



# Meeting the Challenge of a Changing Arctic

**Mike Gill**

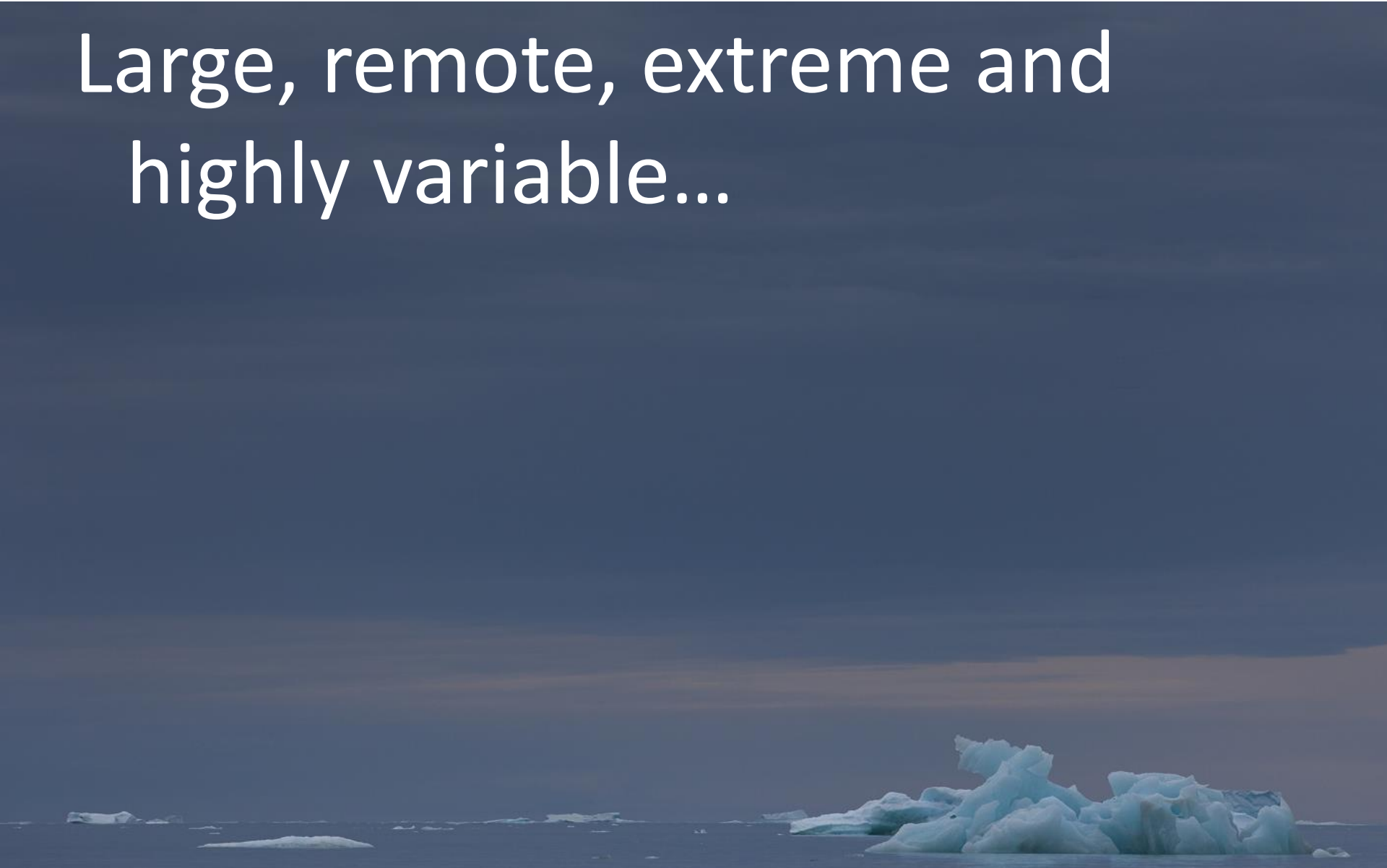
Vice Chair, GEO-Biodiversity Observation Network

Special Advisor, Circumpolar Biodiversity Monitoring Program

Whitehorse, Canada

# The Arctic

Large, remote, extreme and  
highly variable...



# The Arctic

4 million inhabitants...



# The Arctic – Multiple Players



Permanent  
Participants to the  
Arctic Council.

Compiled by W.K.

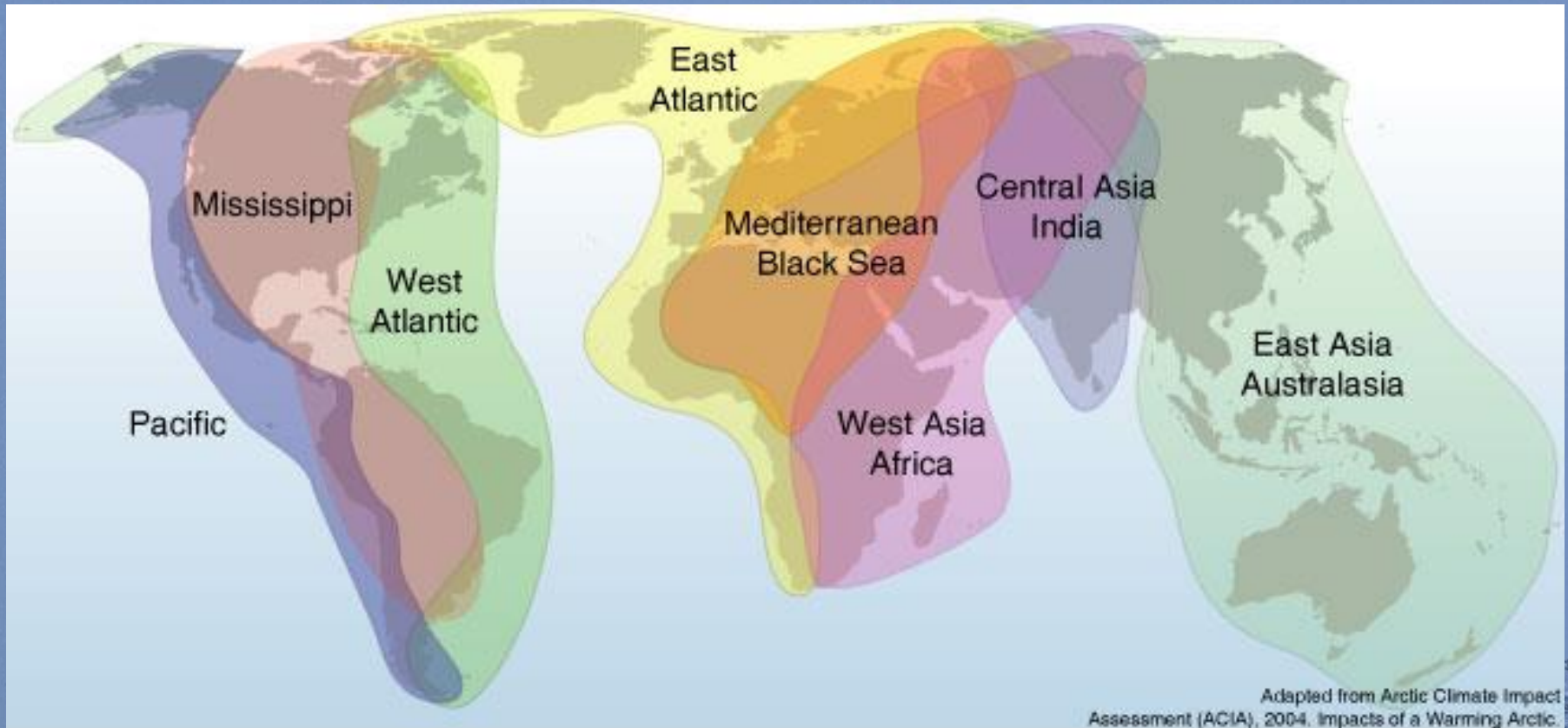
Dallman © Norwegian  
Image courtesy of CAP  
Polar Institute



# The Arctic

## Global Connections...

### Bird Migration Routes to the Arctic



# The Arctic

- Home of the world's few remaining pristine environments
- Largest freshwater resources (together with Antarctic)
- Plays a key role in the global physical, chemical and biological balance



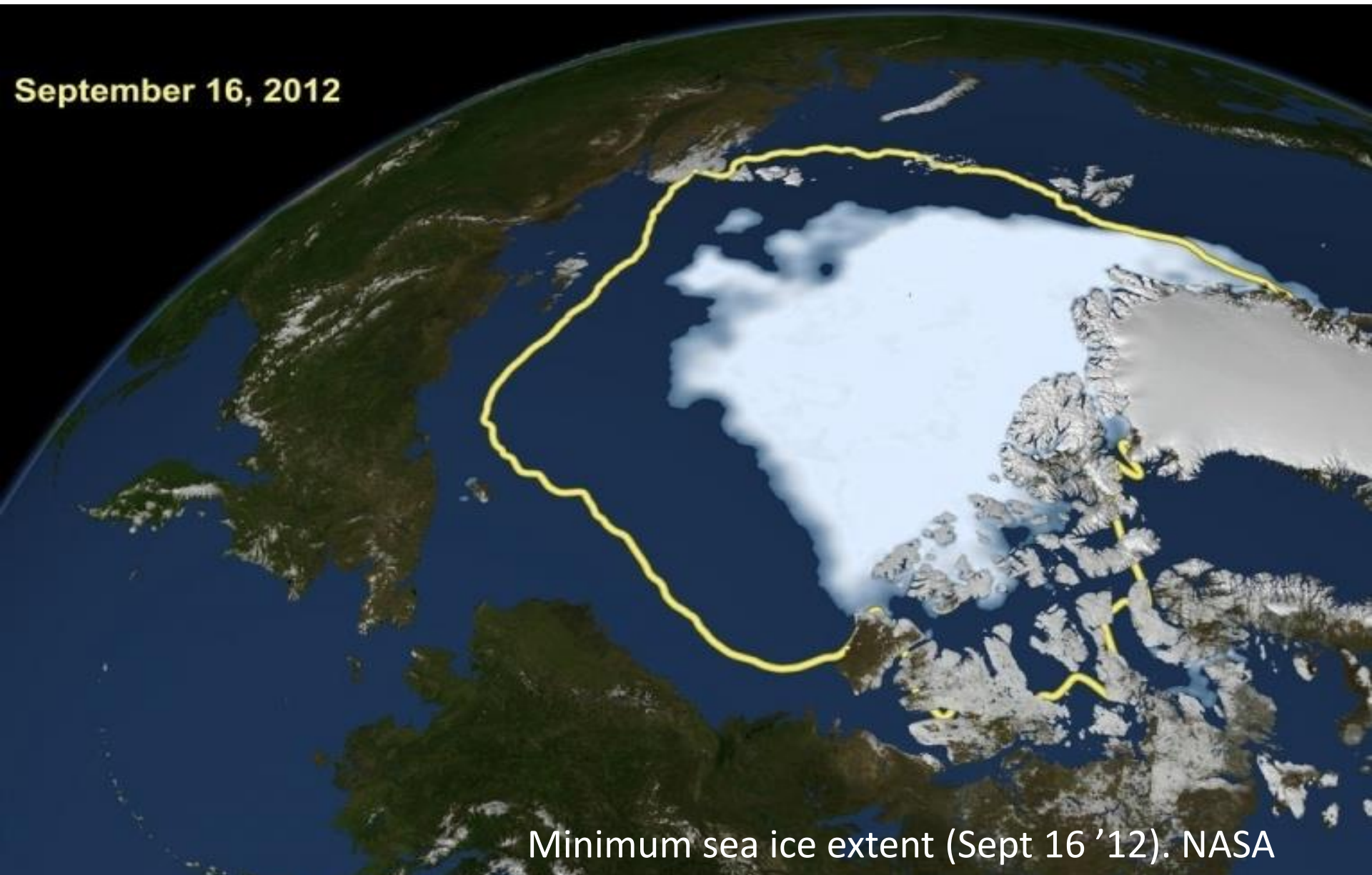
# ...Supporting

- Unique species adapted to extreme (cold and highly variable) environment
- Large and often concentrated wildlife populations
- Limited functional redundancy





