13. Great Siberian Polynya



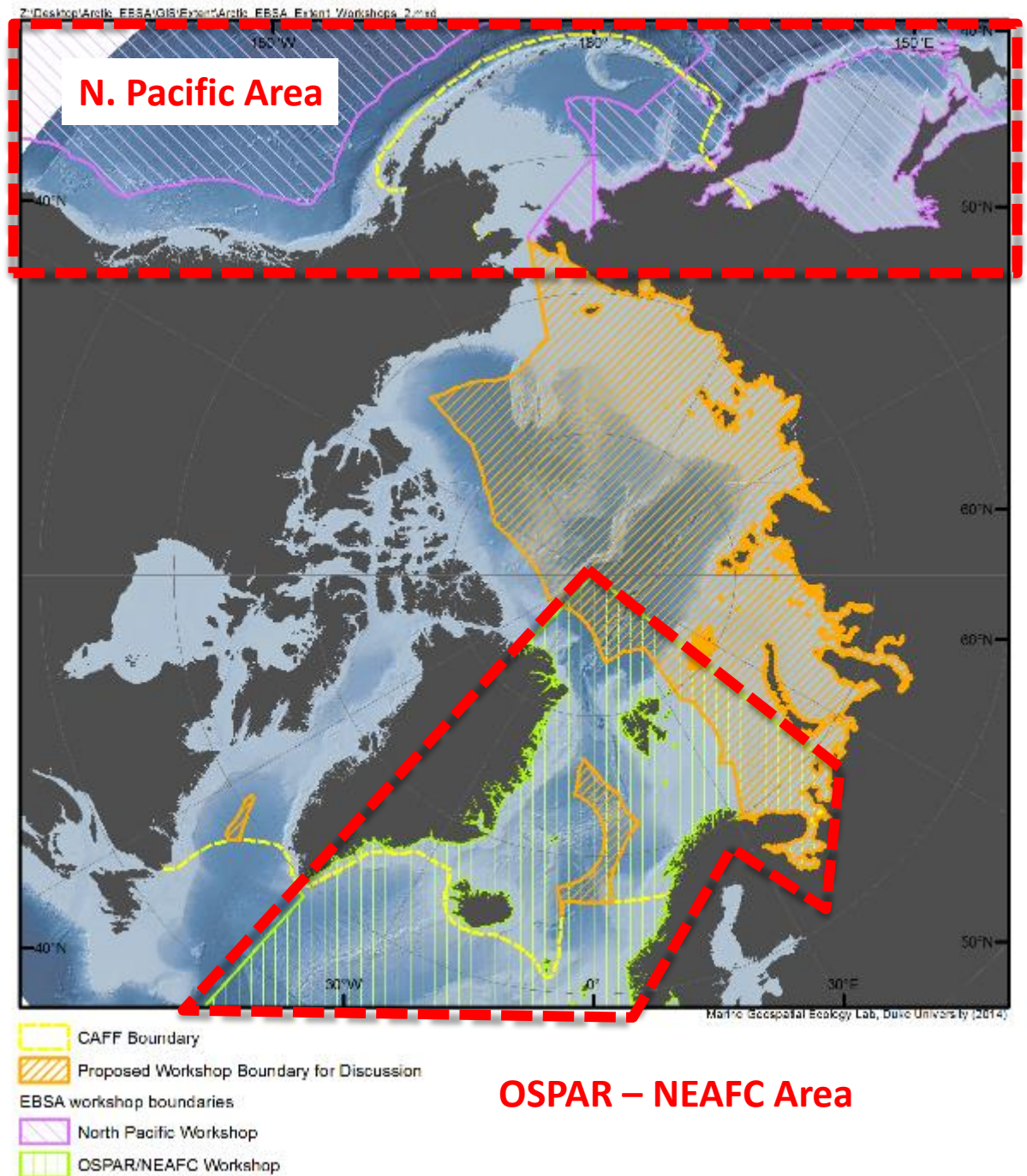
# Special importance for life history of species

## AMSA II(c) Sub-Areas for Ecological Function



(4) Complement the previous / future EBSA workshop boundaries:

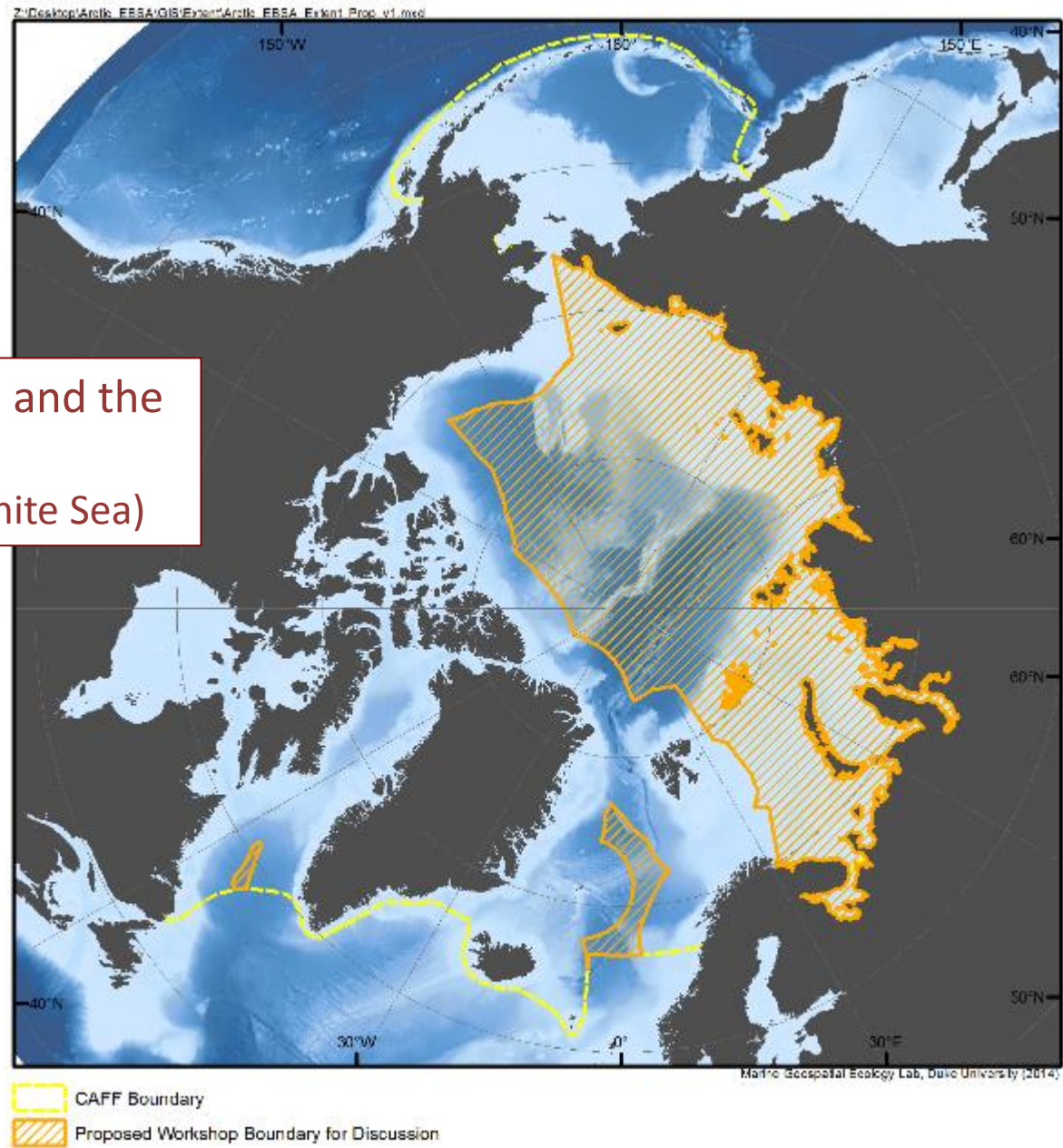
## Previous EBSA Processes



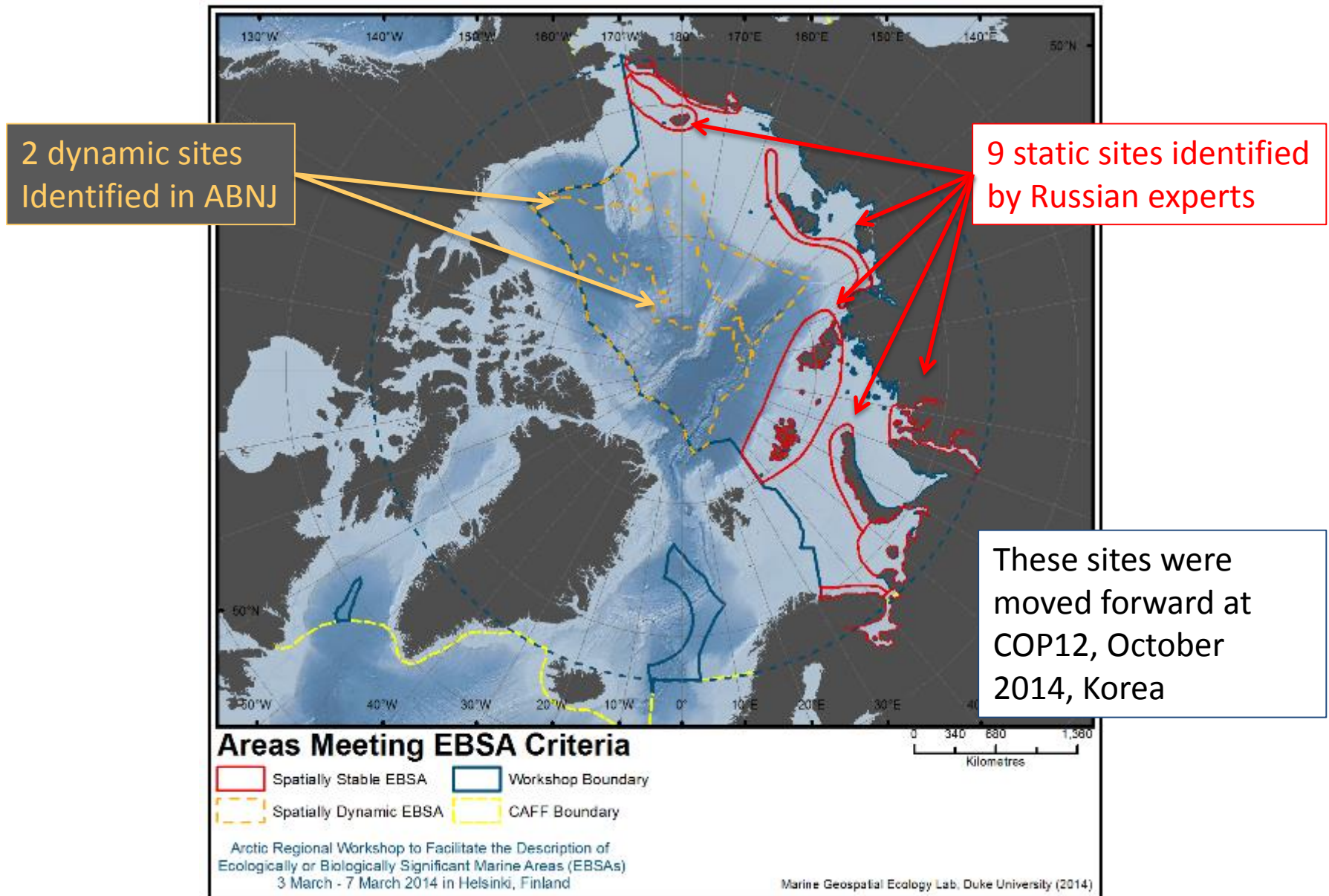
# Arctic Region

(3) Allow for sites to be described within ABNJ and EEZ areas as agreed by parties...

Arctic CAFF area including ABNJ and the Russian Federation EEZ (excluding N. Pacific & including White Sea)

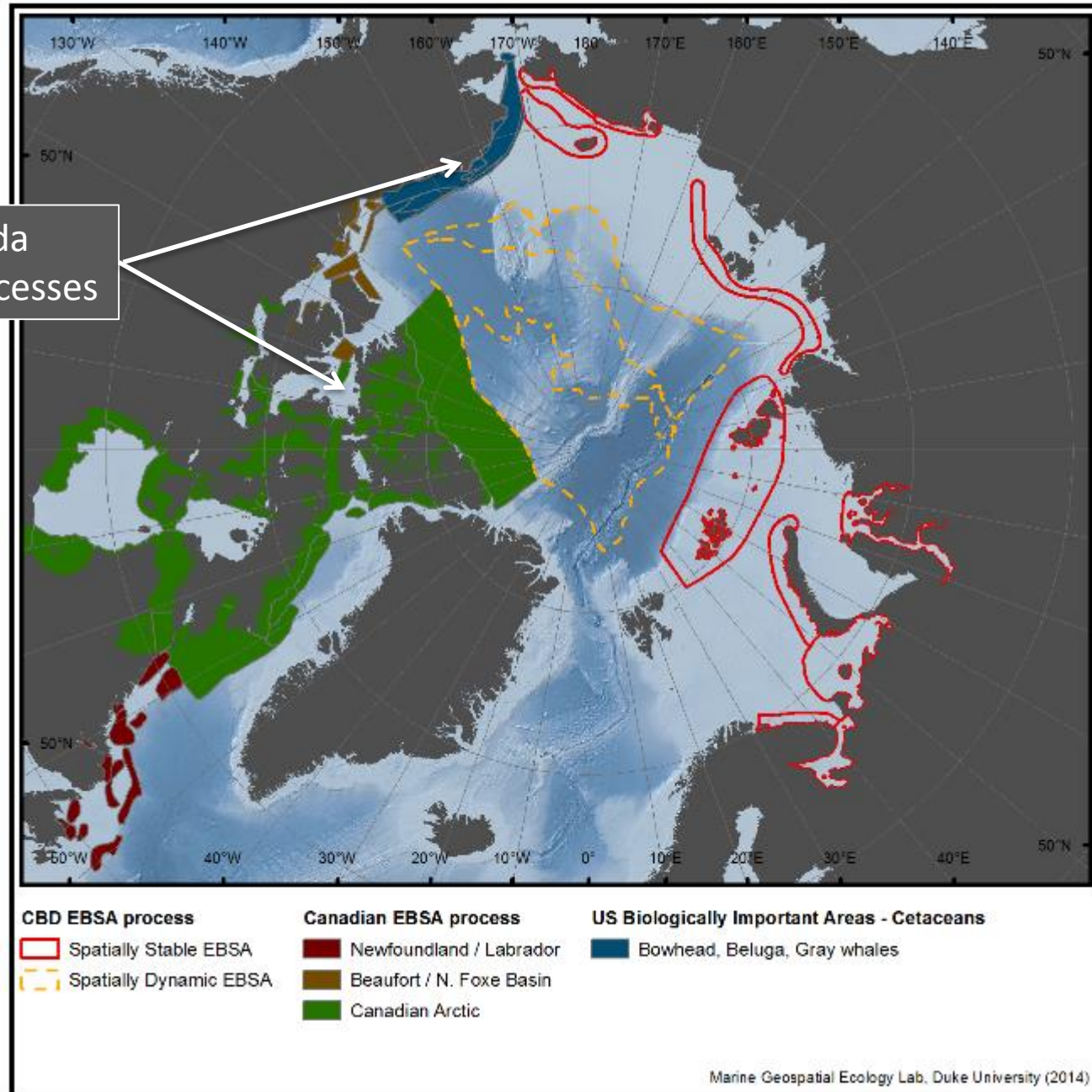


# Areas described to meet the EBSA criteria





# Ecologically or Biologically Important Areas


USA & Canada national processes



# Areas described to meet the EBSA criteria

  **CBD**

---

 **Convention on Biological Diversity**

Distr.  
GENERAL

UNEP/CBD/EBSA/WS/2014/1/5  
20 May 2014\*\*

ORIGINAL: ENGLISH

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**ARCTIC REGIONAL WORKSHOP TO FACILITATE THE DESCRIPTION OF ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS**  
Helsinki, 3 to 7 March 2014

**REPORT OF THE ARCTIC REGIONAL WORKSHOP TO FACILITATE THE DESCRIPTION OF ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS<sup>1</sup>**

**INTRODUCTION**

1. At its tenth meeting, the Conference of the Parties to the Convention on Biological Diversity requested the Executive Secretary to work with Parties and other Governments as well as competent organizations and regional initiatives, such as the Food and Agriculture Organization of the United Nations (FAO), regional seas conventions and action plans, and, where appropriate, regional fisheries management organizations (RFMOs) to organize, including the setting of terms of reference, a series of regional workshops, with a primary objective to facilitate the description of ecologically or biologically significant marine areas through the application of scientific criteria in annex I of decision IX/20 as well as other relevant compatible and complementary nationally and intergovernmentally agreed scientific criteria, as well as the scientific guidance on the identification of marine areas beyond national jurisdiction, which meet the scientific criteria in annex I to decision IX/20 (paragraph 36 of decision X/29).

2. In the same decision, the Conference of the Parties requested that the Executive Secretary make available the scientific and technical data, and information and results collated through the workshops referred to above to participating Parties, other Governments, intergovernmental agencies and the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) for their use according to their competencies.

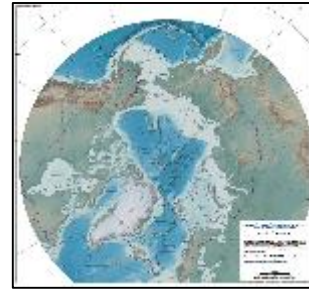
\*\* Reported on 19 June for technical reasons.