# Rapid and accelerating change



Minimum sea ice extent (Sept 16 '12). NASA

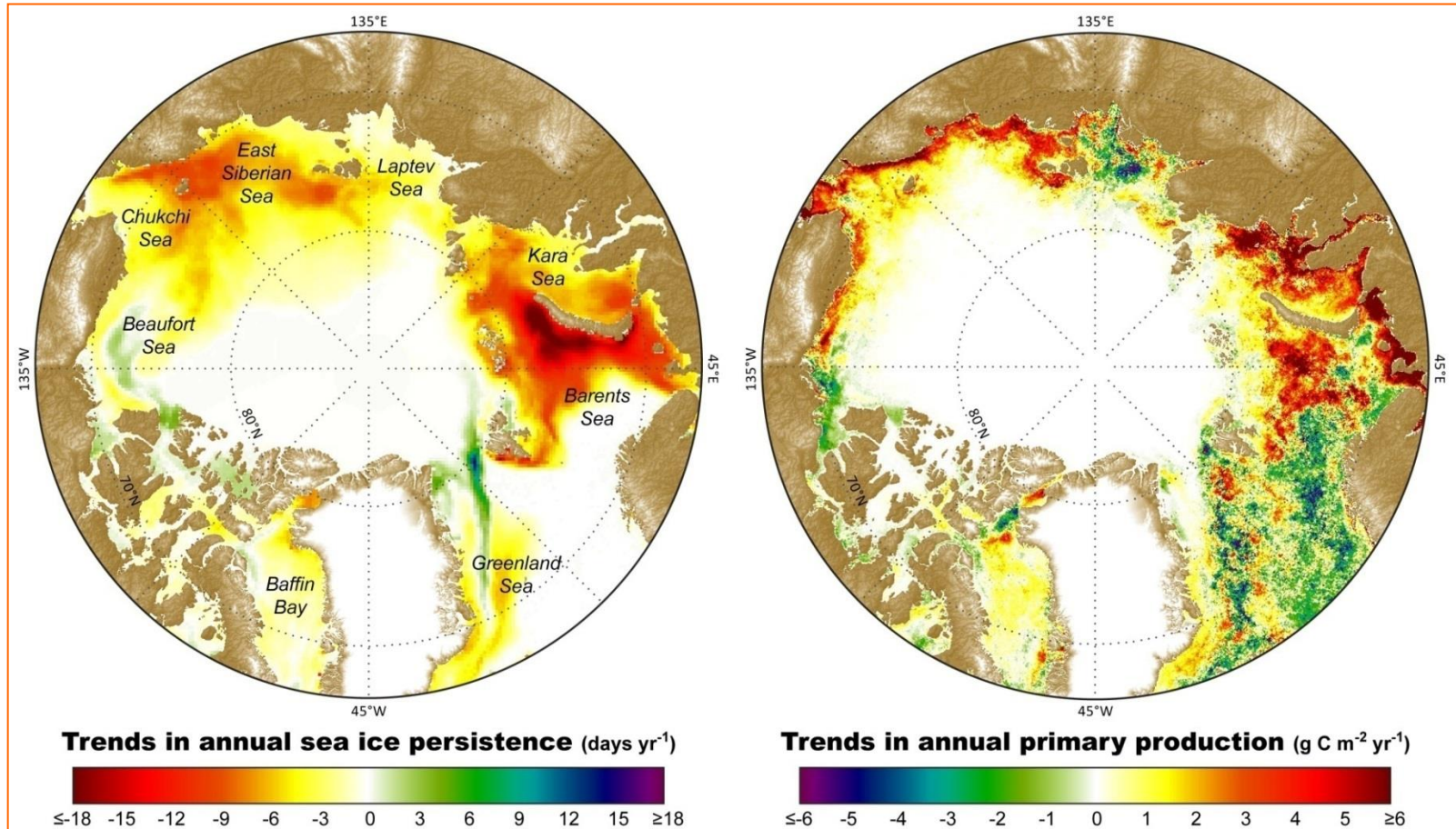


# Multiple, Interacting Stressors

- Climate Change
- Habitat disturbance
- Environmental contamination
- Invasive species
- Overexploitation
- Increased shipping
- Resource development
- Combinations of the above stressors

# Trends in annual sea ice and net marine primary production

Up 20% (between 1998 and 2009) as Sea-Ice Retreats



From: Frey et al. 2011. Arctic Report Cards.

# Migration of Marine Life Northward

## Beaufort Sea Survey

**Six Species Have Extended Range from the Bering or Chukchi Seas to the Beaufort Sea**



Marbled eelpout



Bering flounder



Pacific cod



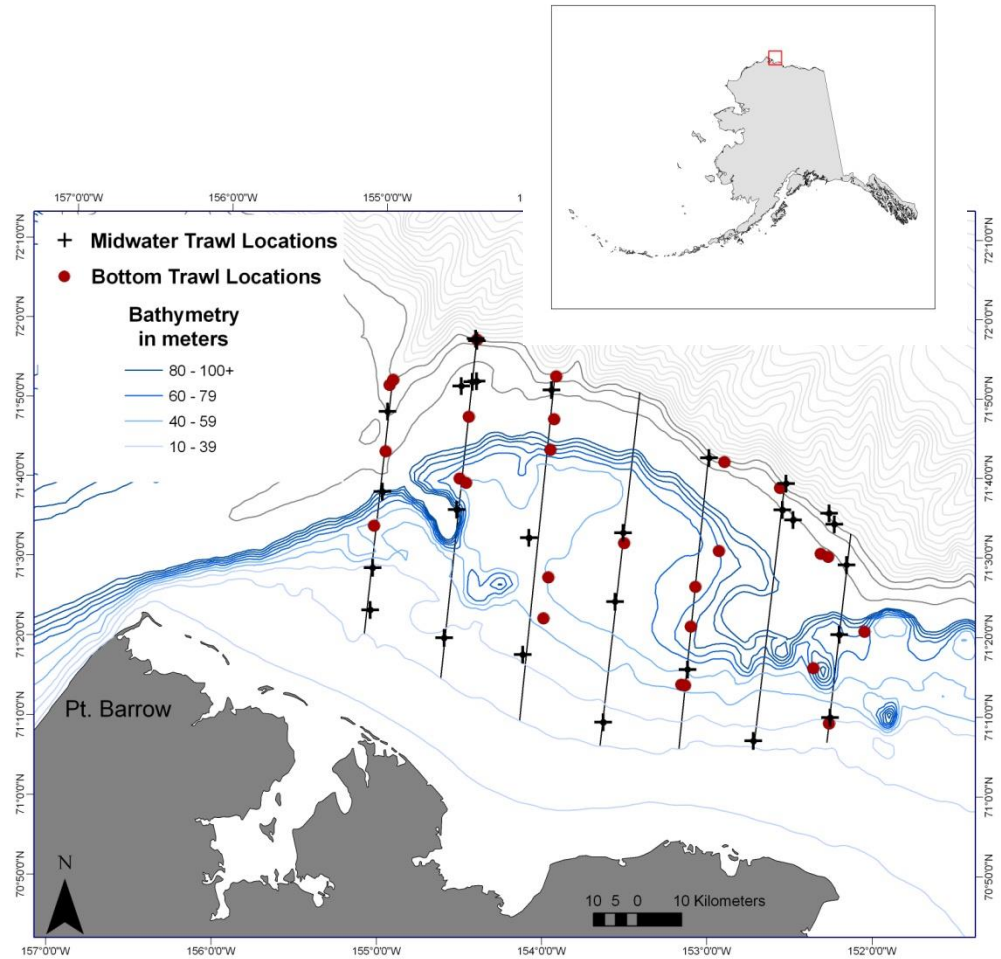
Walleye pollock



Bigeye sculpin



Salmon snailfish

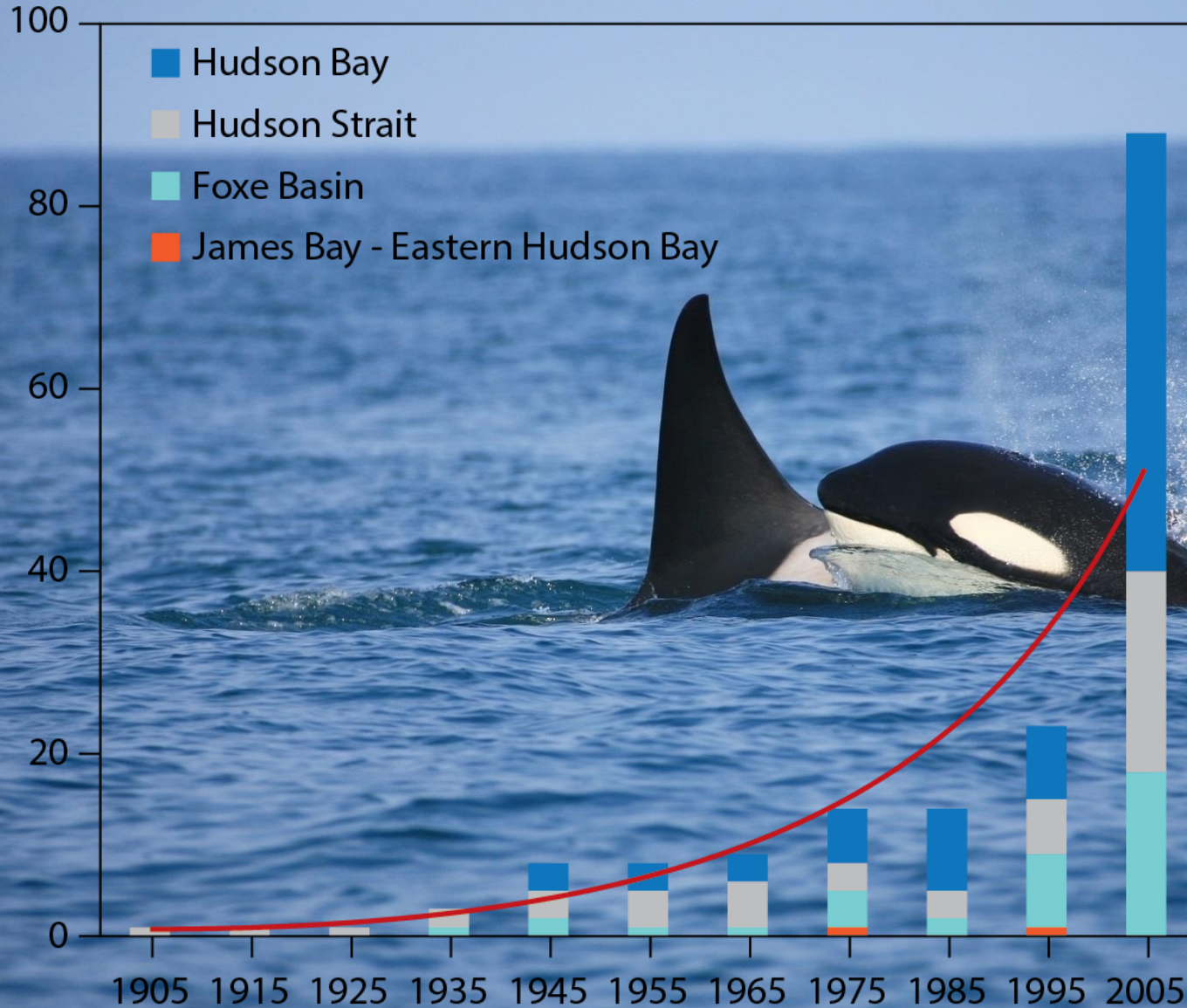


**Logerwell, L. 2008. Cruise Report for the 2008 Beaufort Sea Survey.**  
[http://www.afsc.noaa.gov/REFM/Stocks/fit/PDFS/Beaufort\\_sea\\_cruise\\_report.pdf](http://www.afsc.noaa.gov/REFM/Stocks/fit/PDFS/Beaufort_sea_cruise_report.pdf)





# Migration of Marine Life Northward



Number of Orca sightings. Arctic Biodiversity Assessment. CAFF 2013.

# Increasing Human Activity...

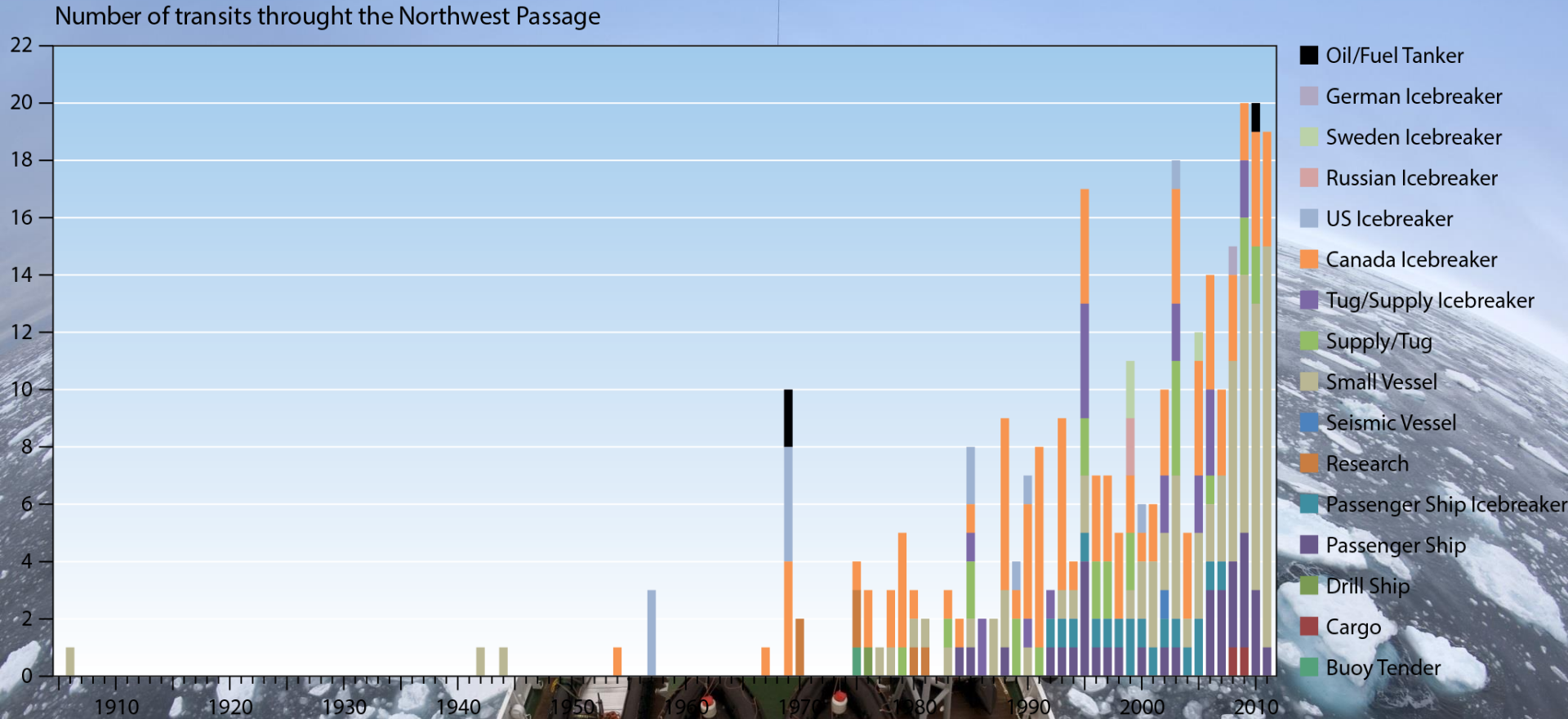
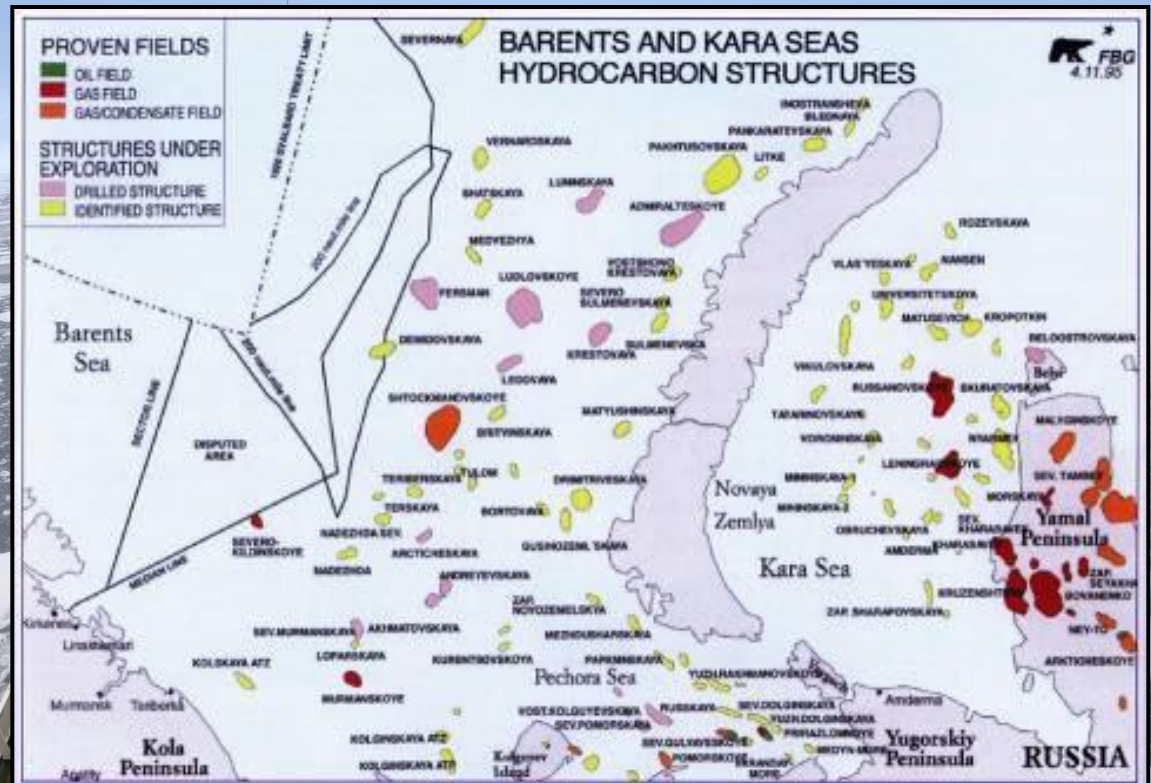
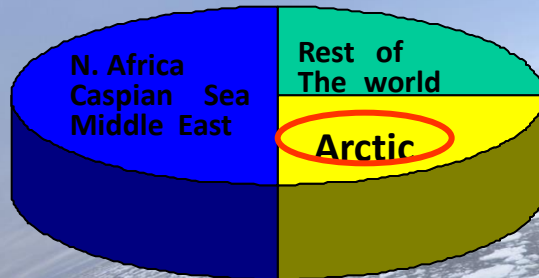


Figure : Ship transits of the Northwest Passage 1906-2011. From the NWT State of the Environment report (ENR 2011) with data from NORDREG updated to 2012. From Arctic Biodiversity Assessment. CAFF. 2013