<sup>1</sup> The designations employed and the presentation of material in this note do not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

In order to minimize the environmental impacts of the Secretariat's processes, and to contribute to the Secretary-General's initiative for a C-Neutral UN, this document is printed in limited numbers. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.



# Topics

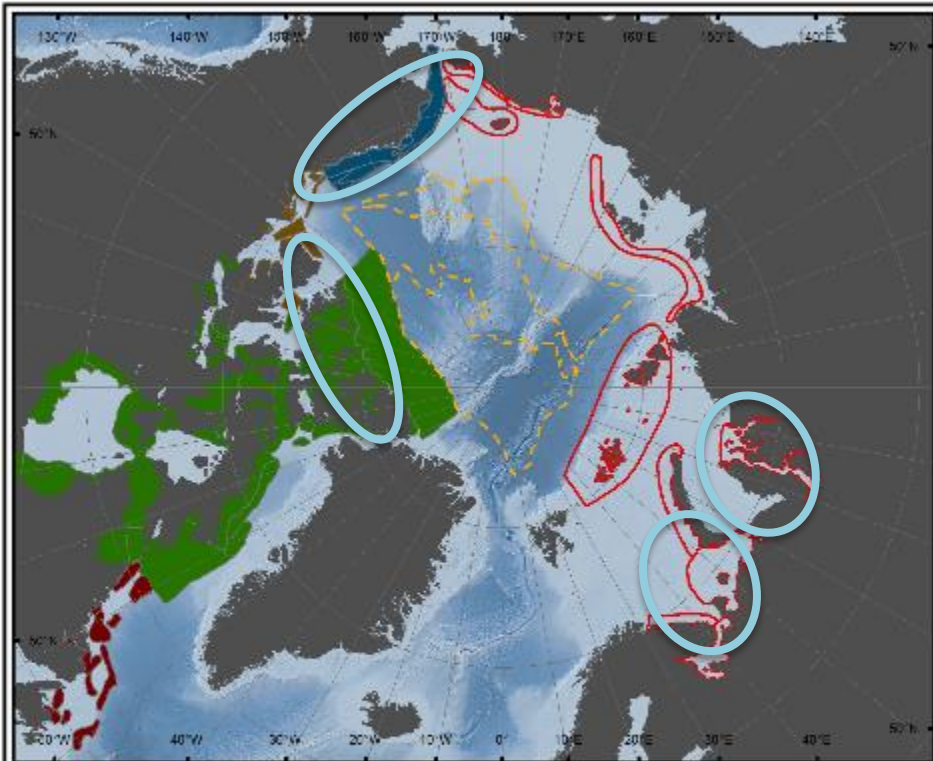


- Overview
- International marine biodiversity processes;
  - Areas described as meeting the UN CBD EBSA criteria;
- **Space-Time overlaps**
  - Oil & Gas exploration
  - Shipping
  - Fisheries
- **Example: Regional dynamic management**
  - BOEM / NOAA-NMFS monitoring
- **Issues and implications.**

# Areas of oil & gas potential vs. ecological importance

Ecologically or Biologically Important Areas

Oil & Gas Potential

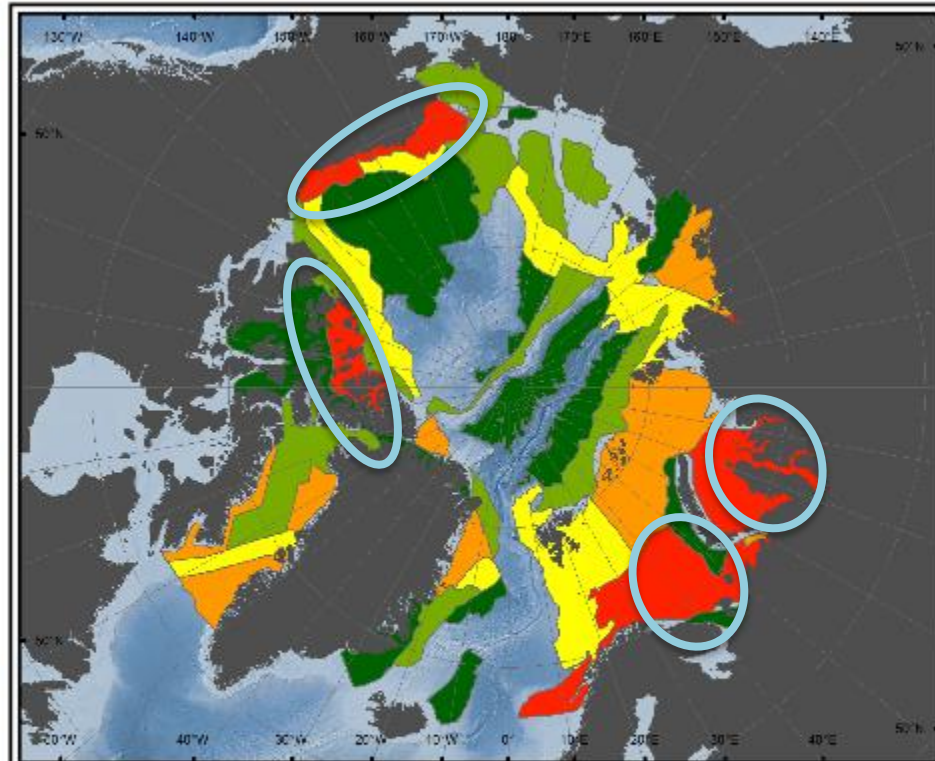


**CBD EBSA process**  
 Spatially Stable EBSA  
 Spatially Dynamic EBSA

**Canadian EBSA process**  
 Newfoundland / Labrador  
 Beaufort / N. Foxe Basin  
 Canadian Arctic

**US Biologically Important Areas - Cetaceans**  
 Bowhead, Beluga, Gray whales

Marine Geospatial Ecology Lab, Duke University (2014)



**Oil and Gas Potential**  
 ~10%  
 10% - 30%  
 30% - 50%  
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 100%

Marine Geospatial Ecology Lab, Duke University (2014)

*USGS 2008/2011. Circum-Arctic Resource Appraisal: Estimates of undiscovered oil and gas north of the Arctic Circle.*

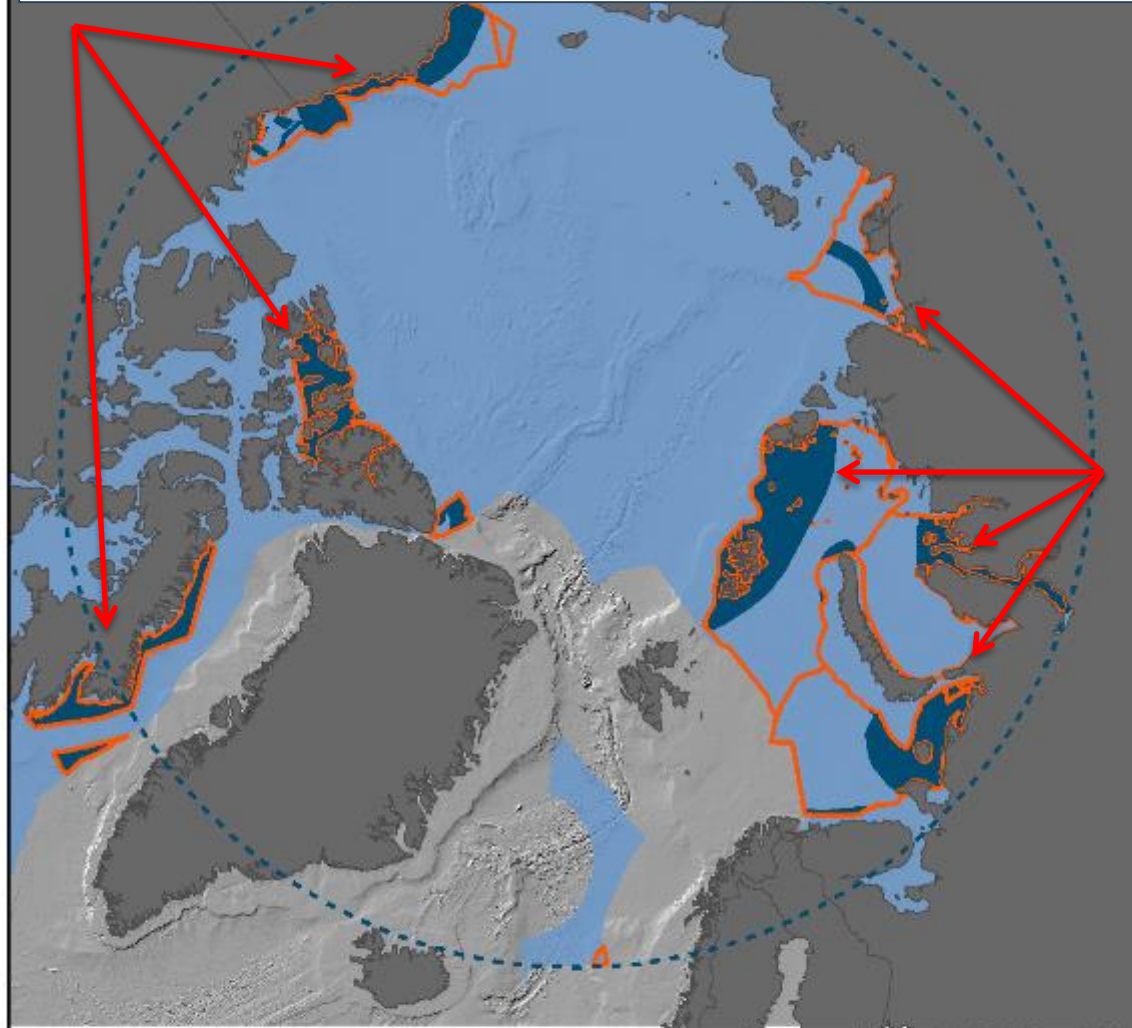
*"Assessment units (AUs) in the Circum-Arctic Resource Appraisal (CARA) color-coded by assessed probability of the presence of at least one undiscovered oil and/or gas field with recoverable resources greater than 50 million barrels of oil equivalent (MMBOE).*

# Areas of oil & gas potential vs. ecological importance




All of the high value oil & gas exploration regions contained EBSAs

\* Percent EBSA/BIA coverage of 100% O/G potential areas: 44.1%

\* Percent EBSA/BIA coverage of 50-100% O/G potential areas: 46.5%

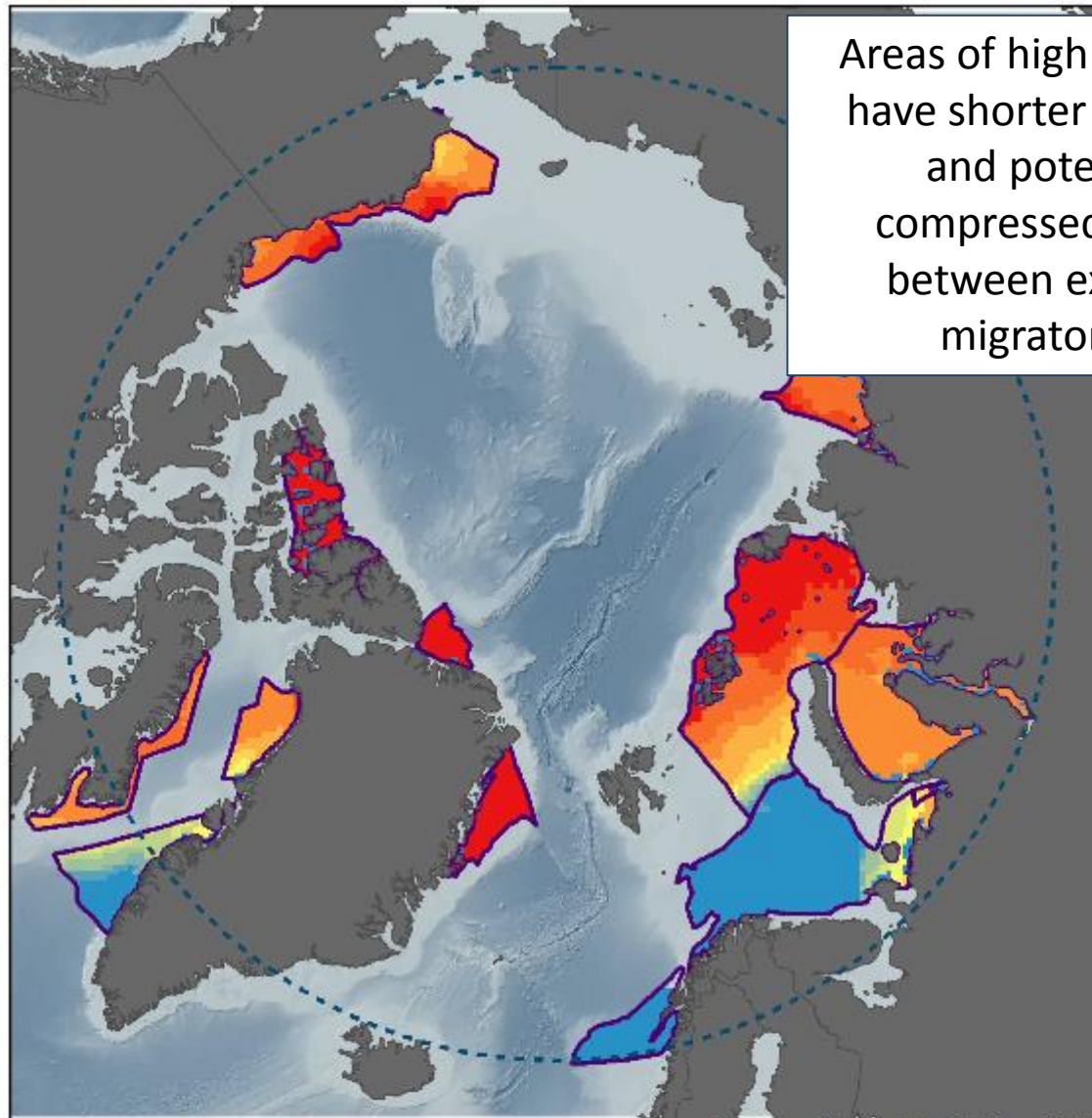


## Ecologically Important Areas and Oil and Gas Potential

-  >50% Oil or Gas Potential (within EBSA/BIA evaluation areas)
-  EBSA/BIA in High Oil or Gas Potential Areas
-  EBSA/BIA evaluation area


Ice months  
vs. oil & gas  
potential

Areas of high ice coverage will  
have shorter ice-free seasons  
and potentially more  
compressed time overlaps  
between exploration and  
migratory species...



Marine Geospatial Ecology Lab, Duke University (2014)

### Ice Coverage and Oil and Gas Potential

 >50% Oil or Gas Potential

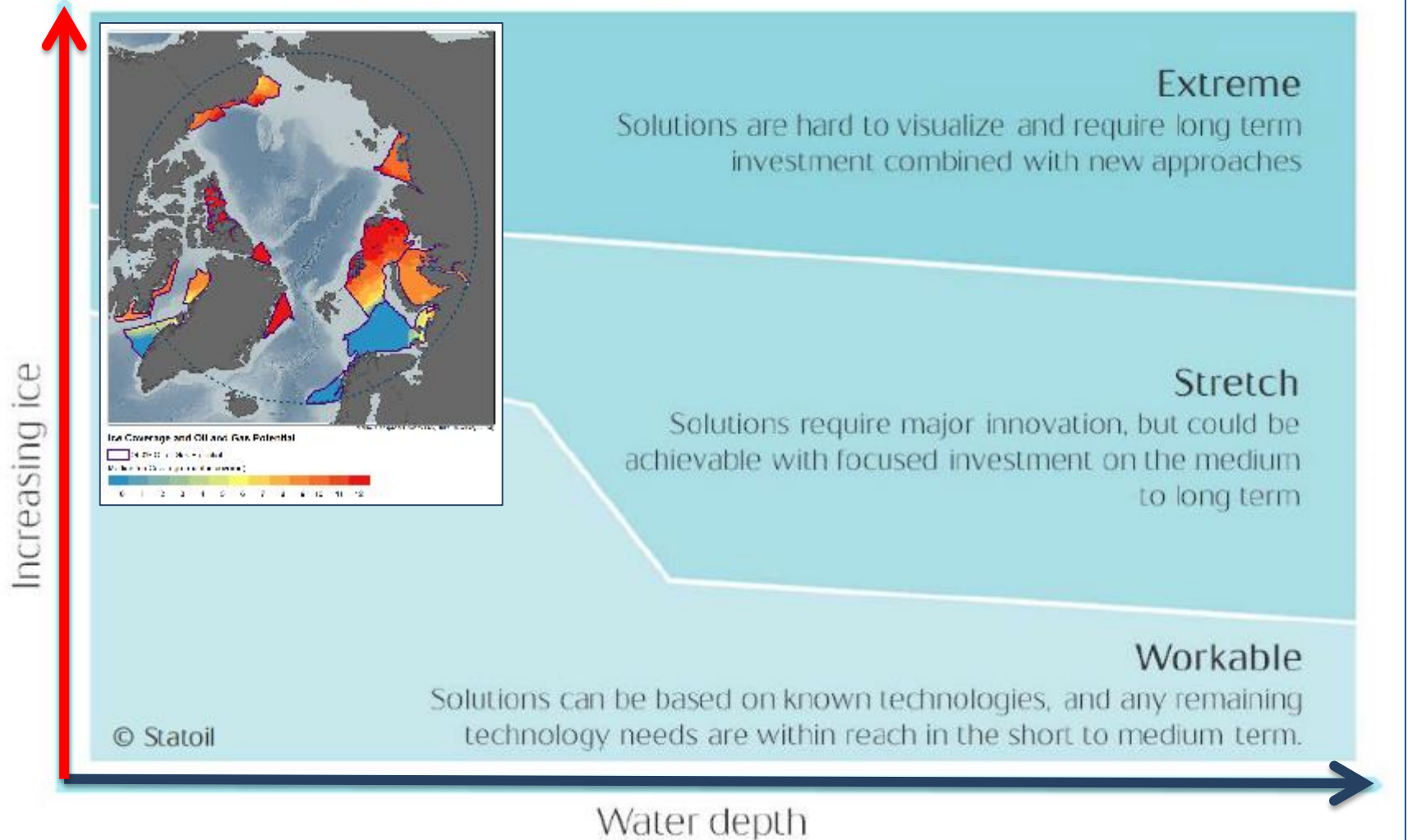
Median Ice Coverage (months covered)