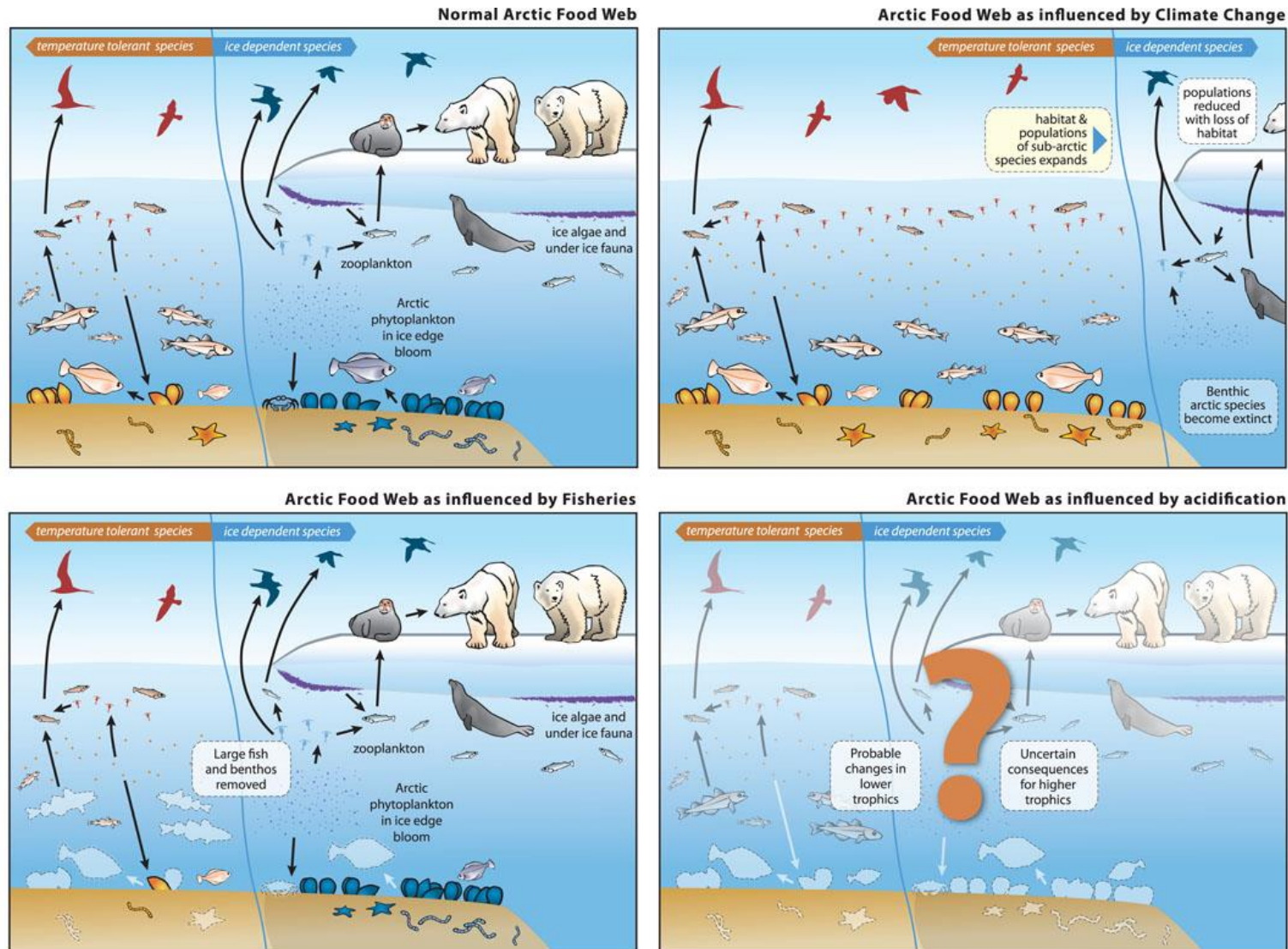


# Increasing Human Activity...





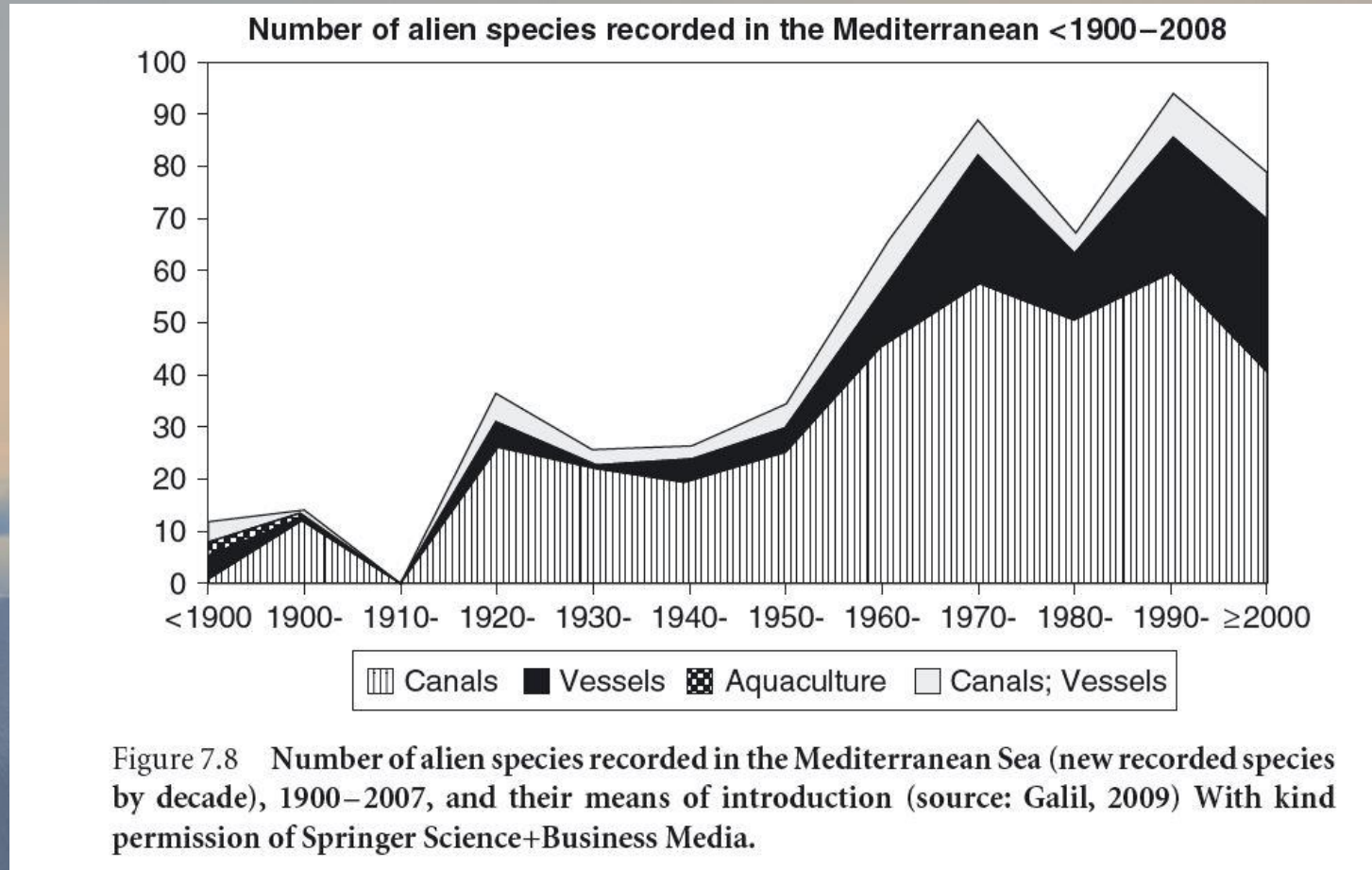
# Current Focus - Impacts of Climate Change; Increasing focus on Fisheries & Acidification



From Gill et al. Arctic Marine Biodiversity Monitoring Plan. 2011.

# Invasive Species – a Global Issue

*“Invasive species are a major threat to biodiversity (second only to habitat change)” – Millenium Ecosystem Assessment 2005*



*From: Biodiversity Monitoring and Conservation: Bridging the Gap between Global Commitment and Local Action, First Edition. Edited by Ben Collen, Nathalie Pettorelli, Jonathan E.M. Baillie and Sarah M. Durant.*

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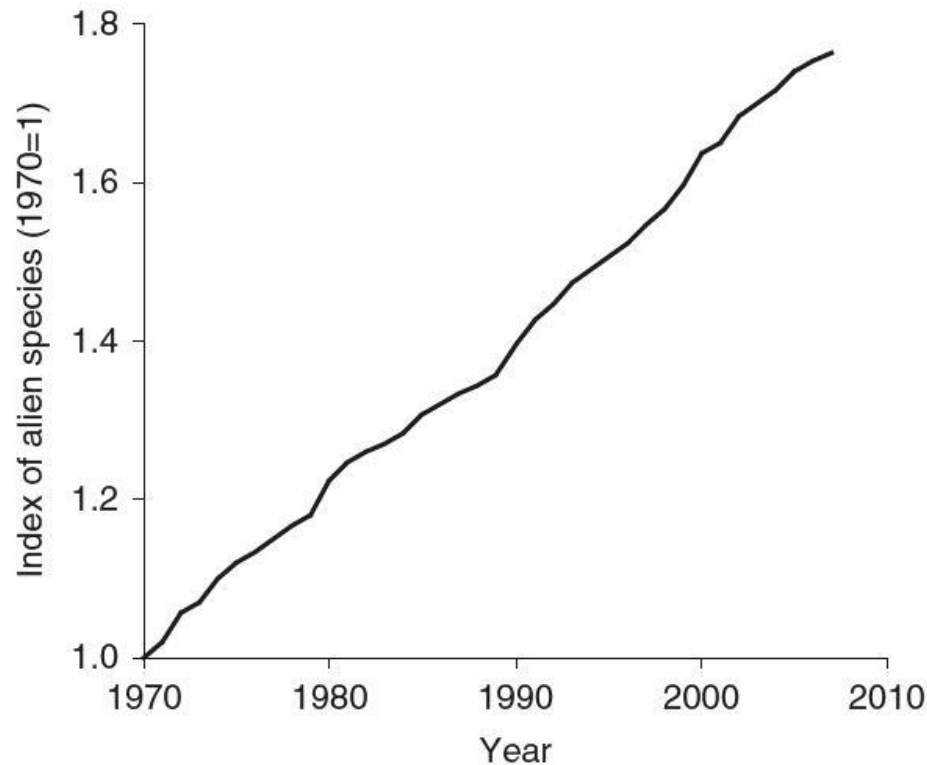


Figure 7.5 Index of trends in number of alien species in Europe during 1970–2007. From Butchart *et al.*, 2010.

*From: Biodiversity Monitoring and Conservation: Bridging the Gap between Global Commitment and Local Action, First Edition. Edited by Ben Collen, Nathalie Pettorelli, Jonathan E.M. Baillie and Sarah M. Durant.*



# Global Response to Invasive Alien Species

**CBD 2020 Aichi Target 9** – By 2020, invasive alien species

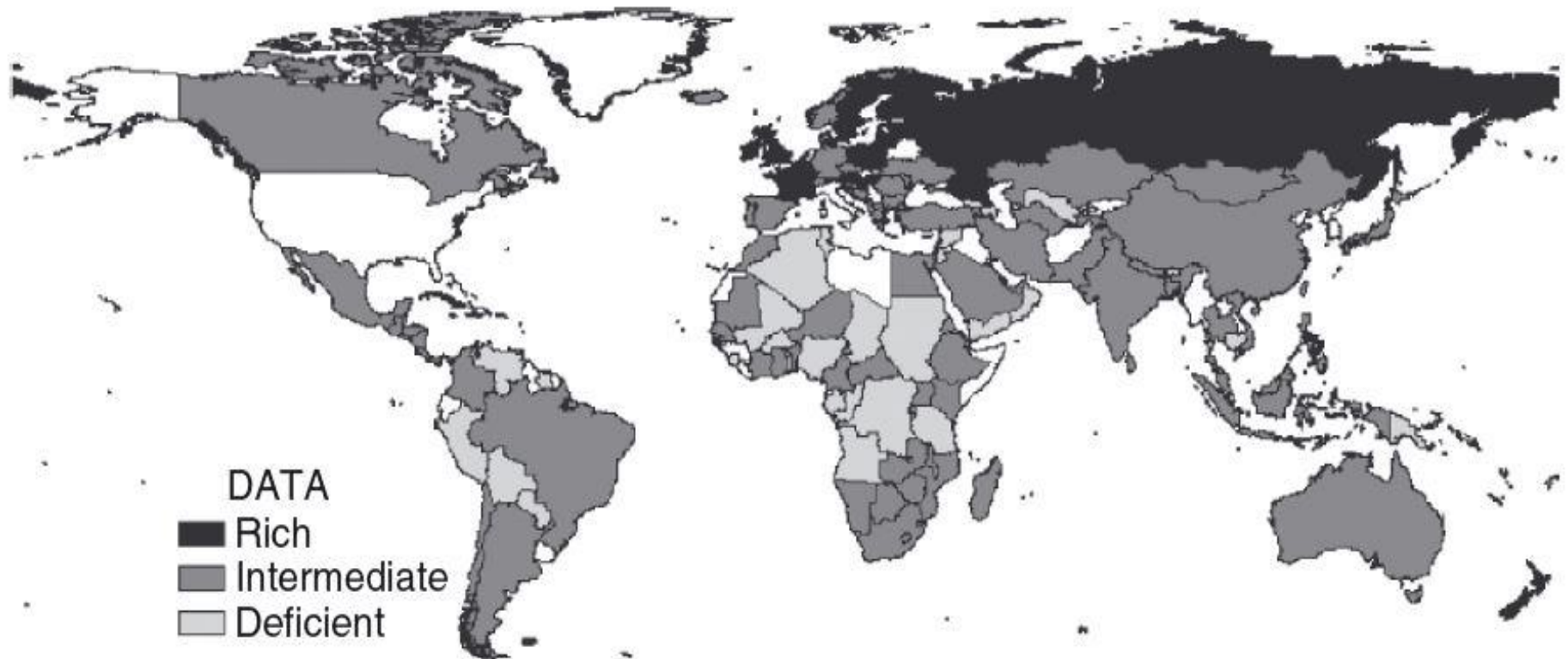


Figure 7.1 Status of Invasive Alien Species information for countries signatory to the Convention on Biological Diversity. With permission from John Wiley & Sons.

# Global Invasive Species Database

GLOBAL INVASIVE SPECIES DATABASE

100 OF THE WORST

DONATIONS

HOME

Standard Search

Taxonomic

Site Index

Species name

Country or location

Habitat

Organism type

GO

WELCOME TO THE GLOBAL INVASIVE SPECIES DATABASE

LATEST ADDITIONS

[Clarias gariepinus](#)

[Ageratina adenophora](#)

[Hemitraqus iemlalicus](#)

[Tamias sibiricus](#)

[Andropogon qayanus](#)

[Herpestes pulverulentus](#)

[Tenrec ecaudatus](#)

[Canis latrans](#)

[Martes melampus](#)



The Global Invasive Species Database (GISD) aims to increase awareness about invasive alien species and to facilitate effective prevention and management activities. It is managed by the Invasive Species Specialist Group (ISSG) of the SSC- Species Survival Commission of the IUCN -International Union for Conservation of Nature. The GISD was developed as part of the global initiative on invasive species led by the Global Invasive Species Programme GISP and was/is supported through partnerships with the National Biological Information Infrastructure (NBII), Manaaki Whenua-Landcare Research and the University of Auckland.

The GISD focuses on invasive alien species that threaten native biodiversity and natural ecosystems and covers all taxonomic groups from micro-organisms to animals and plants in all ecosystems. Species information is either supplied by or reviewed by expert contributors from around the world.

As the database is continually being populated with species information, please check back on a regular basis for updates. See the site index for more information. If you have questions or comments about the GISD, please contact [Shyama Pagad](#), Program Officer of the ISSG.

  
Invasive Species Specialist Group

  
Manaaki Whenua  
Landcare Research

  
NBII

  
IUCN  
The World Conservation Union



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<http://www.issg.org/database/welcome/>

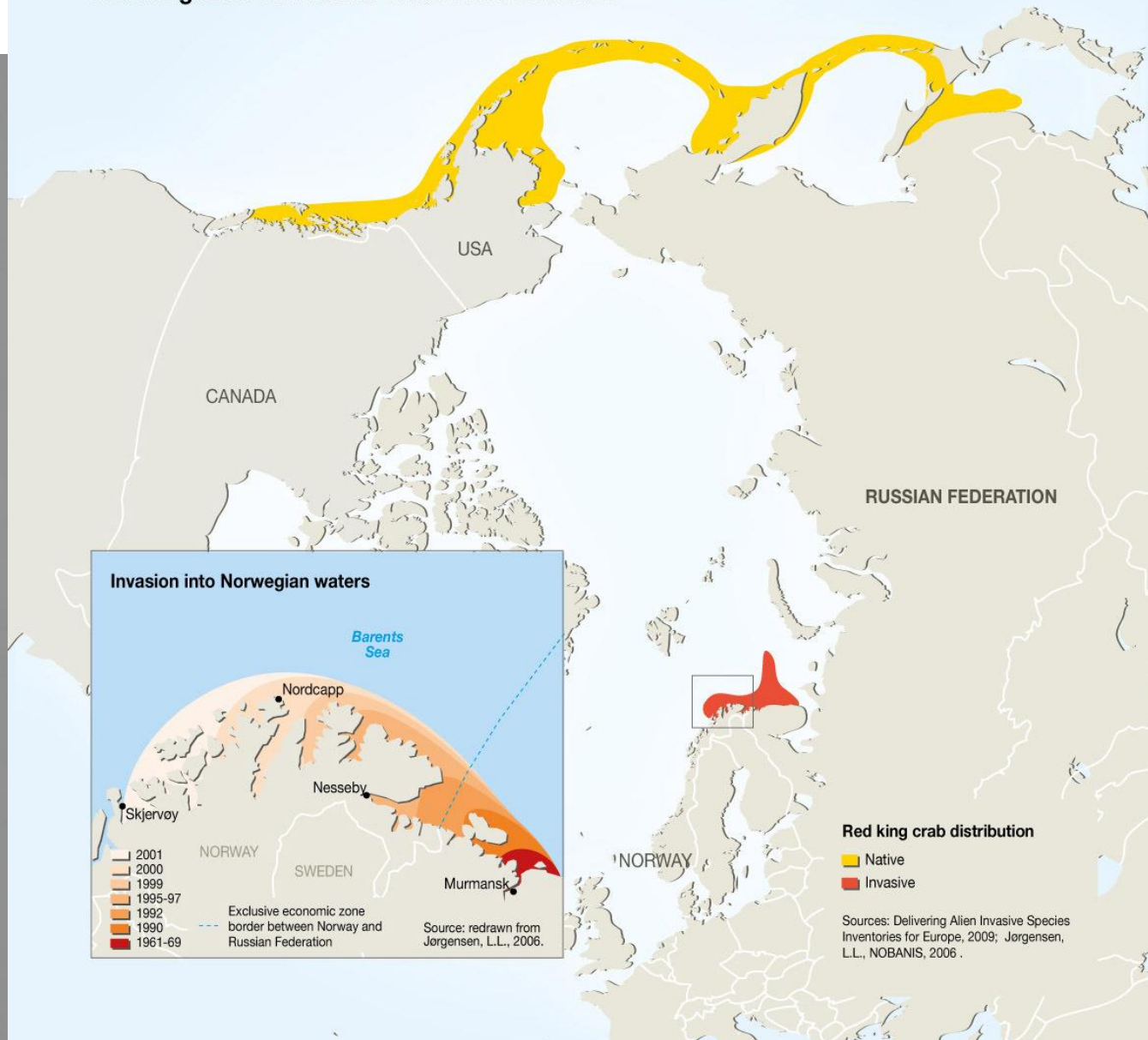
# Arctic Marine Invasives – Current Knowledge

- **Limited studies & surveillance, but few known Arctic invasive species to date**
- **Increased potential for marine invasive species, due to:**
  - Increased human activity (e.g. shipping)
  - Warming marine ecosystem, leading to altered recruitment timing and growth rates





## Red king crab native and invasive distribution



# The Arctic

Limited capacity for research and monitoring...





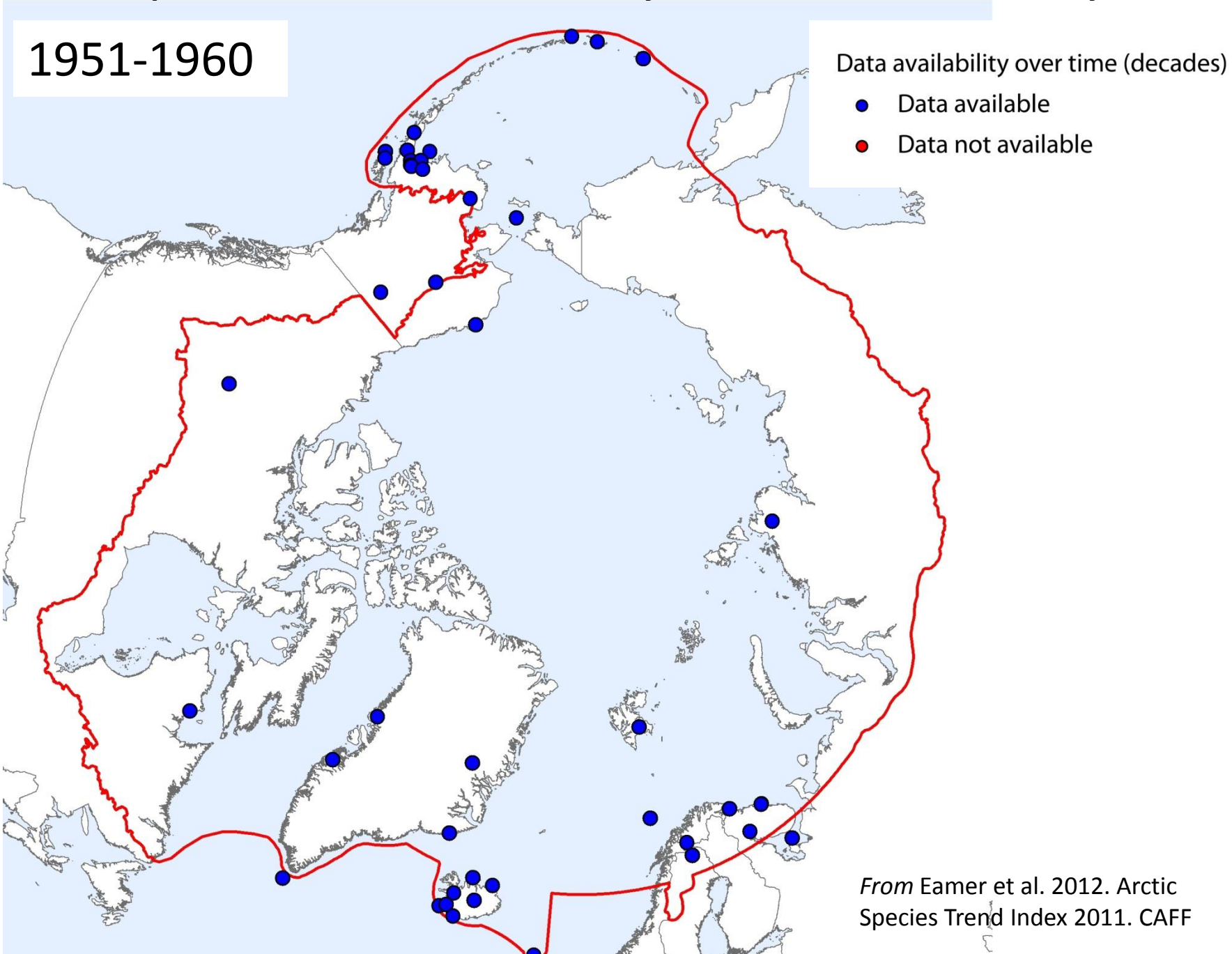
# The Arctic

Limited ability to detect invasive  
alien species...