0 1 2 3 4 5 6 7 8 9 10 11 12

# Exploration vs. ice & depth: industry risk perspective

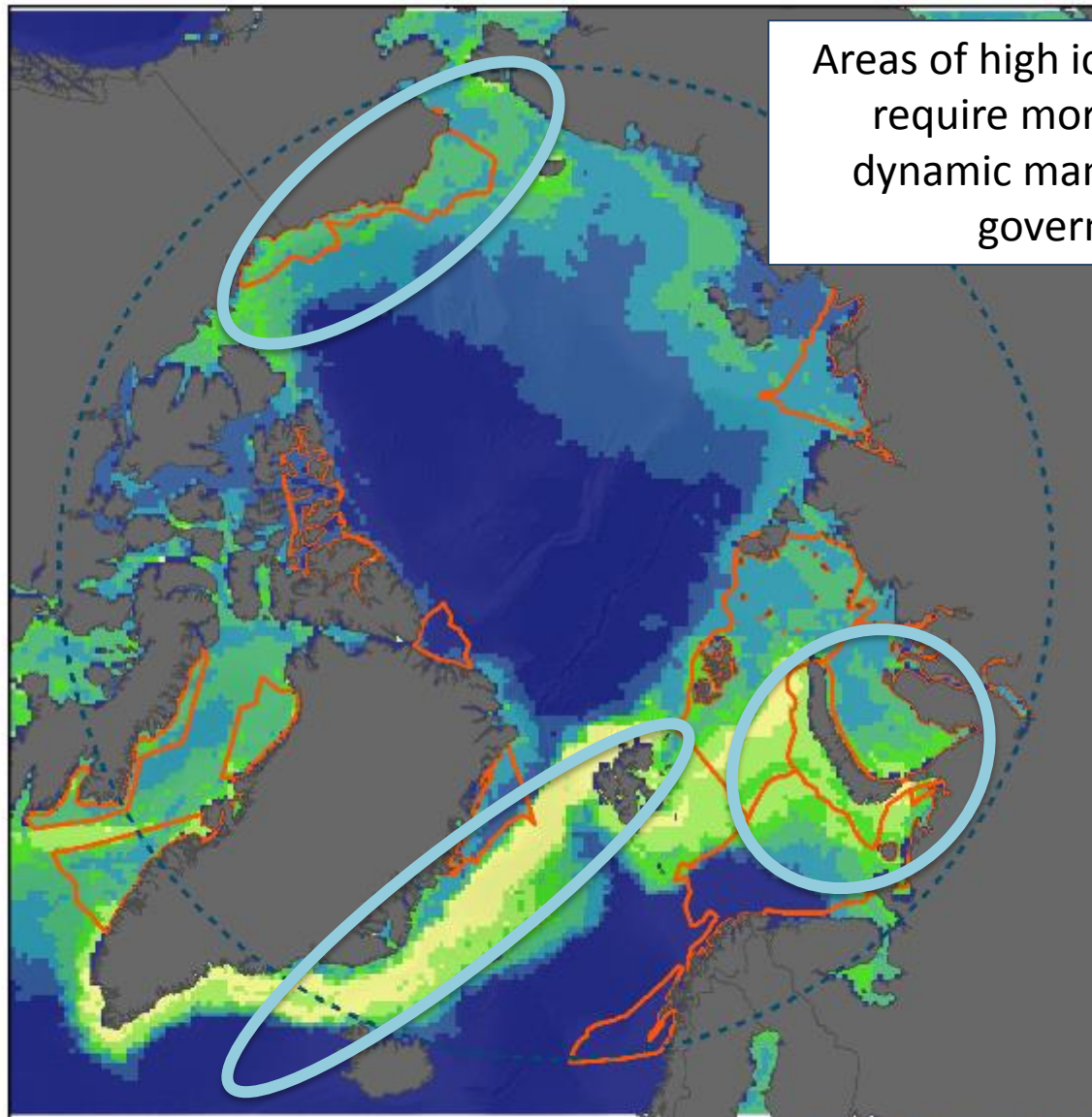
## There is not just one Arctic



Erik Haaland - Statoil: Sustainable Petroleum Activities in the Arctic Statoil's Approach to the Arctic: Knowledge and Challenges, Bergen June 2014


Ice variability  
vs. oil & gas  
potential

Areas of high ice variability will  
require more temporally  
dynamic management and  
governance...

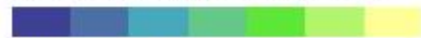


Marine Geospatial Ecology Lab, Duke University (2014)

**Ice Coverage Variability and Oil and Gas Potential**

 >50% Oil or Gas Potential

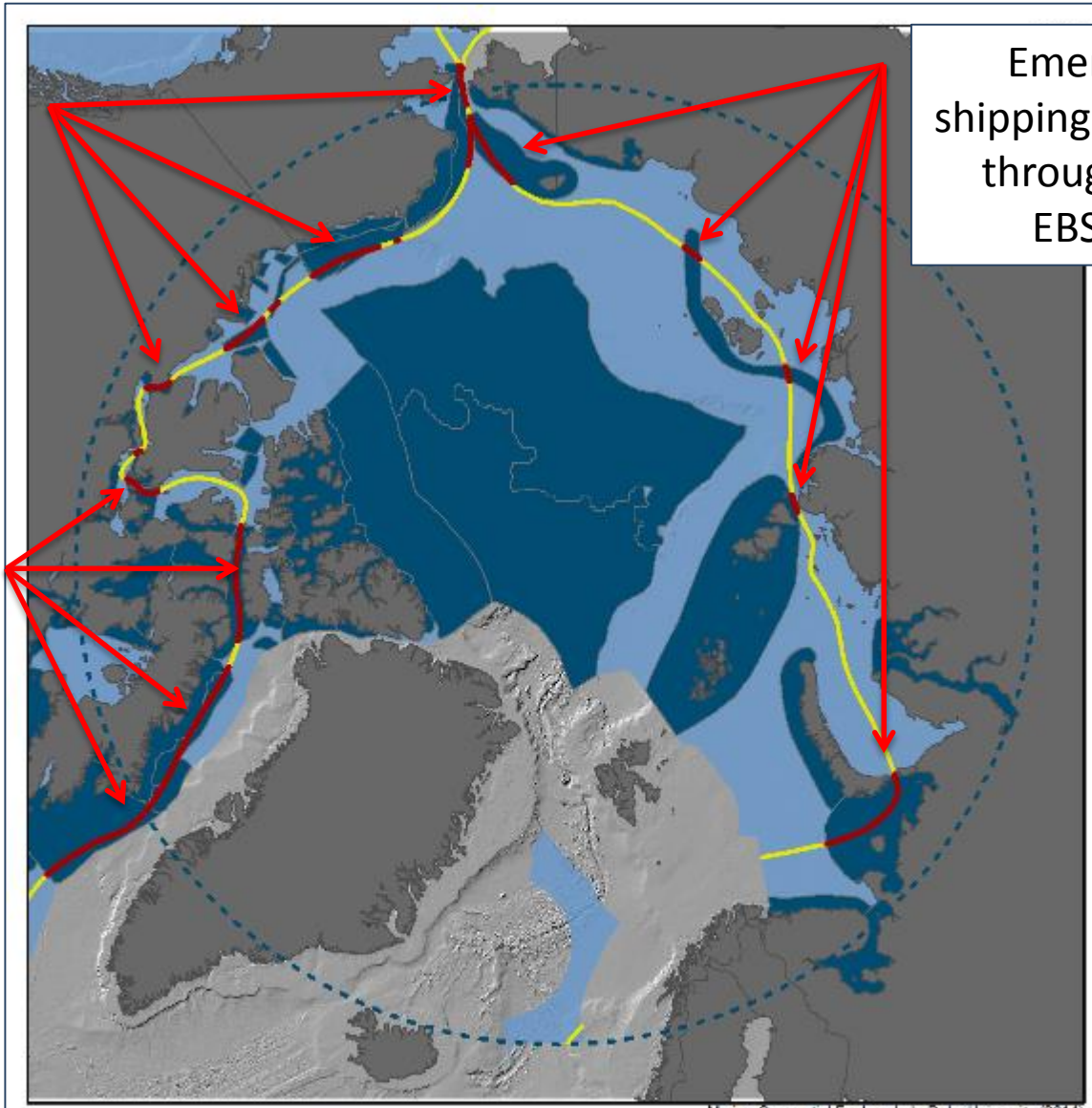
Ice Coverage - SD (months covered)



0.6 1.7 2.6 3.3 3.9 4.7 5.7

EBSAs vs. oil  
& Arctic  
shipping  
routes

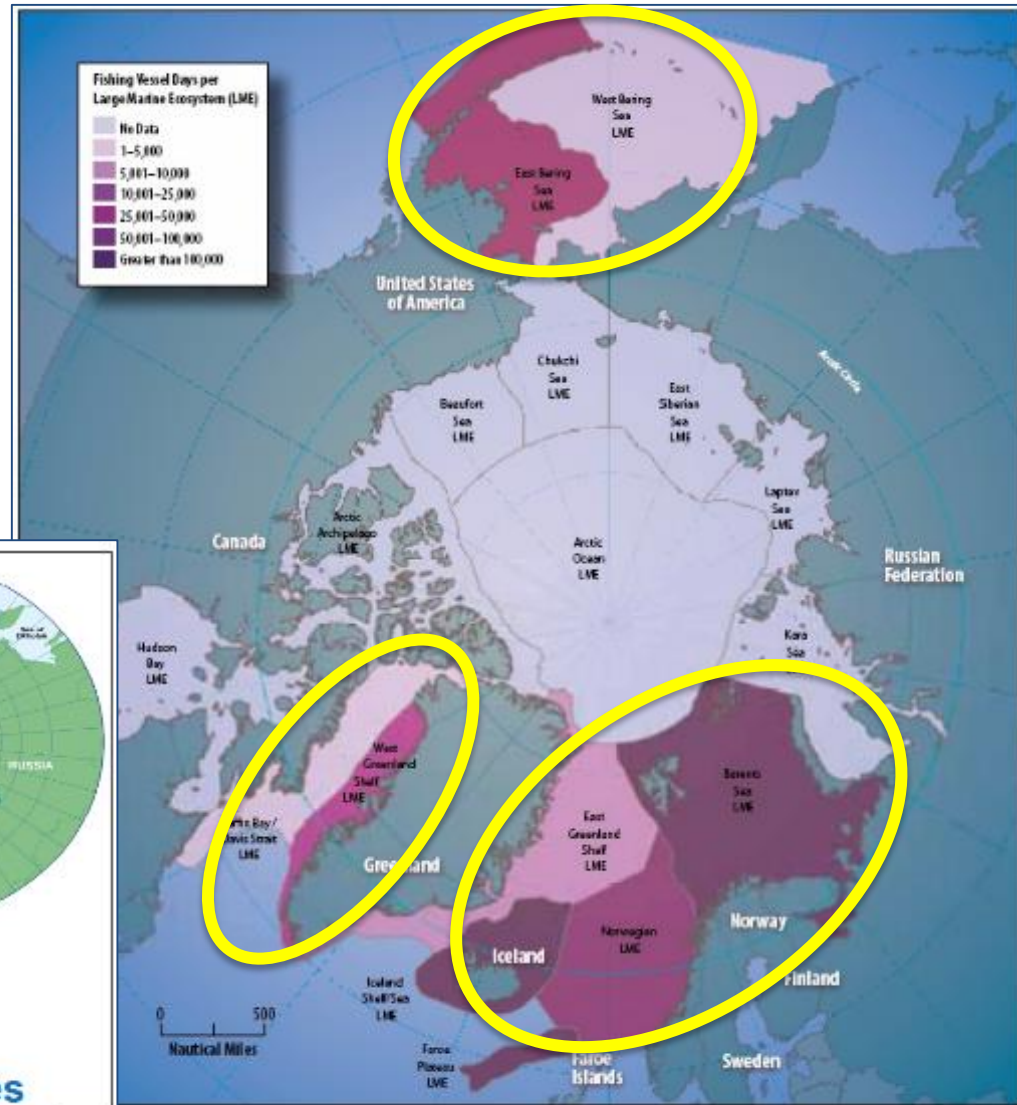
Emerging arctic  
shipping lanes will pass  
through identified  
EBSA areas...



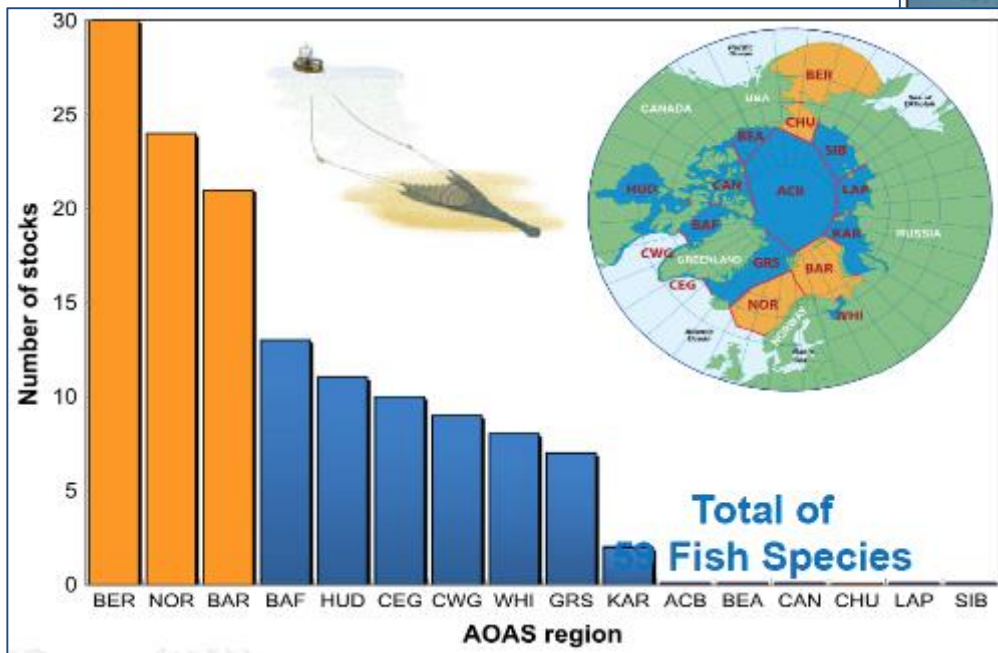
**Ecologically Important Areas and Shipping Lanes**

- NEP/NWP crossing EBSA/BIA
- NEP/NWP shipping lane in EBSA/BIA evaluation area
- EBSA/BIA
- EBSA/BIA evaluation area

# Fishing activity by Large Marine Ecoregions (LME) & AOAS regions



Fishing vessel activity. Source: AMSA



# Potential deepsea fishing areas

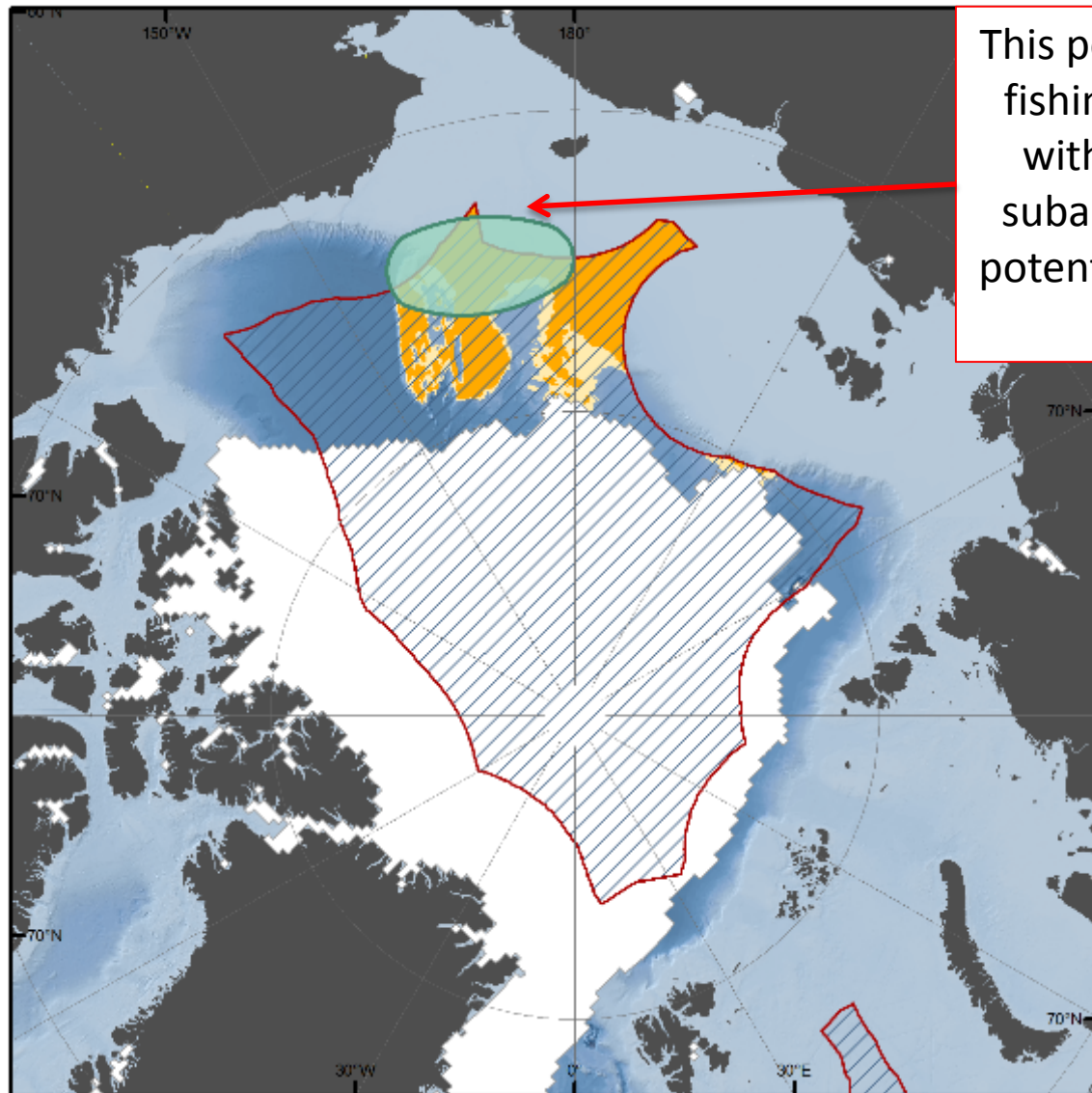
Due to reduced annual  
sea ice coverage, new  
deep sea fishing areas  
are opening in the  
arctic...



Marine Decapod Ecology Lab, Duke University (2014)

-  Area Beyond National Jurisdiction
-  Ice Extent, September 2012
-  1500 - 2000m deep
-  < 1500m deep

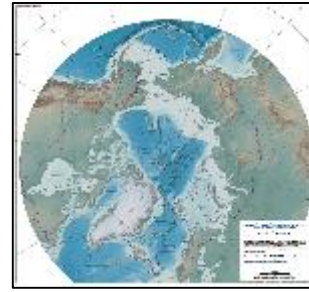
Potential  
deepsea  
fishing areas  
in ABNJ



This potential deep sea  
fishing area overlaps  
with an AMSA-II(c)  
subarea identified as  
potential cod spawning  
habitat ...

- Area Beyond National Jurisdiction
- Ice Extent, September 2012
- 1500 - 2000m deep
- < 1500m deep
- AMSA II(c) - subarea F3, potential Arctic Cod spawning

# Topics



- Overview
- International marine biodiversity processes;
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- Space-Time overlaps
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  - Fisheries
- **Example: Regional dynamic management**
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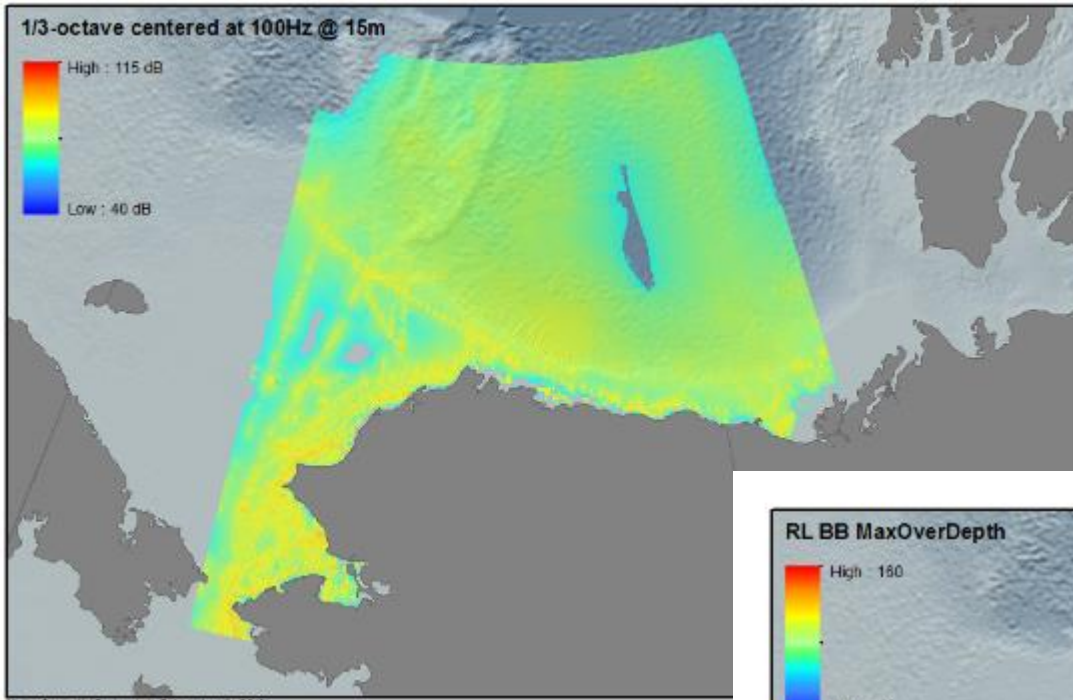
# Dynamic Ocean Management

In order to separate potential adverse effects of exploration activities from migratory species in space & time we will need to focus on ***dynamic ocean management*** strategies.

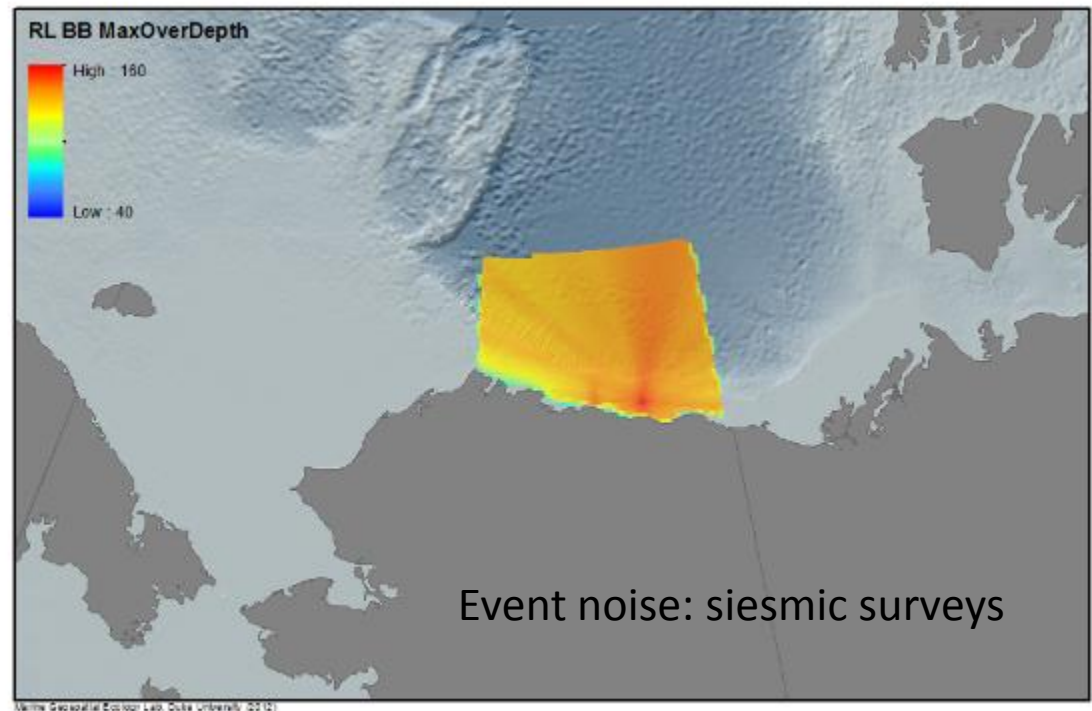
- Acoustic disruptions
- Potential oil spill impacts



# NOAA: CetSound / CetMap



Chronic noise (shipping)



Event noise: seismic surveys

# Conceptual Model of Arctic Oil Spill Exposure and Injuries

## Wetlands, low coastal tundra, lagoons:

Provide refuge, nesting, and spawning areas. Highly productive.

### OIL IMPACT

Oiled, degraded or eroding habitat reduces productivity.

## Pelagic Zone

Productive area for food web.

### OIL IMPACT

Surface and dispersed oil affects food web. Fish eggs and larvae are especially sensitive.

## Benthos

Can be highly productive, important in cycling nutrients.

### OIL IMPACT

Oil in sediments reduces productivity and affects food web.

## Top Predators

Marine mammal and bird populations are of global significance.

### OIL IMPACT

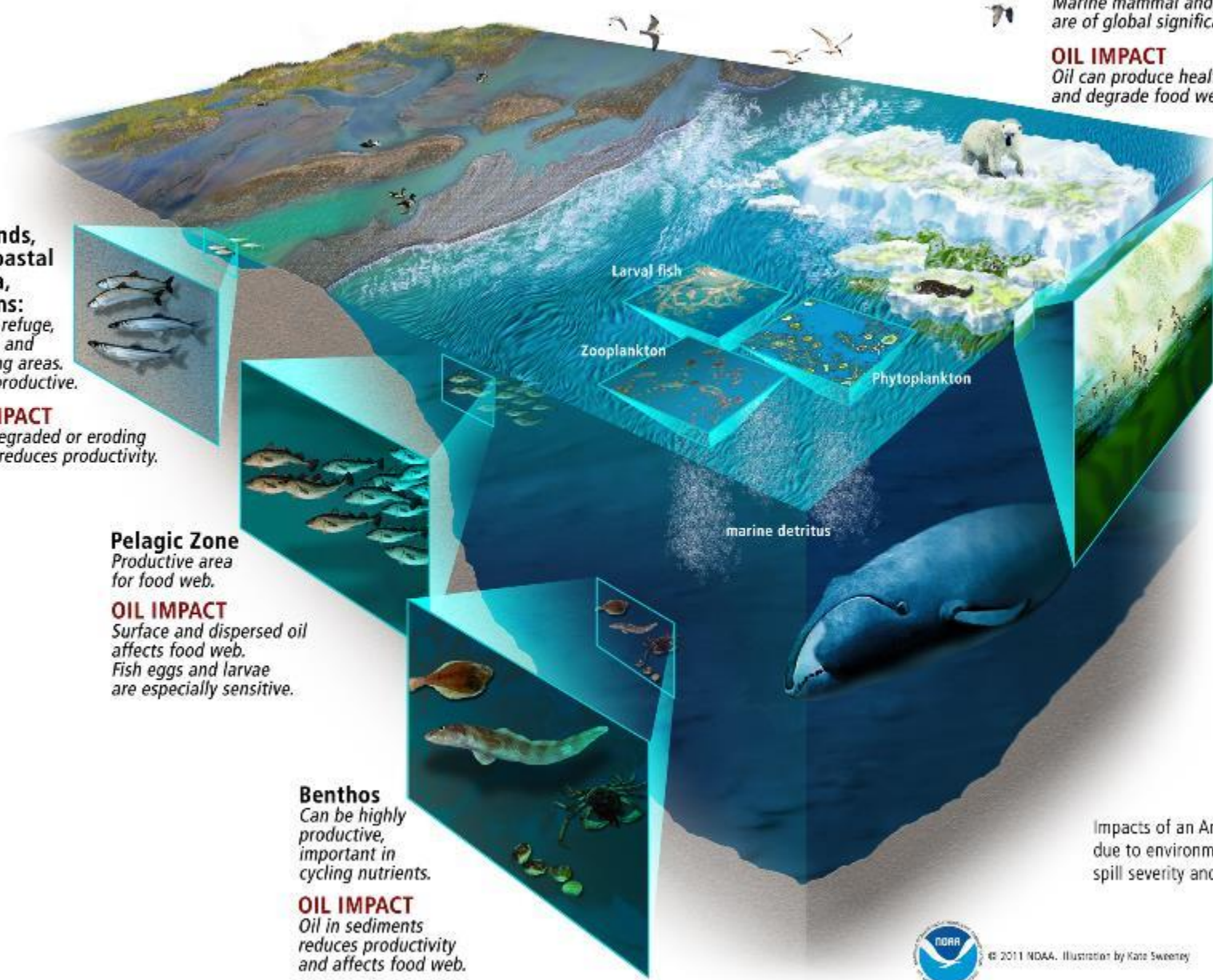
Oil can produce health effects and degrade food web.

## Ice Habitat

Seasonally important source of production, habitat for marine mammals.

### OIL IMPACT

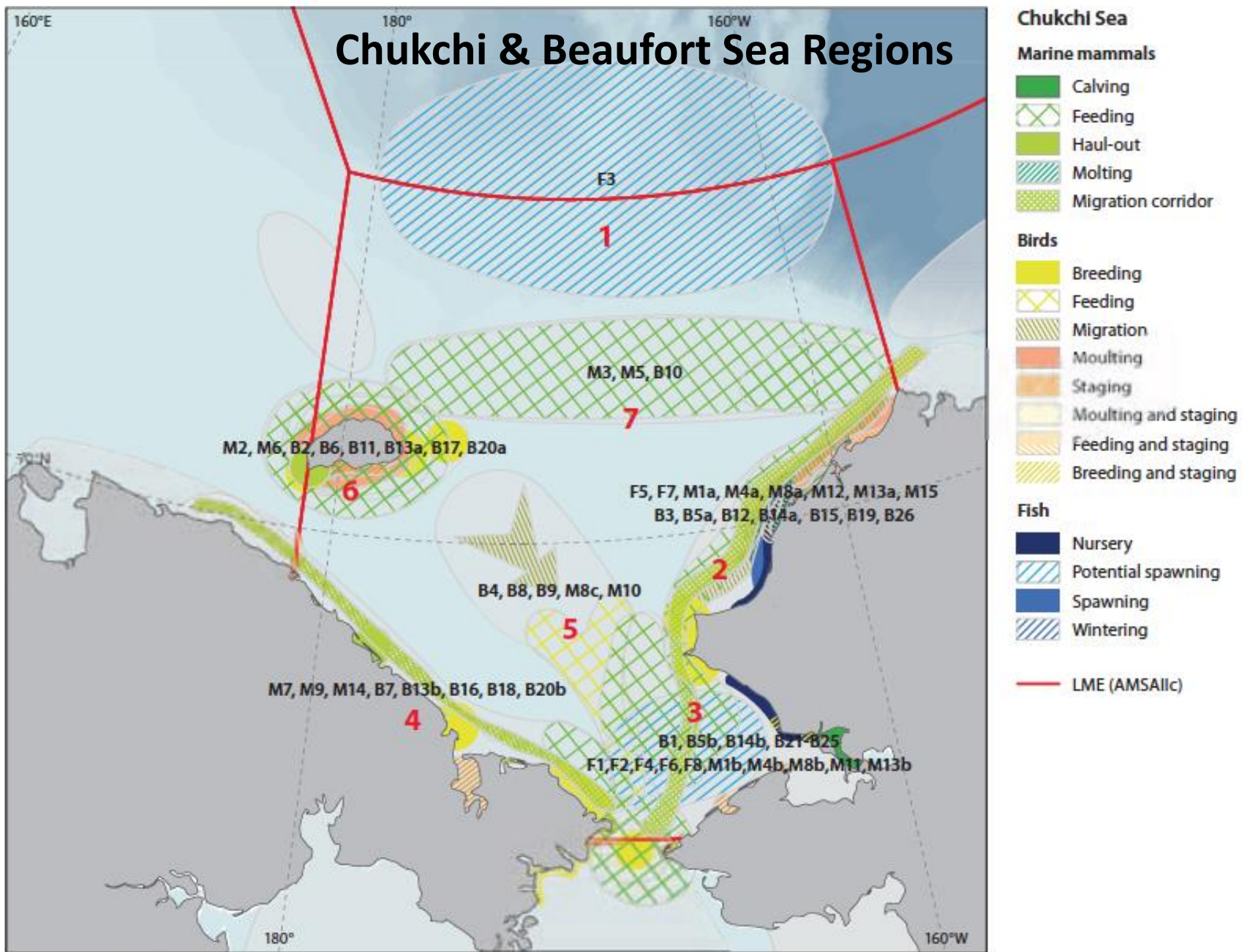
Sensitivity to oiling is poorly studied.



Impacts of an Arctic oil spill will vary due to environmental conditions, spill severity and response capacity.