# Vertebrate Population Trend Data Availability Over Time, Summarized by Decade

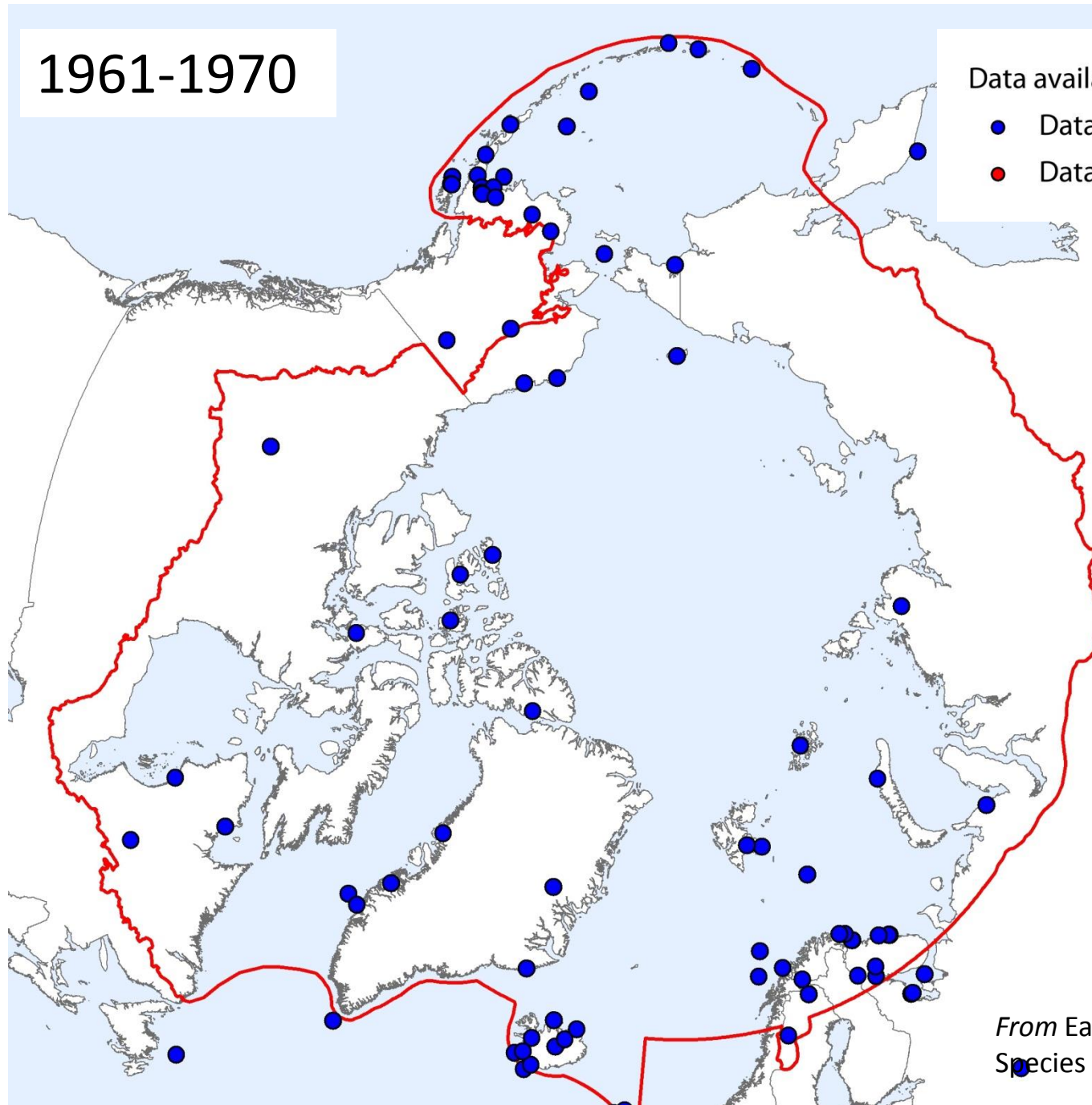


1961-1970

Data availability over time (decades)

● Data available

● Data not available



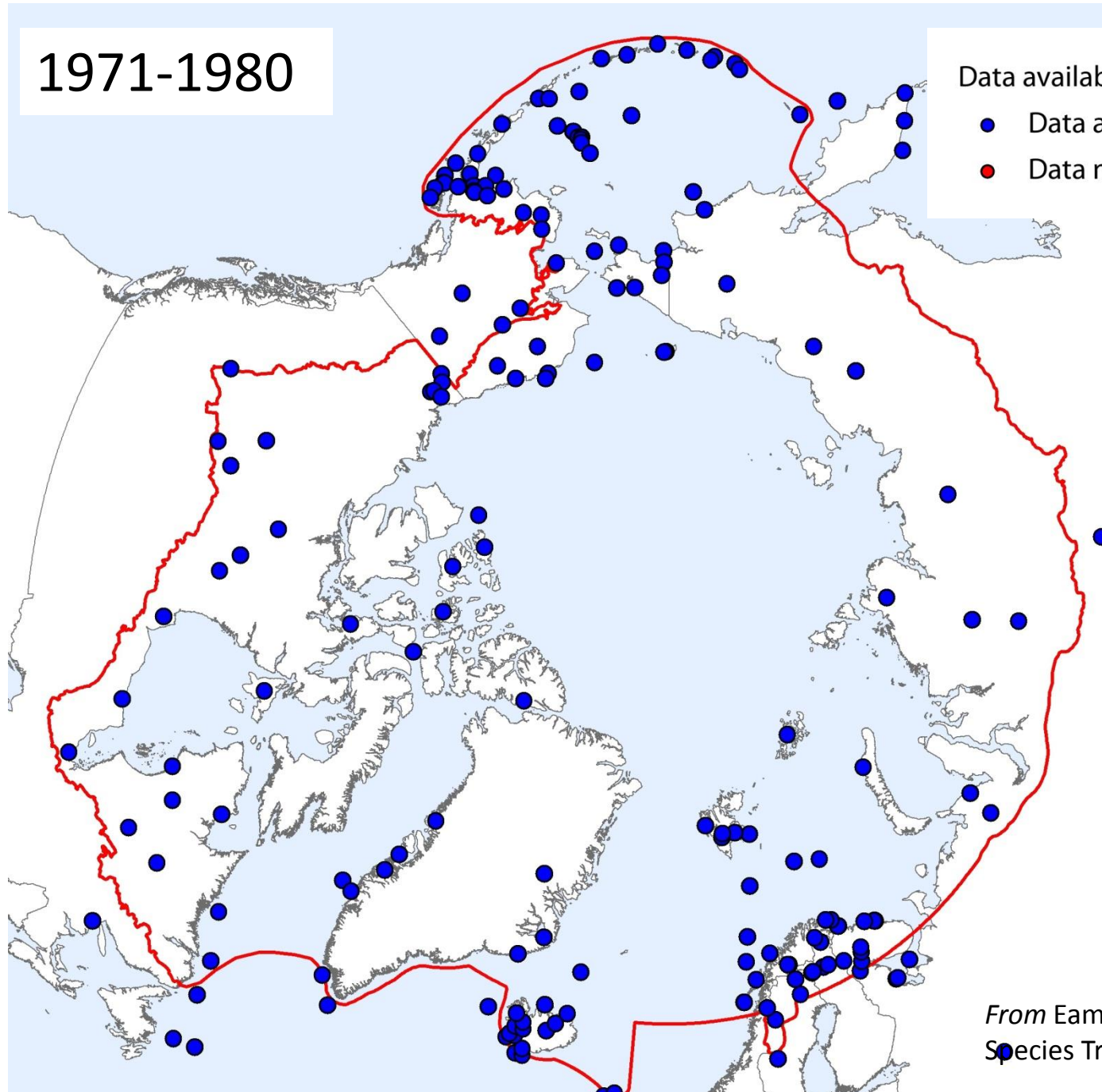
From Eamer et al. 2012. Arctic  
Species Trend Index 2011. CAFF

1971-1980

Data availability over time (decades)

• Data available

• Data not available



From Eamer et al. 2012. Arctic  
Species Trend Index 2011. CAFF

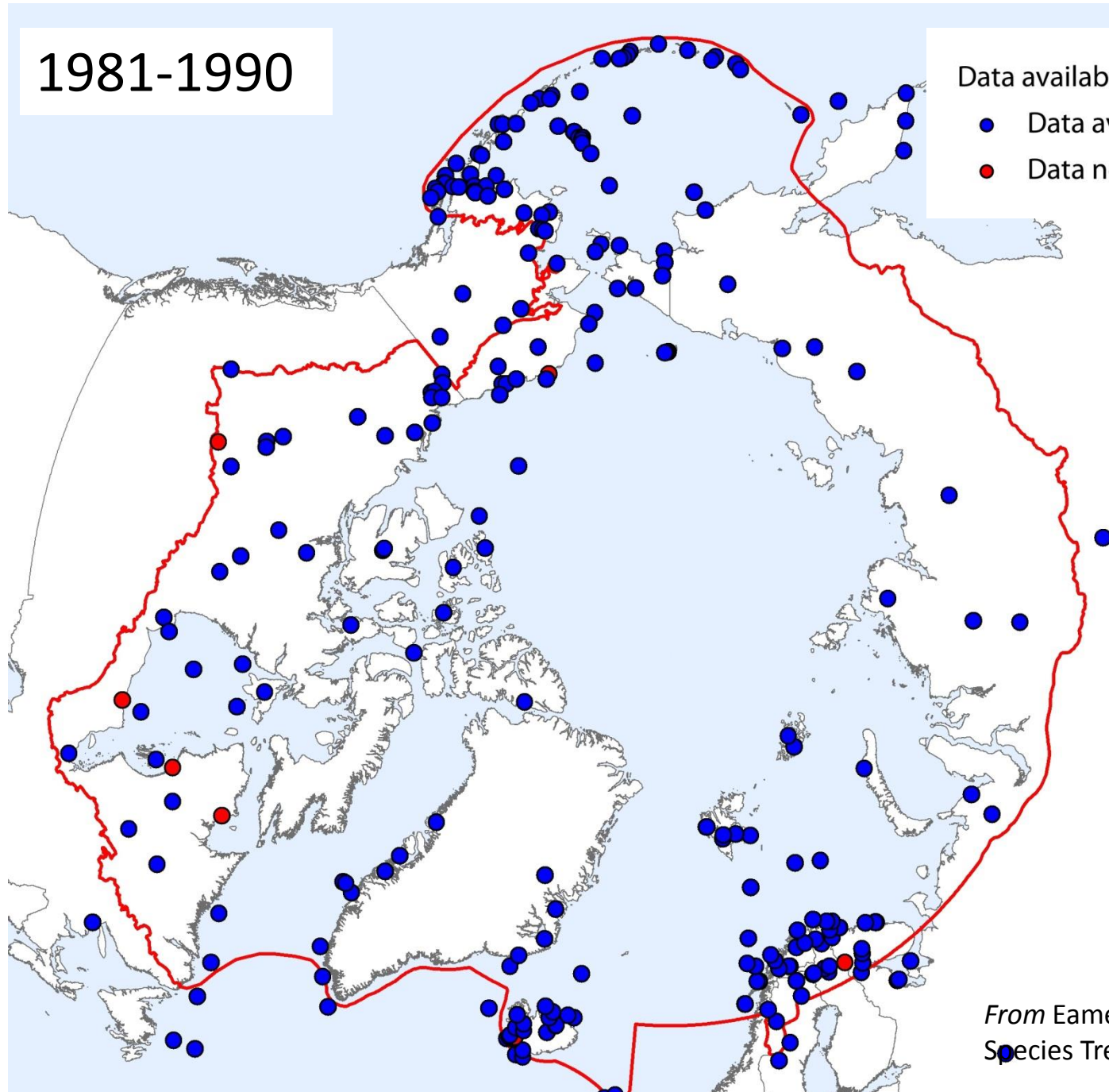


1981-1990

Data availability over time (decades)