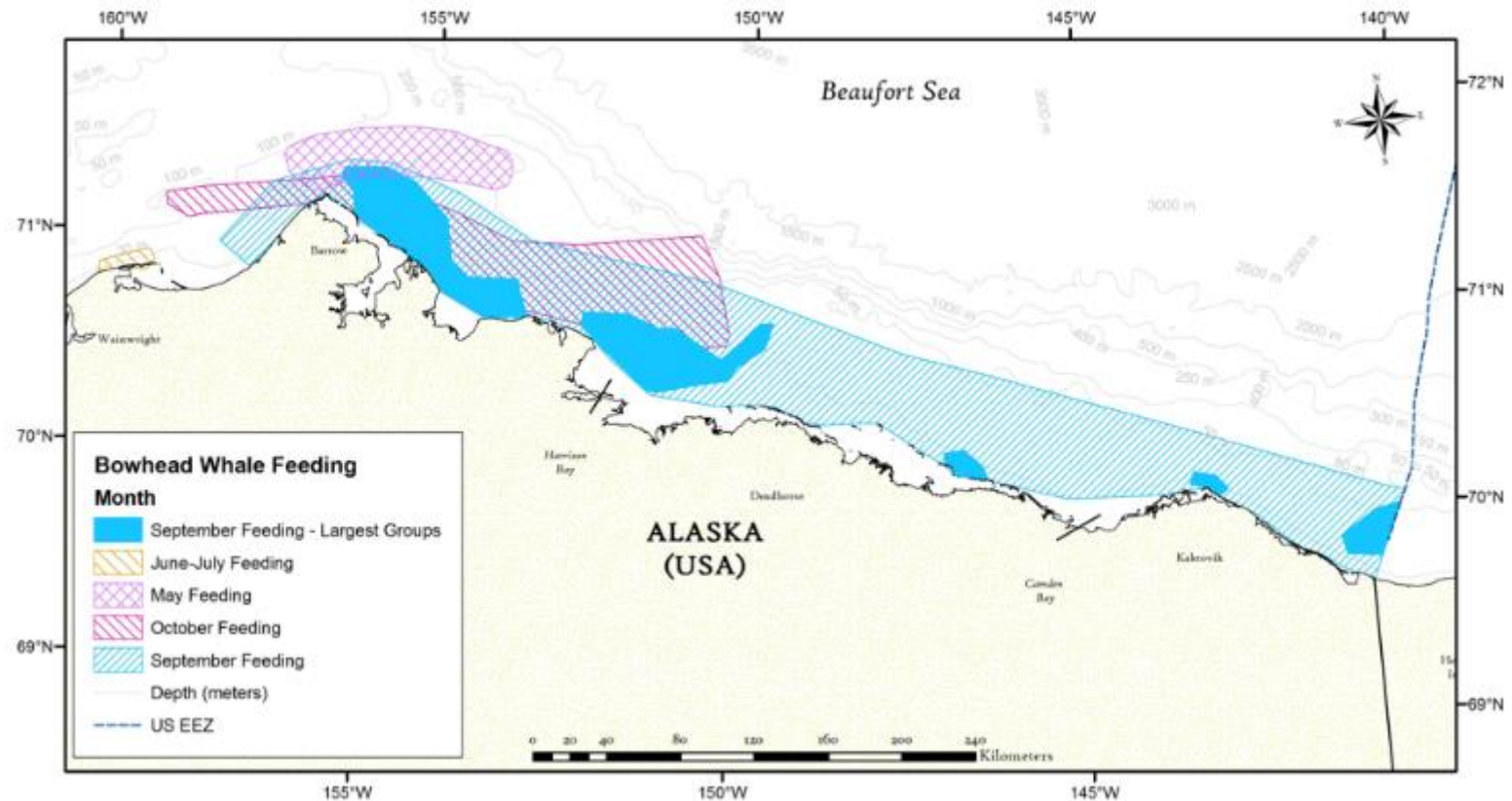
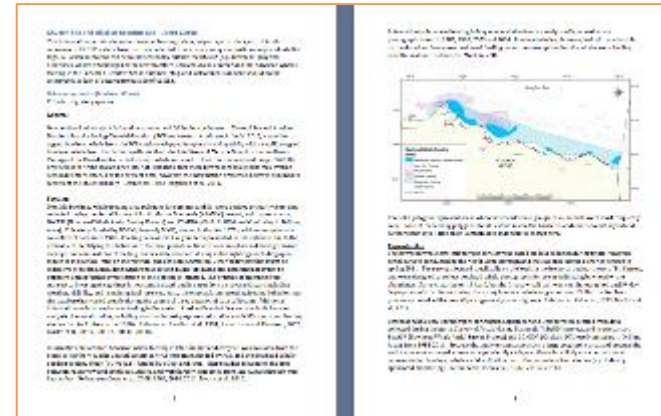
© 2011 NOAA. Illustration by Kate Sweeney



**Figure A.11a.** Areas of heightened ecological significance in the Chukchi Sea LME.

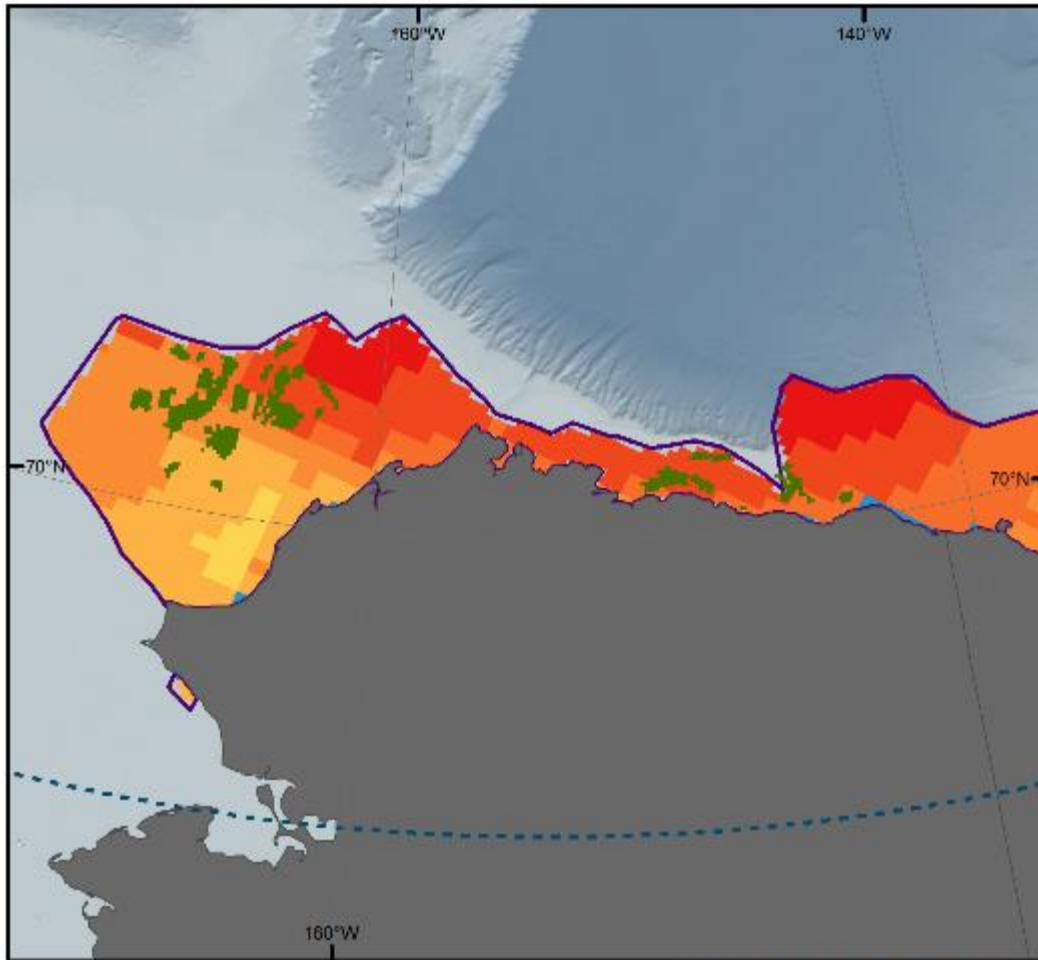
# Biologically Important Areas Criteria

- Reproductive Areas/Times
- Feeding Areas/Times
- Migratory Corridors
- Small or Resident Populations





# Dynamic management case-study: The Chukchi & Beaufort Seas regions



**Ice Coverage and Oil and Gas Potential**

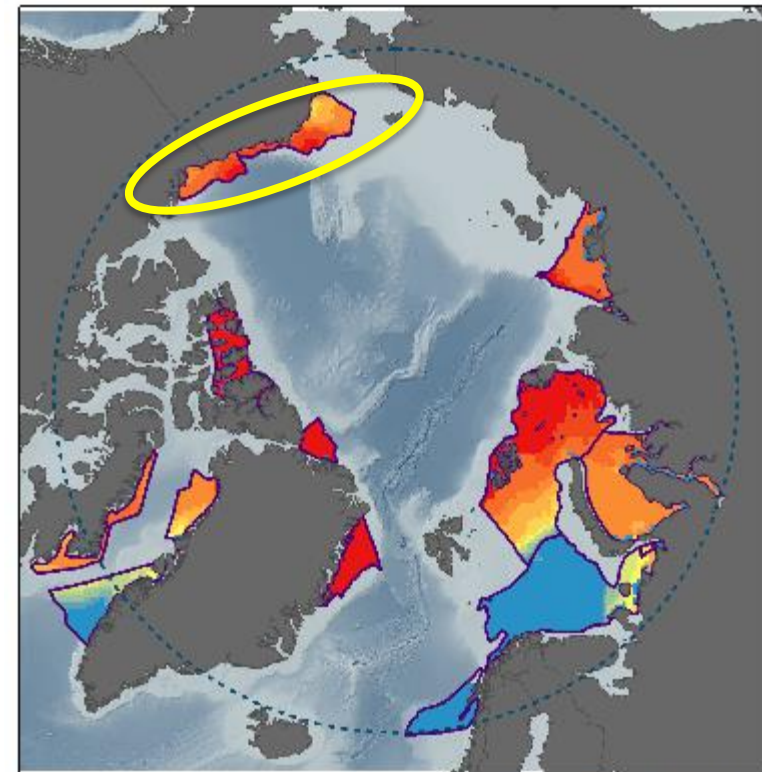
▭ >50% Oil or Gas Potential

▭ US Oil and Gas Lease

Median Ice Coverage (months covered)



Marine Geospatial Ecology Lab, UConn University (2014)



**Ice Coverage and Oil and Gas Potential**

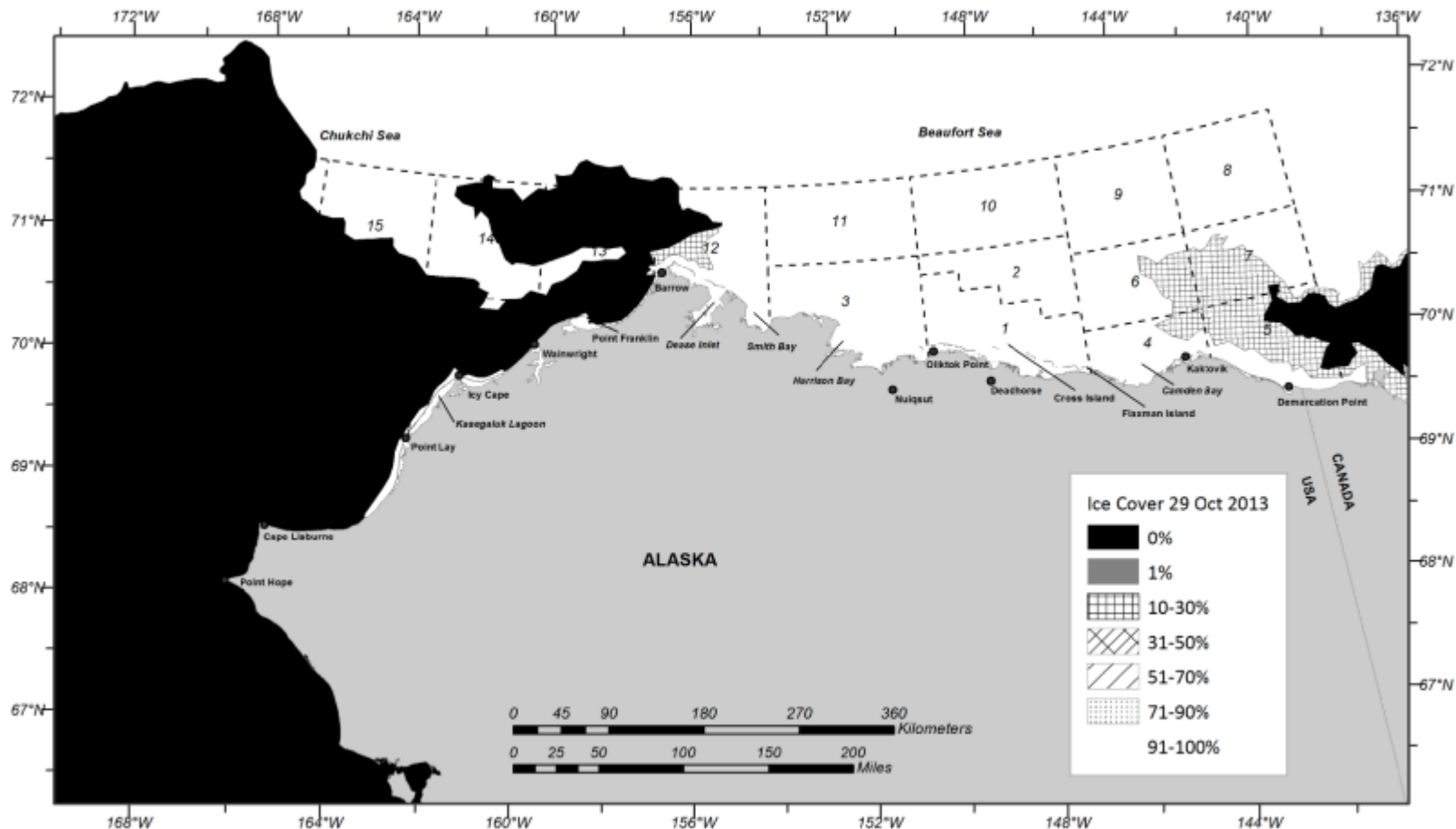
▭ >50% Oil or Gas Potential

Median Ice Coverage (months covered)



Marine Geospatial Ecology Lab, UConn University (2014)

# Ice concentrations in the northeastern Chukchi and Alaskan Beaufort seas, July – October 2013



Sea ice information was obtained from the National Ice Center (U.S. National Ice Center,

Clark, J.T., A.A. Brower, C.L. Christman, and M.C. Ferguson. 2014. Distribution and relative abundance of marine mammals in the northeastern Chukchi and Western Beaufort Seas, 2013 Annual Report, OCS Study BOEM 2014-018. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AKC3, Seattle, WA 98115-6349.

# Regional: Aerial Surveys of Arctic Marine Mammals (ASAMM)



**NOAA FISHERIES** | ALASKA FISHERIES SCIENCE CENTER  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

General Info | Species | Programs | Publications | Data & Tools | Images | Education & Outreach | Search

### National Marine Mammal Laboratory Cetacean Assessment & Ecology Program Aerial Surveys of Arctic Marine Mammals (ASAMM)

Inter-agency agreements have been established between the Bureau of Ocean Energy Management (BOEM), Department of Interior and the National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. The intent of these agreements is to provide funding to conduct surveys of bowhead whales (*Balaena mysticetus*) and other marine mammals in the Alekian Arctic.

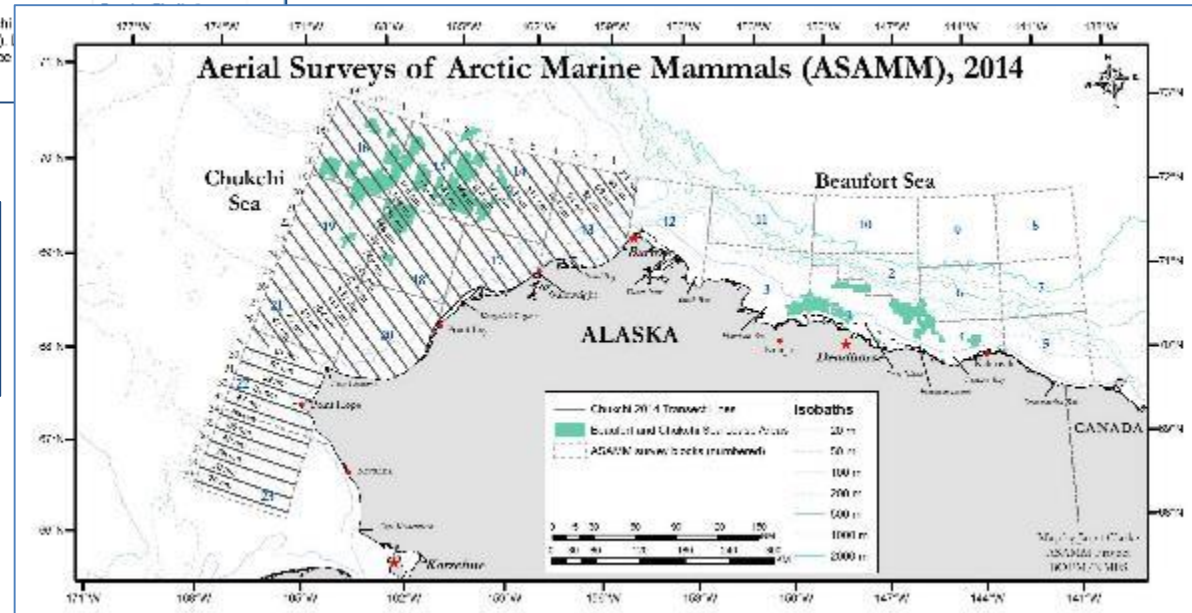
The Aerial Surveys of Arctic Marine Mammals project is a continuation of the Bowhead Whale Aerial Survey Project ([BWASP](#)) and Chukchi Offshore Monitoring in Drilling Area ([COMIDA](#)) marine mammal aerial survey project. The goal of these studies is to document the distribution and relative abundance of bowhead, gray, right, and fin whales, belugas, and other marine mammals in areas of potential oil and natural gas exploration, development, and production activities in the Alekian Beaufort and northeastern Chukchi Seas.