• Data available

• Data not available



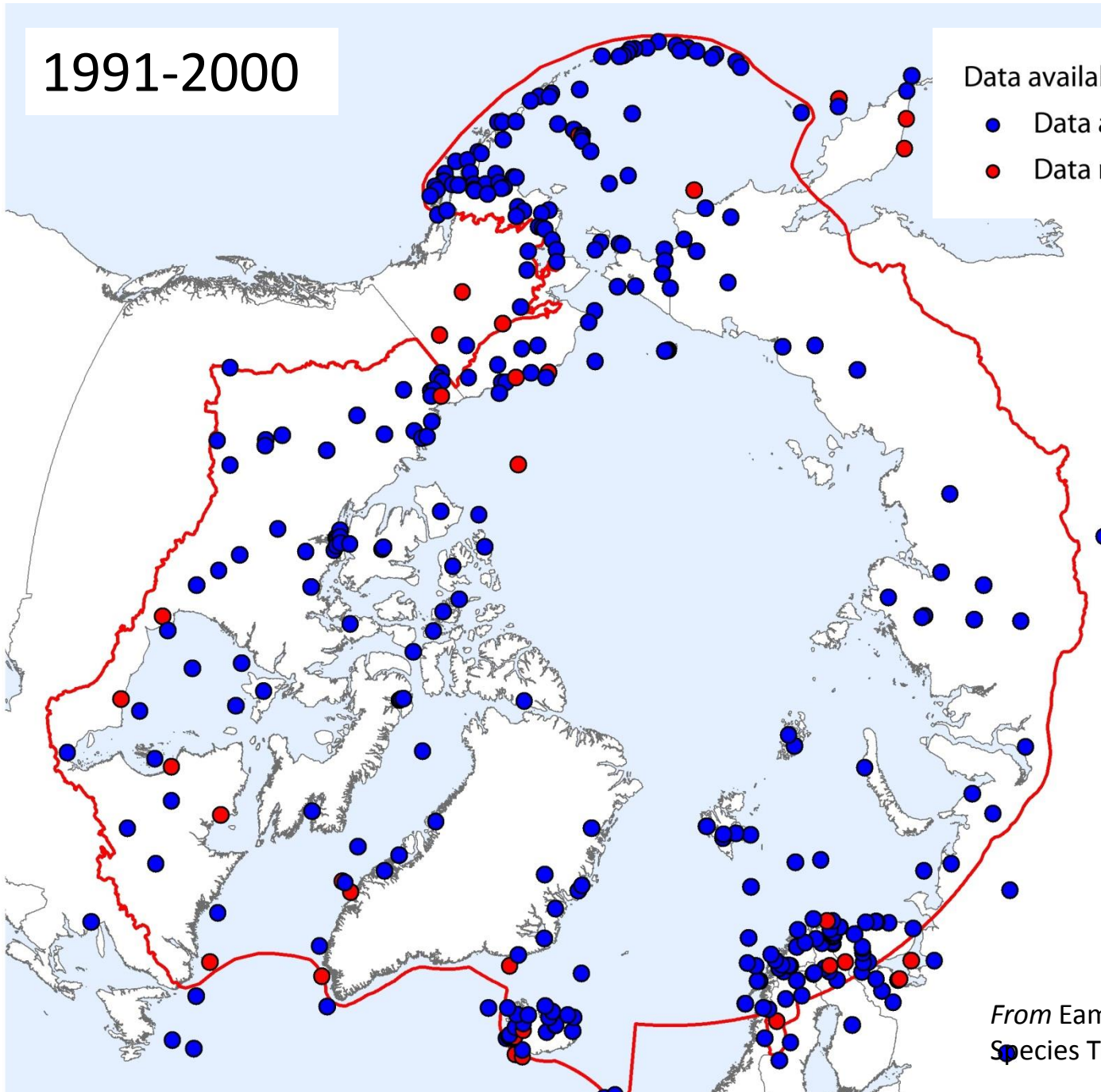
From Eamer et al. 2012. Arctic  
Species Trend Index 2011. CAFF

1991-2000

Data availability over time (decades)

● Data available

● Data not available



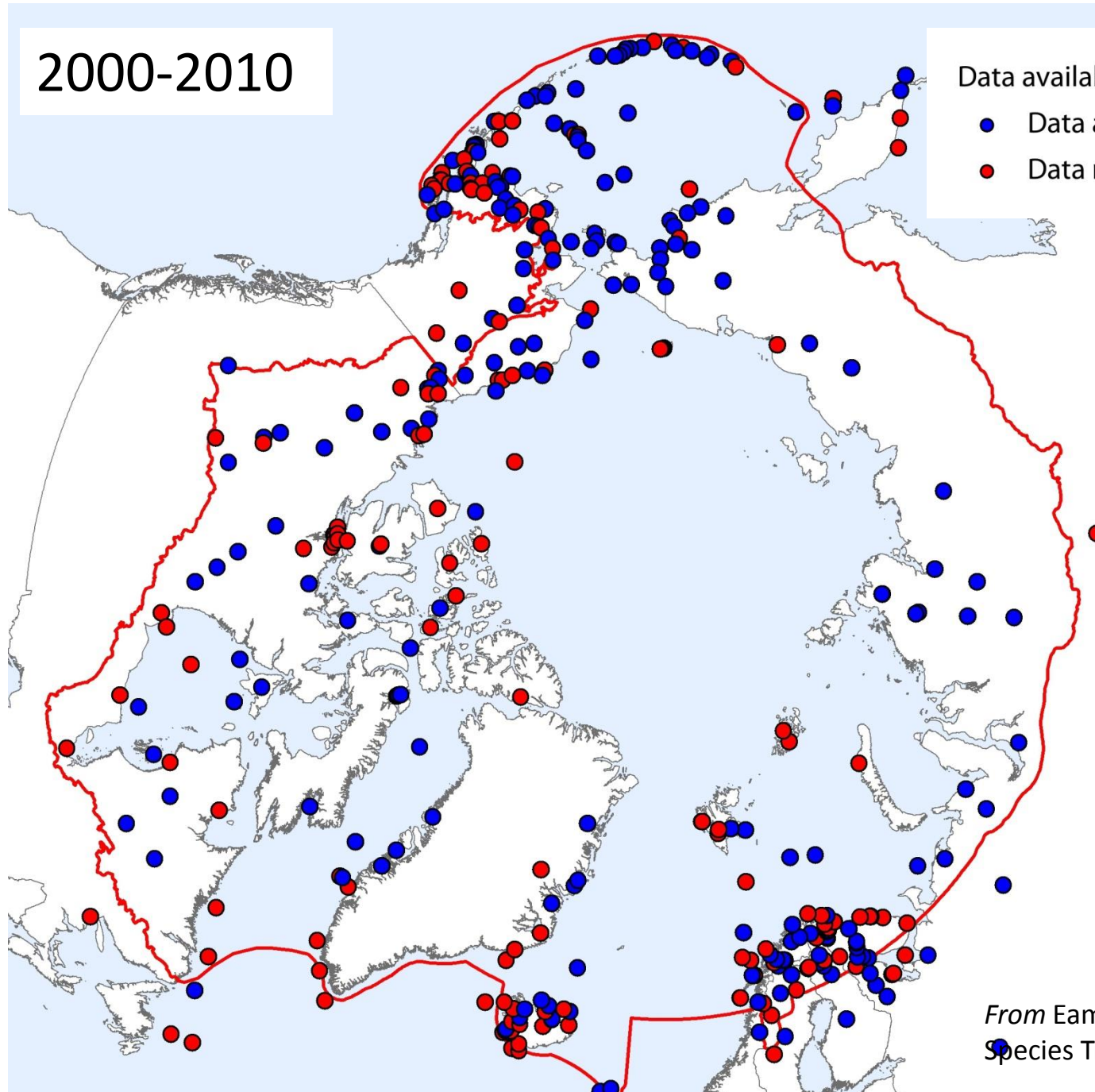
From Eamer et al. 2012. Arctic  
Species Trend Index 2011. CAFF

2000-2010

Data availability over time (decades)