The 2014 ASAMM field season will run from 2 July to 30 October ([click here for daily survey reports](#)). Data from the ASAMM surveys will be used to relate variation in marine mammal distribution or abundance to other variables, such as physical oceanographic conditions, indices of potential prey density, and anthropogenic activities, if information on these variables is available. ([See historical data below.](#))

- NMML Home
- Cetacean Assessment & Ecology Program
- Research Projects
- Personnel
- Publications
- Posters
- Quarterly Reports

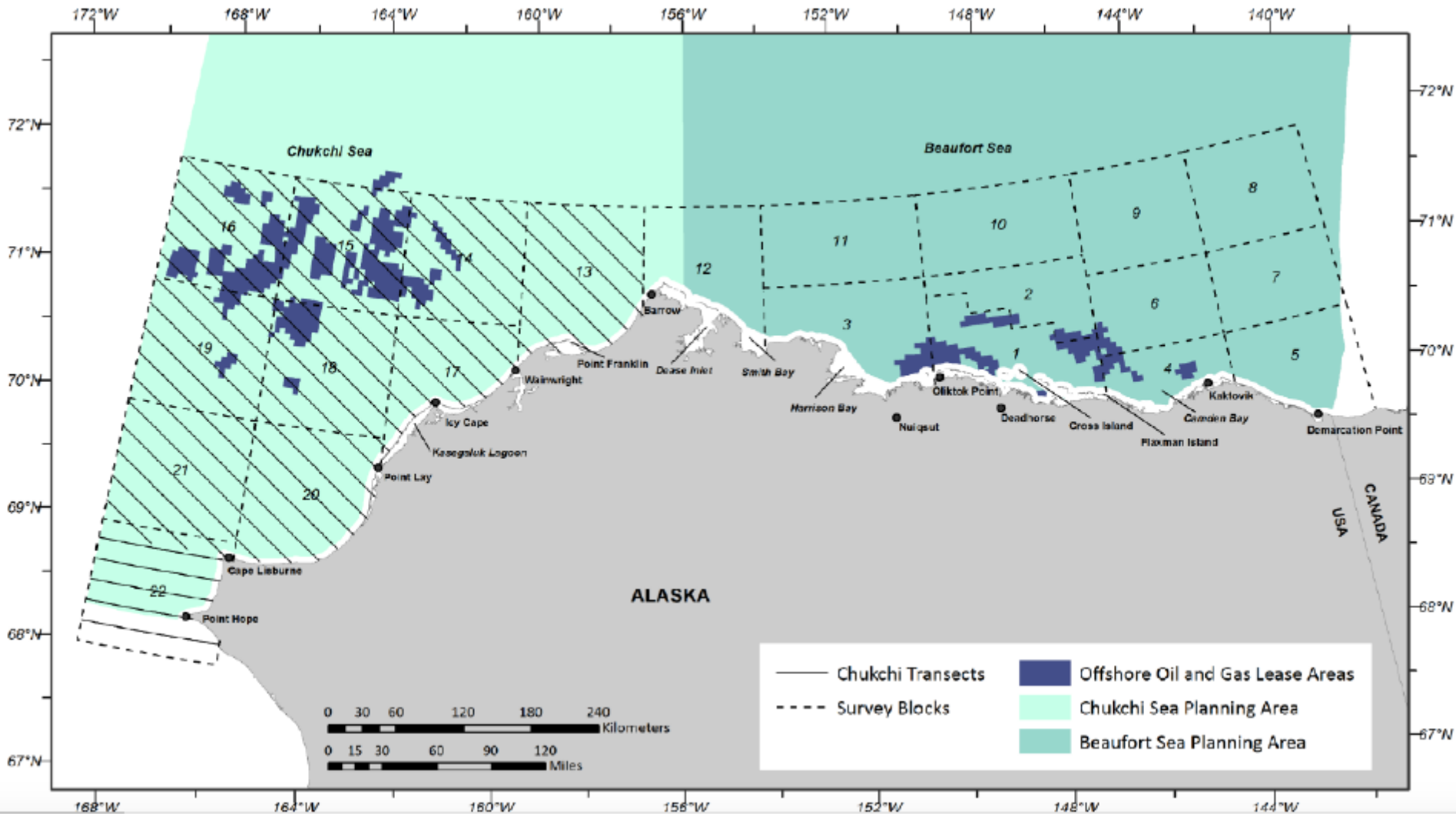


**“Dynamic Ocean Management”**  
Through high-frequency aerial  
survey monitoring





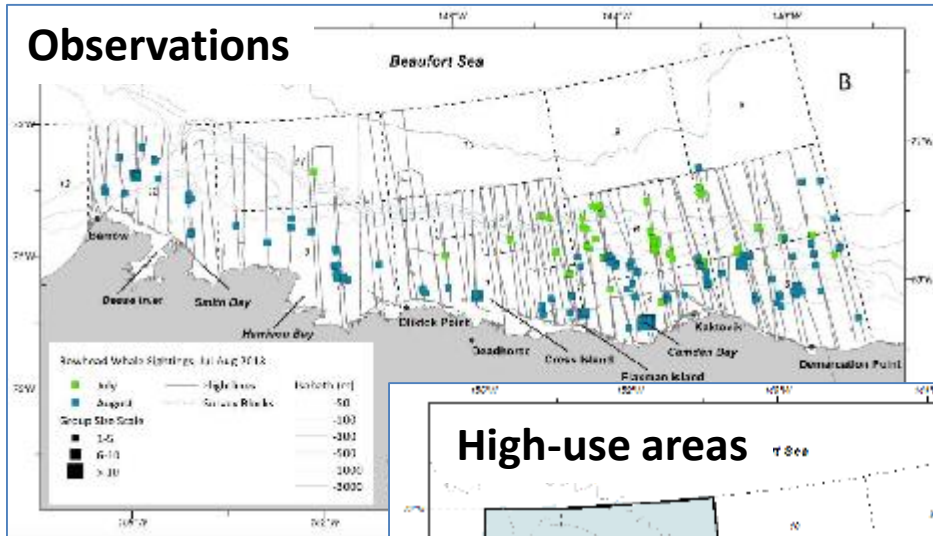
# Regional: Aerial Surveys of Arctic Marine Mammals (ASAMM)



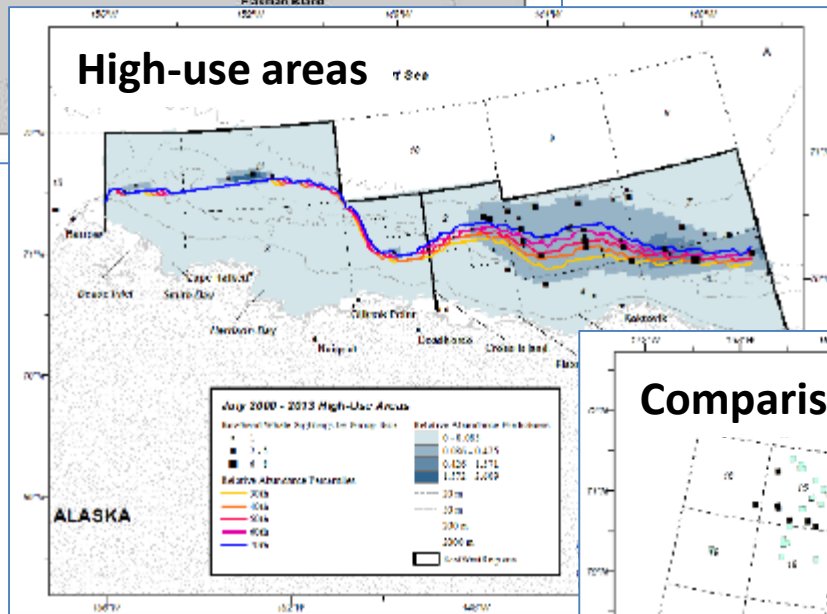
Clark, J.T., A.A. Brower, C.L. Christman, and M.C. Ferguson. 2014. Distribution and relative abundance of marine mammals in the northeastern Chukchi and Western Beaufort Seas, 2013 Annual Report, OCS Study BOEM 2014-018. National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 7600 Sand Point Way NE, F/AC3, Seattle, WA 98115-6349.

# Decision support: analysis & context

## Observations



## High-use areas



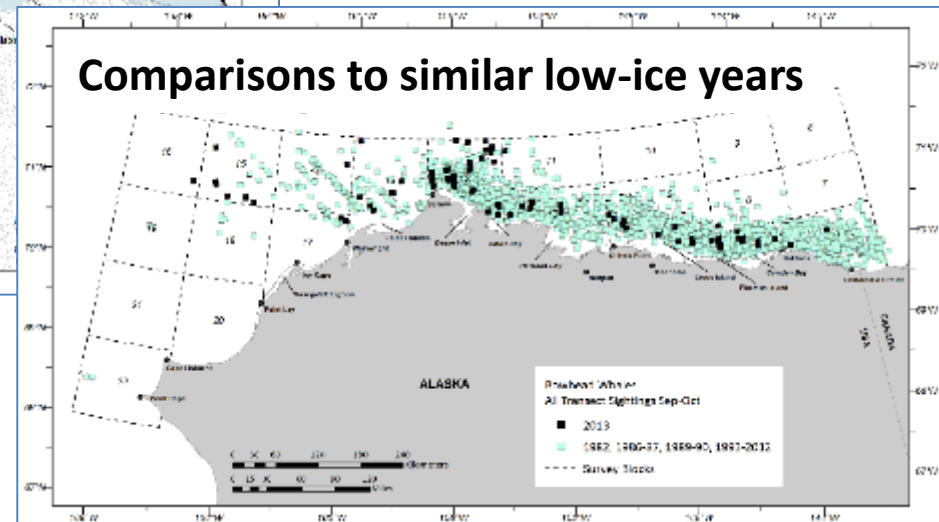
## Distribution and Relative Abundance of Marine Mammals in the Northeastern Chukchi and Western Beaufort Seas, 2013 Annual Report



U.S. Department of the Interior  
Bureau of Ocean Energy Management (BOEM)  
Alaska OCS Region  
3801 Cantarano Drive, Suite 500  
Anchorage, AK 99503

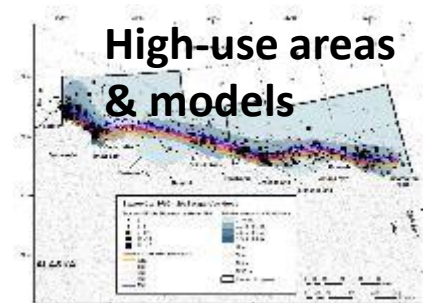
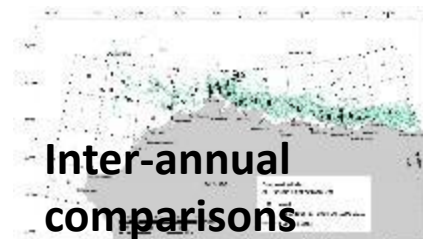
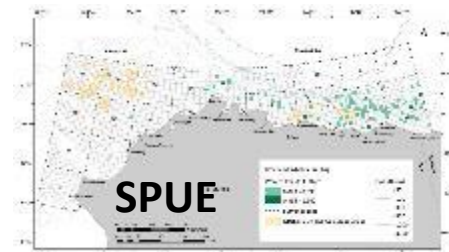
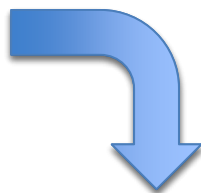
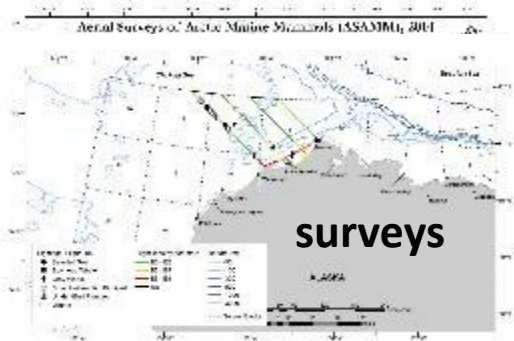


## Comparisons to similar low-ice years



Response time: annual report

# Spatial Decision Support System



Response time: near real-time



OBIS-SEAMAP

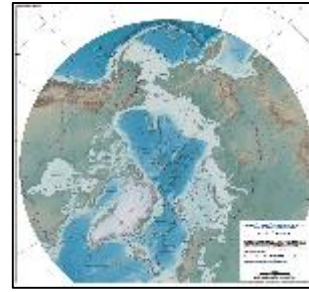
OBIS-USA

This block contains two screenshots of web interfaces. The left screenshot shows the OBIS-SEAMAP interface with a map and various data panels. The right screenshot shows the OBIS-USA interface with a map and various data panels.



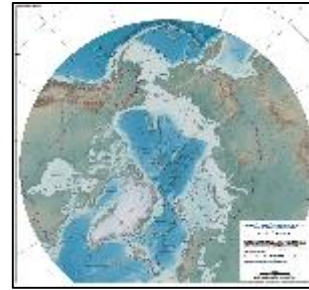


# Topics



- Overview
- International marine biodiversity processes;
  - Areas described as meeting the UN CBD EBSA criteria;
- Space-Time overlaps
  - Oil & Gas exploration
  - Shipping
  - Fisheries
- Example: Regional dynamic management
  - BOEM / NOAA-NMFS monitoring
- Issues and implications.

# Topics



- Overview
- International marine biodiversity processes;
  - Areas described as meeting the UN CBD EBSA criteria;
- Space-Time overlaps
  - Oil & Gas exploration
  - Shipping
  - Fisheries
- Example: Regional dynamic management
  - BOEM / NOAA-NMFS monitoring
- **Issues and implications.**

# Identifying ecologically or biologically important areas in the Arctic

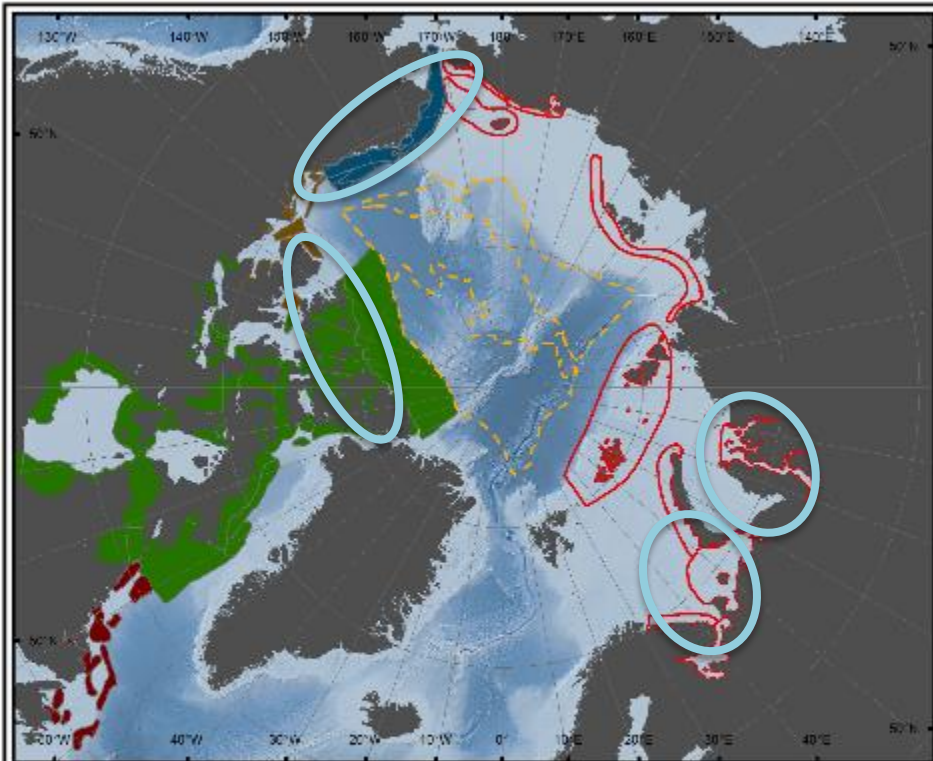
## Issues that will influence ocean resource planning in the Arctic

- Significant spatial & temporal overlaps between areas of ecological importance & areas of high value for exploration...
- Significant variability in knowledge...
- Shifting baselines...
- New conditions and new trajectories...
- ...

# Areas of oil & gas potential vs. ecological importance

Ecologically or Biologically Important Areas

Oil & Gas Potential

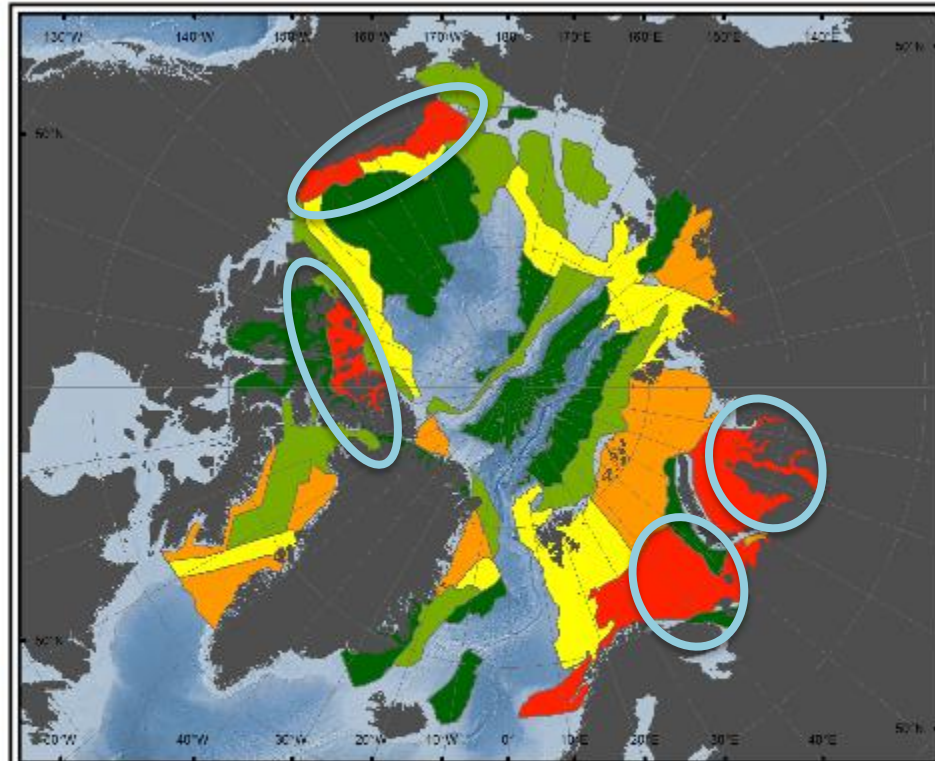


**CBD EBSA process**  
 [Red outline] Spatially Stable EBSA  
 [Yellow dashed outline] Spatially Dynamic EBSA

**Canadian EBSA process**  
 [Dark red] Newfoundland / Labrador  
 [Brown] Beaufort / N. Foxe Basin  
 [Green] Canadian Arctic

**US Biologically Important Areas - Cetaceans**  
 [Blue] Bowhead, Beluga, Gray whales

Marine Geospatial Ecology Lab, Duke University (2014)



**Oil and Gas Potential**

[Green] ~10%  
 [Light Green] 10% - 30%  
 [Yellow] 30% - 50%  
 [Orange] 50% - 100%  
 [Red] 100%

*USGS 2008/2011. Circum-Arctic Resource Appraisal: Estimates of undiscovered oil and gas north of the Arctic Circle.*

Marine Geospatial Ecology Lab, Duke University (2014)

*"Assessment units (AUs) in the Circum-Arctic Resource Appraisal (CARA) color-coded by assessed probability of the presence of at least one undiscovered oil and/or gas field with recoverable resources greater than 50 million barrels of oil equivalent (MMBOE).*

# We also need to account for technological response

Short ice season increases risks...

## Rig Runs Aground in Alaska, Reviving Fears About Arctic Drilling



A view of the Kulluk aground southeast of Sikkalidax Island. The grounding was only the latest of the problems Shell has run into in seeking to drill north of Alaska.

By JOHN M. BRODER and HENRY FOUNTAIN  
Published: January 1, 2013

New technologies expected to use “brute-force” to combat seasonality

### Arctic oil production requires ‘brute-force’ engineering

Shell's exploratory drilling this summer in the Beaufort and Chukchi seas was limited to the brief “open-water” season, when ice wasn't covering the water. If exploration becomes production, the year-round schedule would require equipment that can withstand the extreme Arctic environment. A look at some of the challenges:

#### Standing up to the elements

This conceptual design, provided by Shell, illustrates a potential production platform using “brute-force” engineering. The construction and installation of a platform such as this would be a multibillion dollar investment.

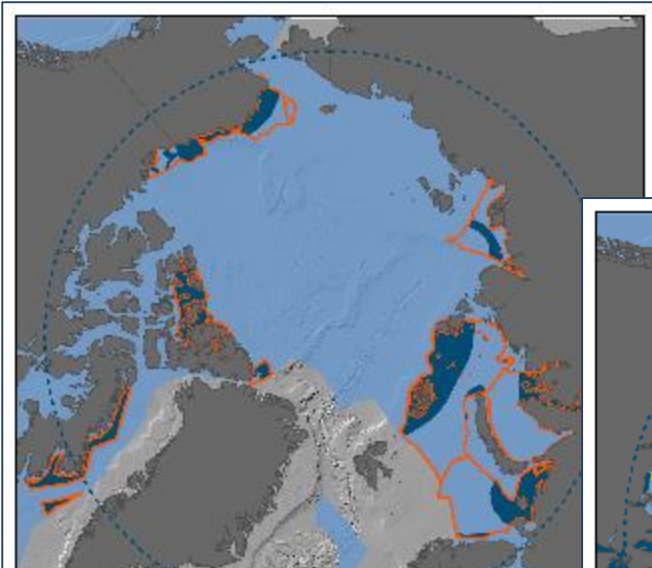
Unlike the open structures that dot the Gulf of Mexico, this platform would be partially enclosed to protect workers and equipment from the lethal cold and freezing sea spray.

The facility would sit high above the water to avoid deadly ice ridges

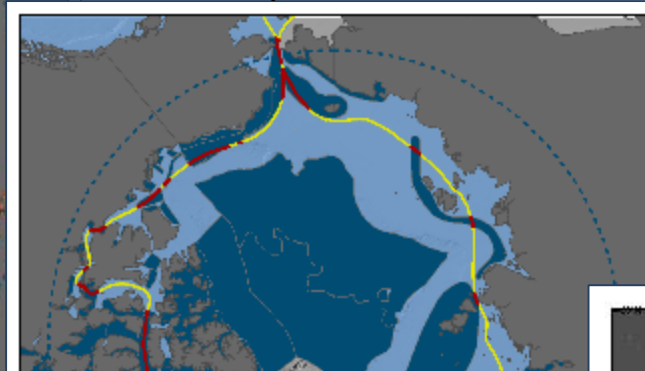


Oil & gas vs. ecological importance

# Potential space & time overlaps



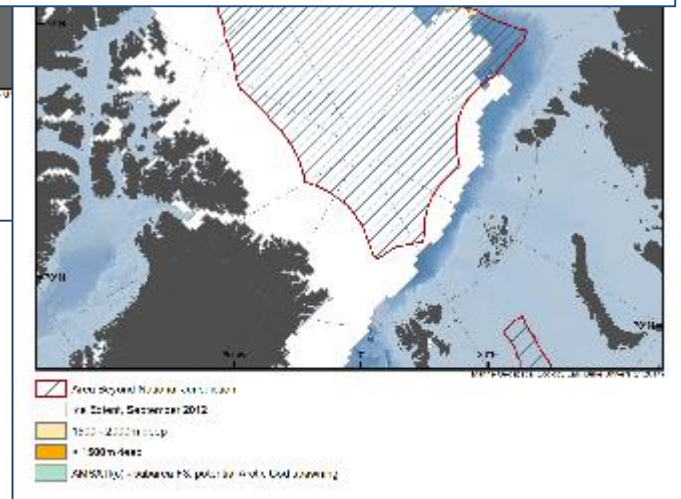
Shipping vs. ecological importance



New fisheries vs. ecological importance

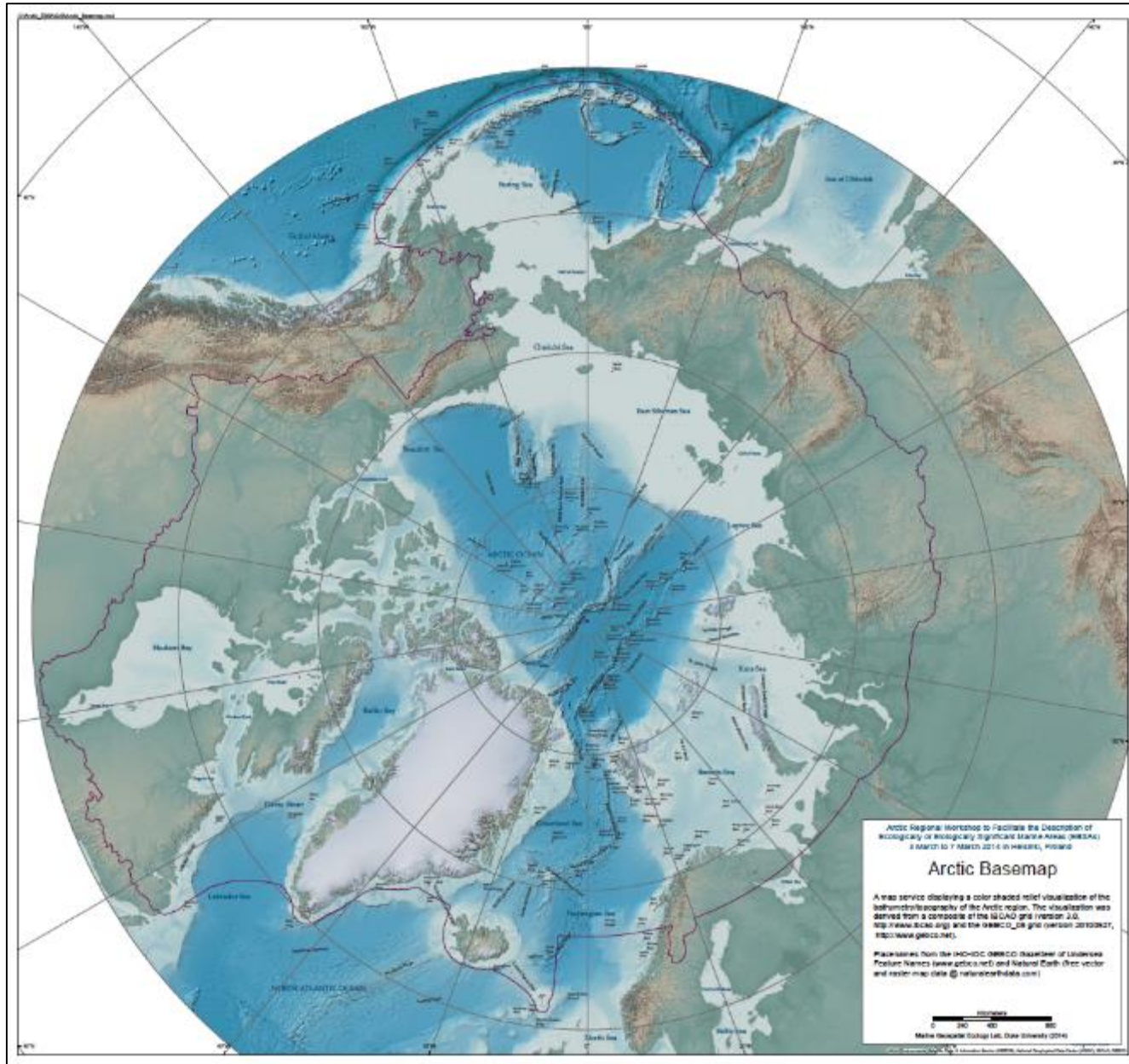


*Need for dynamic ocean management and near real-time decision support, data sharing, and analysis capabilities*



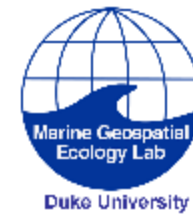
**General comment:** *The arctic is noteworthy for having resources use and ecological importance compressed in space & time.*

# Discussion





*Thank you!*



National Science Foundation  
WHERE DISCOVERIES BEGIN

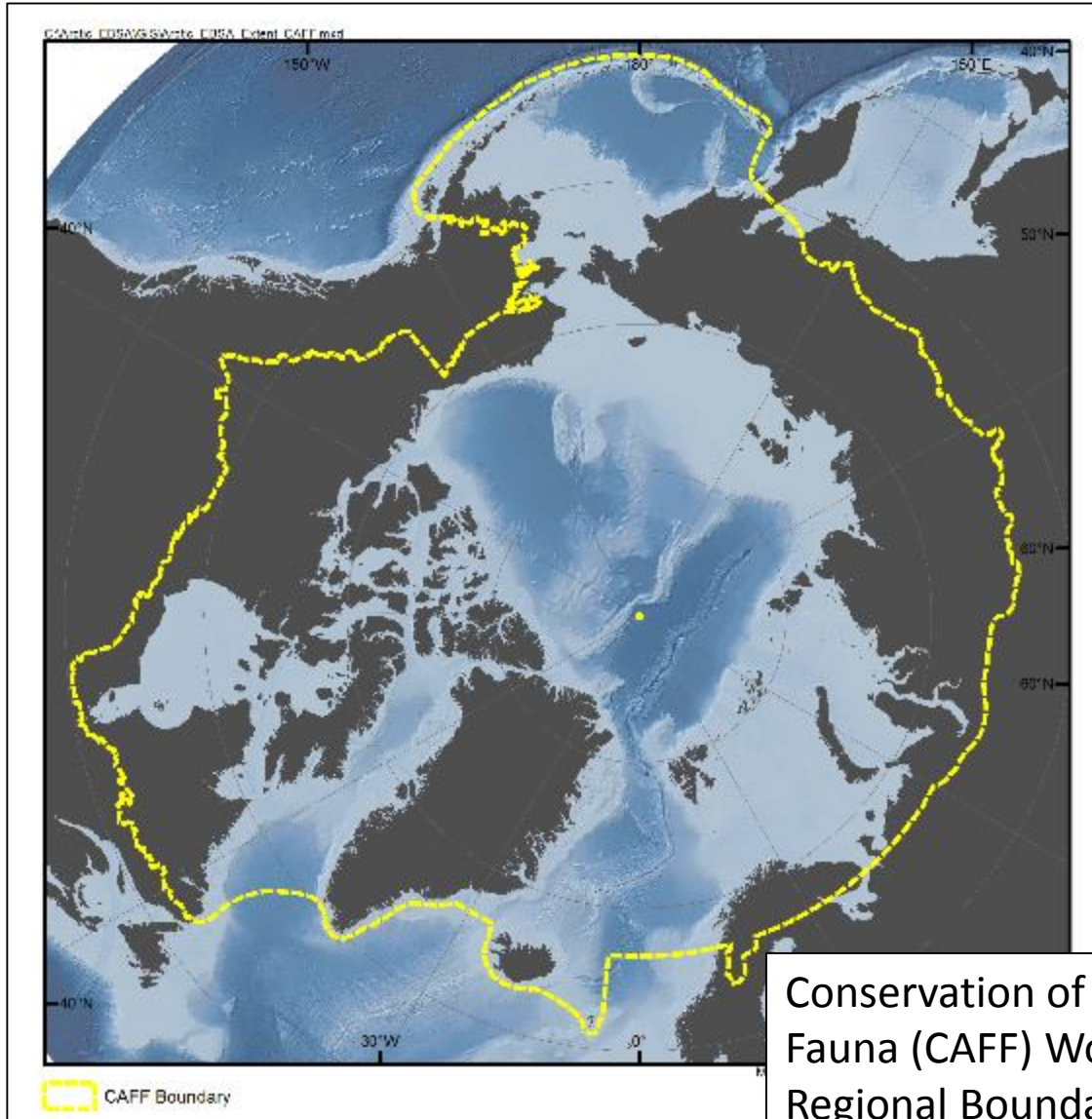
<http://seamap.env.duke.edu/>

**Marine Geospatial Ecology Lab  
Nicholas School of the Environment  
Duke University**



# Arctic Region

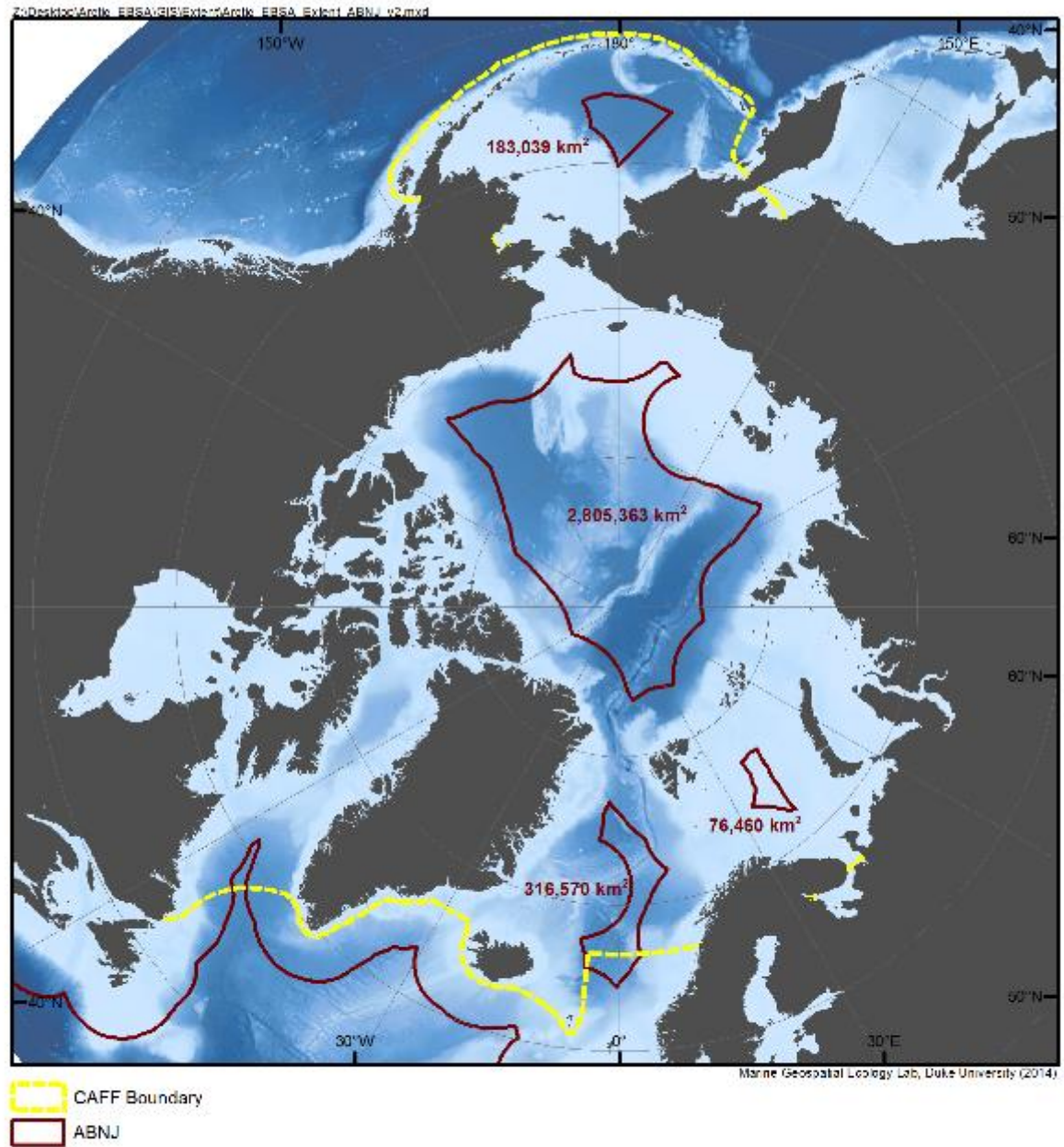
(1) Relate to existing regional areas



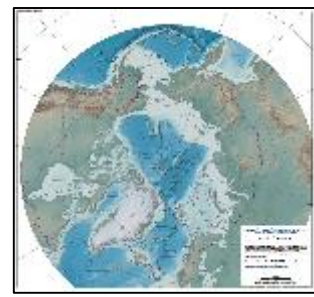


# Arctic Region

(3) Allow for sites to be described within ABNJ and EEZ areas as agreed by parties...

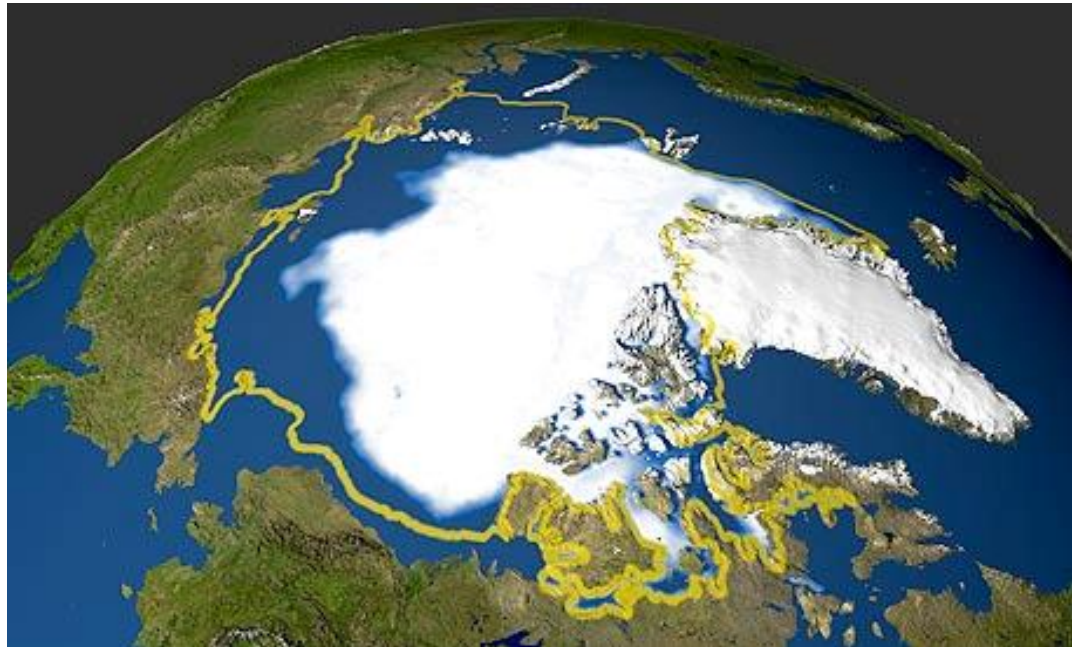


# Arctic Ice EBSAs

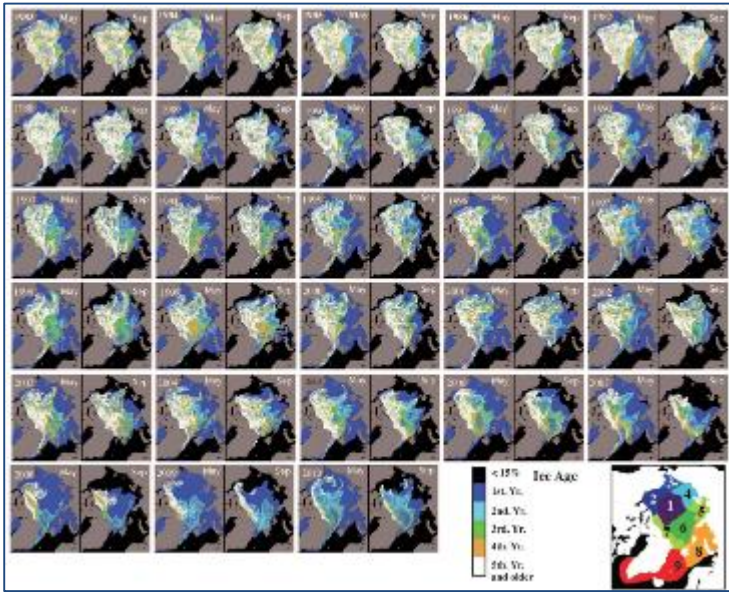


## Two dynamic Arctic ice EBSA types:

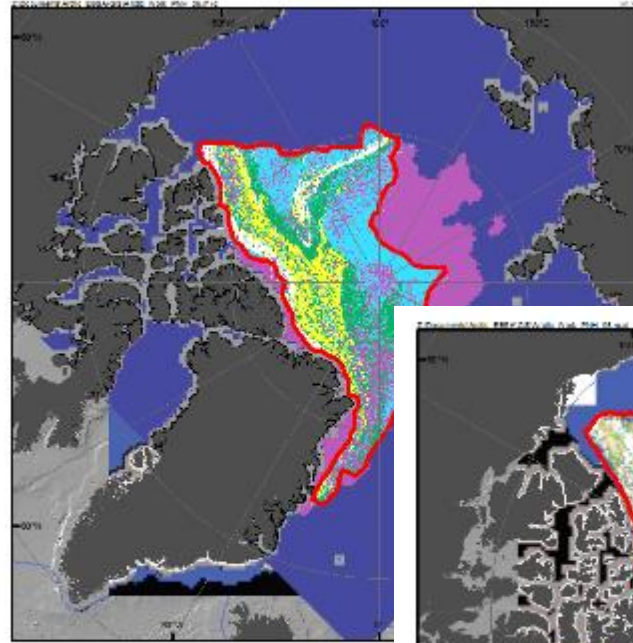
1. Multi-year ice area
2. Ice Margin



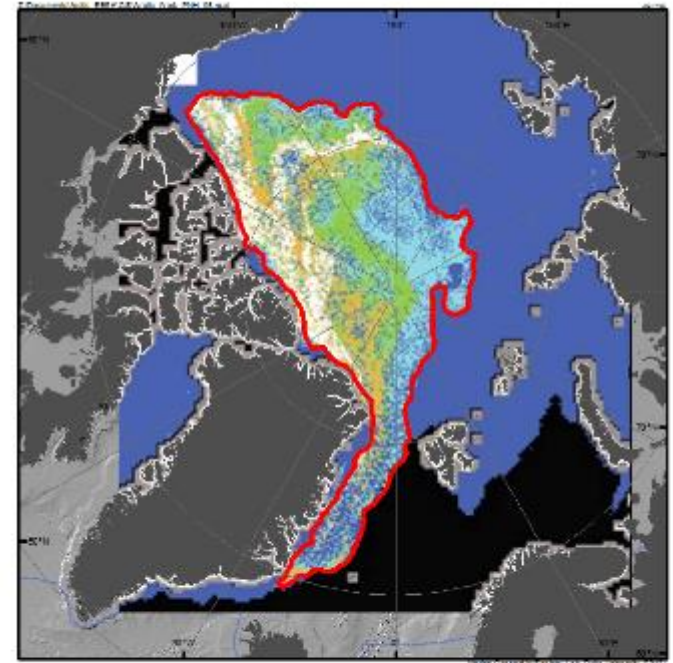
# multi-year ice minimum & maximum



*Maslanik et al. 2011*



**September 2012 multi**

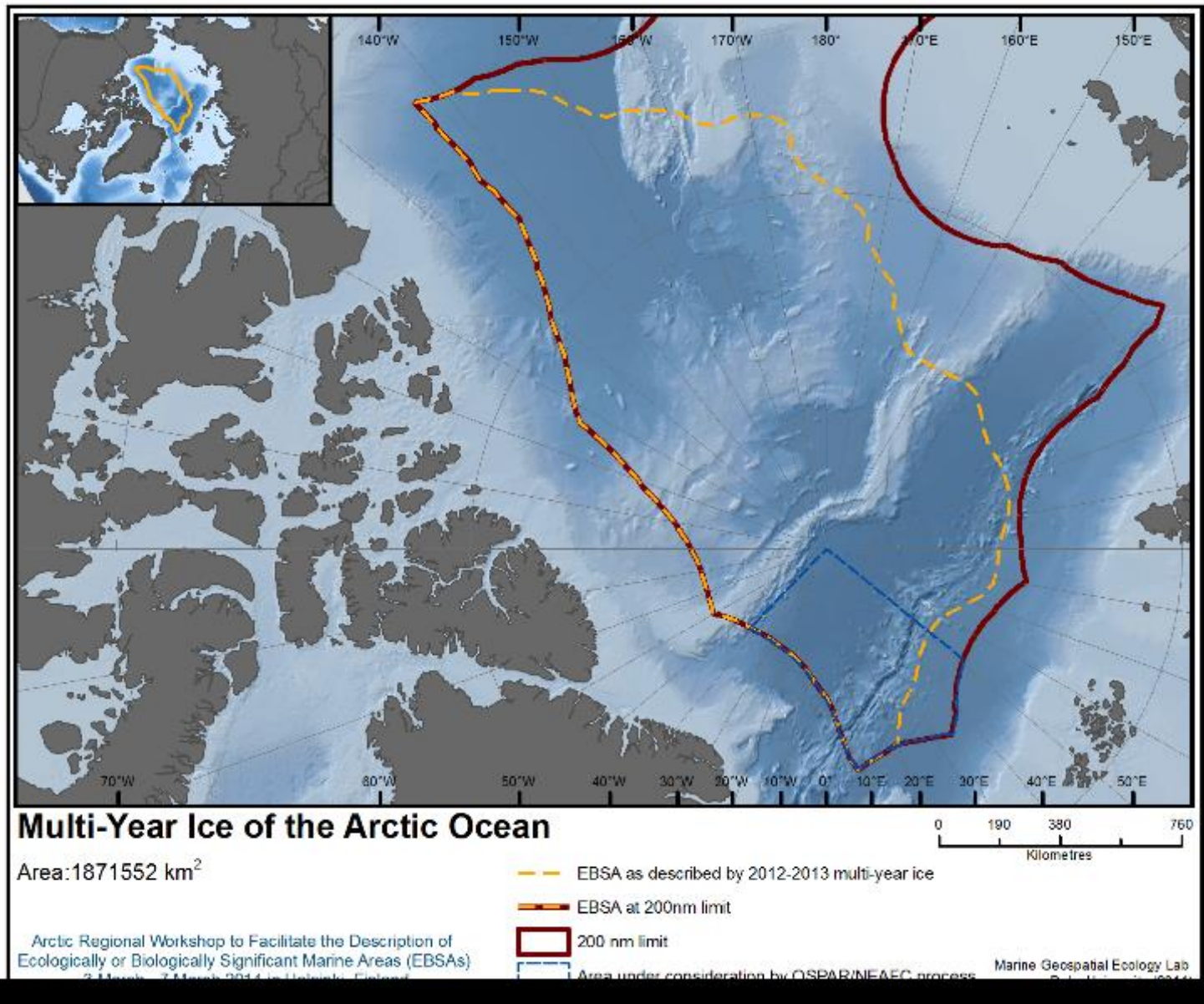


**March 2013 multi-year ice (2-5 year)**

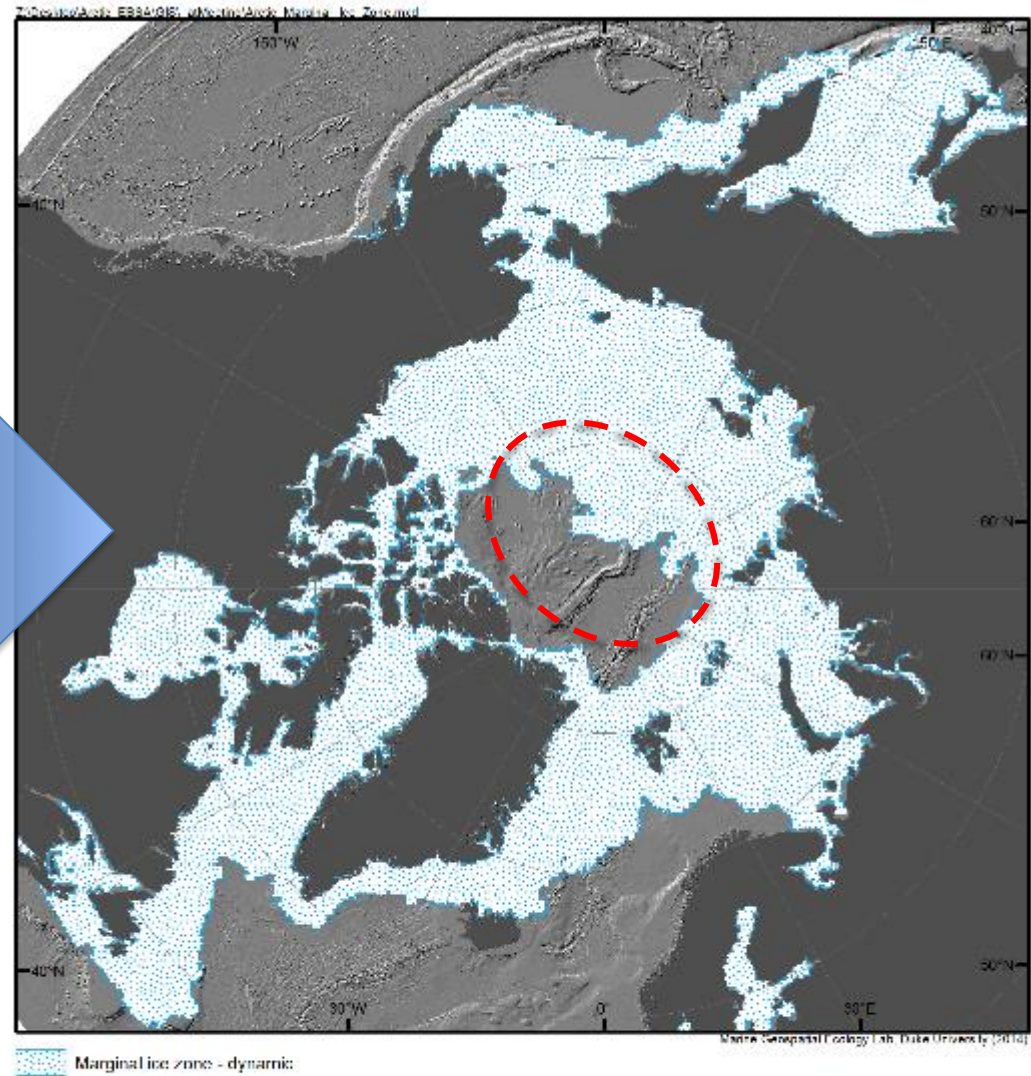
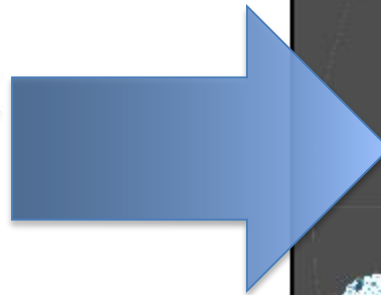
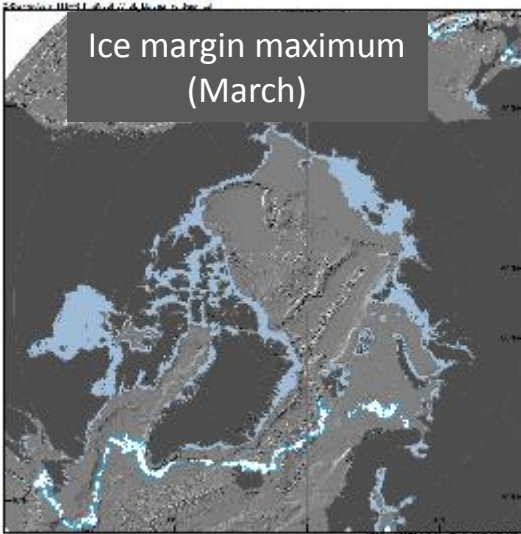
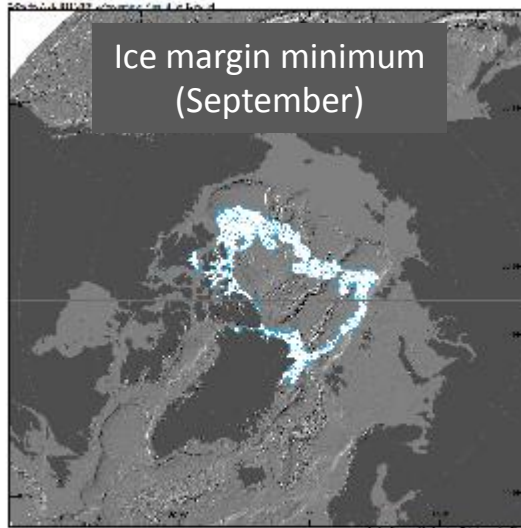
Animation:

<http://www.climate.gov/news-features/features/arctic-sea-ice-getting-thinner-younger>

# Areas described to meet the EBSA criteria



# Arctic ice margin EBSA



September – March  
marginal ice range (1972-2007)

# Areas described to meet the EBSA criteria