● Data available

● Data not available

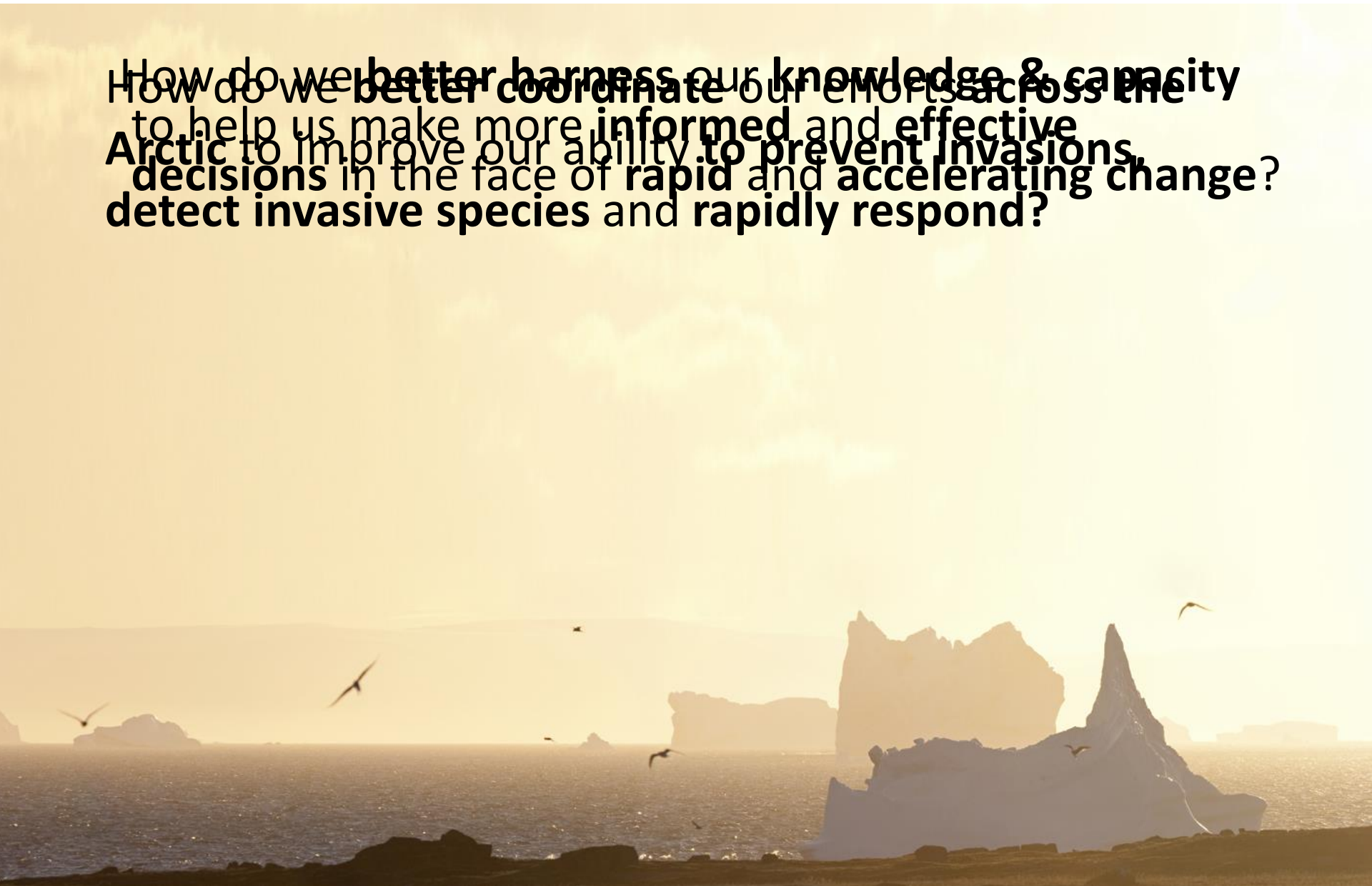


From Eamer et al. 2012. Arctic  
Species Trend Index 2011. CAFF



# The Challenge

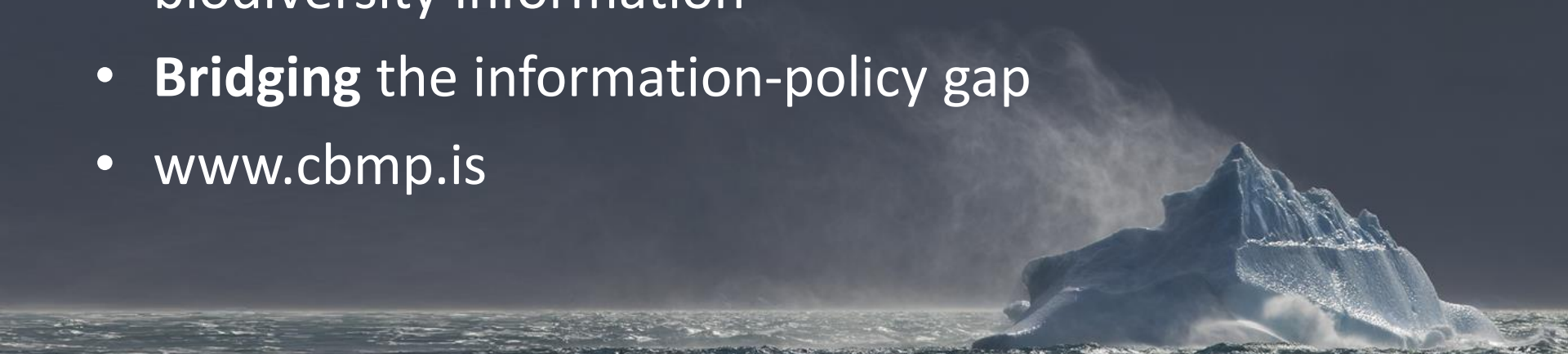
How do we better harness our knowledge & capacity  
How do we better coordinate our efforts across the  
to help us make more informed and effective  
Arctic to improve our ability to prevent invasions,  
decisions in the face of rapid and accelerating change?  
detect invasive species and rapidly respond?



# Meeting the Challenge: The Circumpolar Biodiversity Monitoring Programme



- **Arctic Council (CAFF) Program;** Co-led by Denmark/Greenland and USA
- **International network** improving detection, understanding and reporting of Arctic biodiversity trends
- **Focal point** for current and credible Arctic biodiversity information
- **Bridging** the information-policy gap
- [www.cbmp.is](http://www.cbmp.is)



# CBMP Approach: Capacity Building



**IveGot1**  
Identify and Report  
Invasive Animals and Plants  
in Florida

ANDROID APP ON  
 Google play

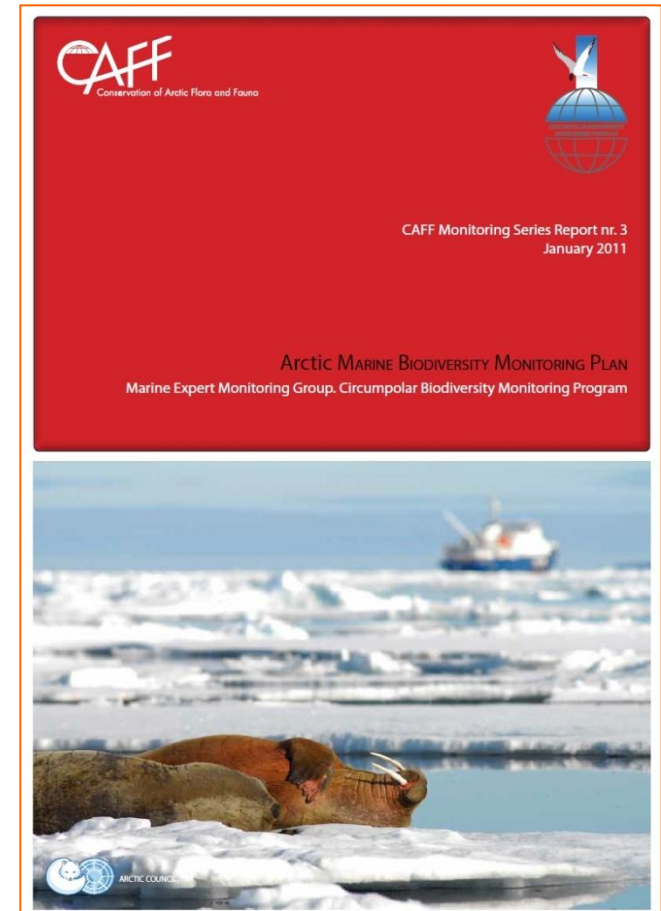
Available on the  
App Store





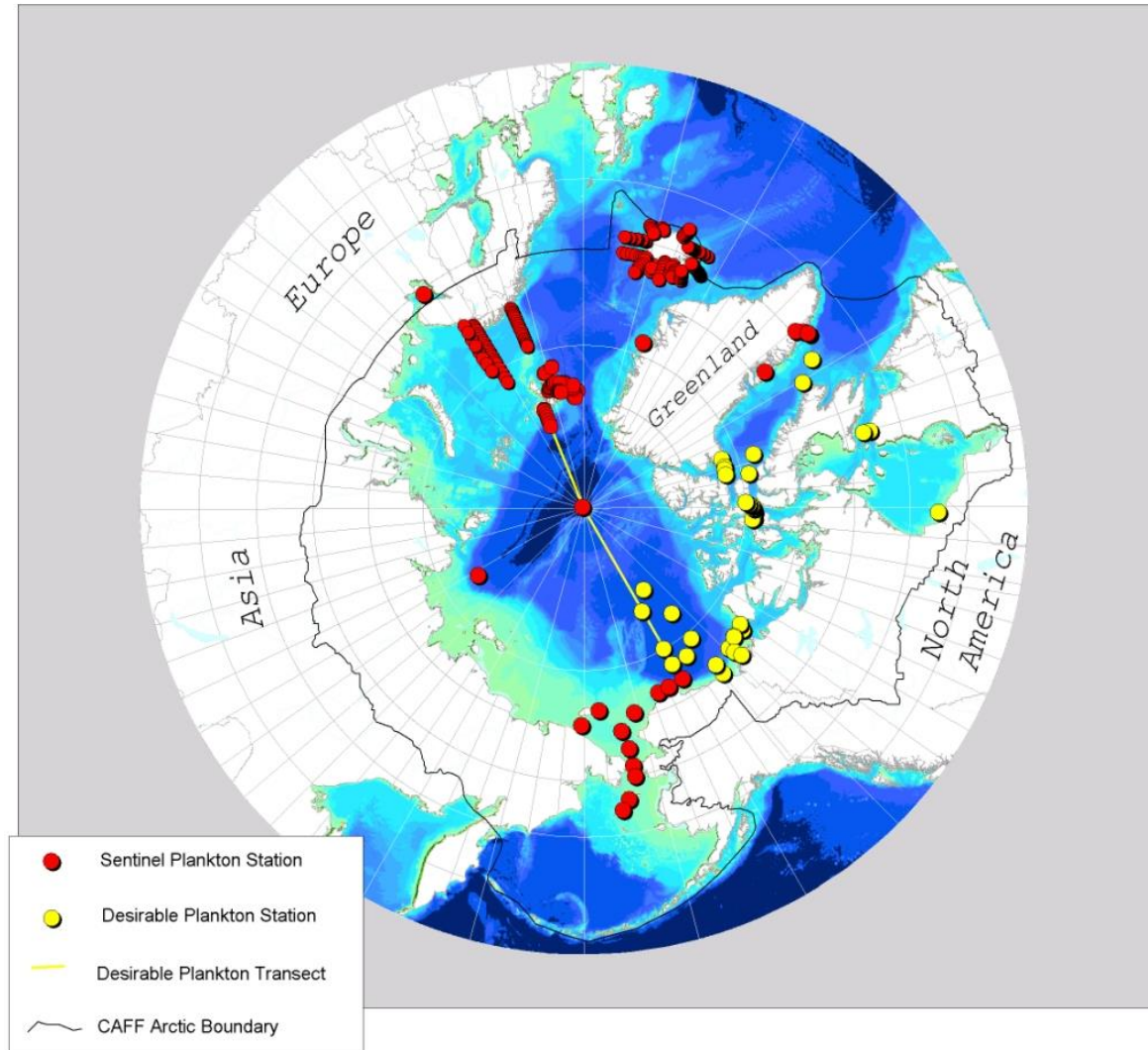
# CBMP Approach: Coordinated Monitoring

- Expert Monitoring Groups (EMGs):
  - **Marine, Coastal, Freshwater, Terrestrial**
  - Ecosystem-based, network of networks
  - Forum for scientists and community experts
  - Pan-Arctic, integrated monitoring plans



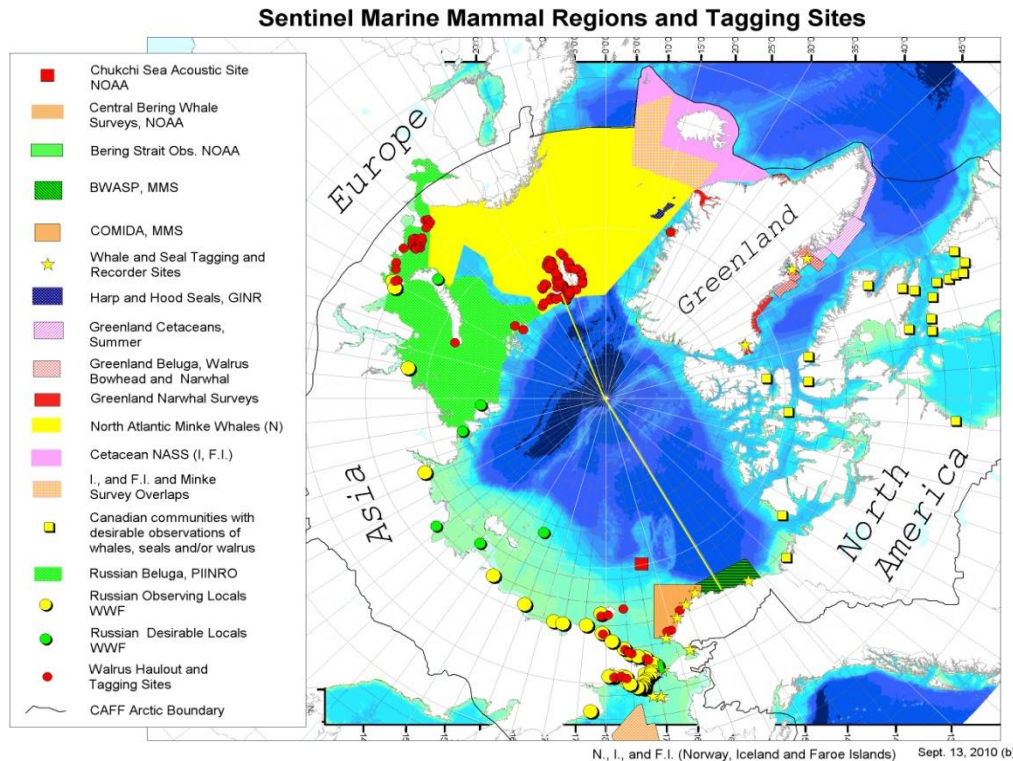
# Pan-Arctic Collaboration

**Sentinel Plankton Stations and Transects**



*From Gill et al. 2011.*  
Arctic Marine  
Biodiversity Monitoring  
Plan

# Pan-Arctic Collaboration

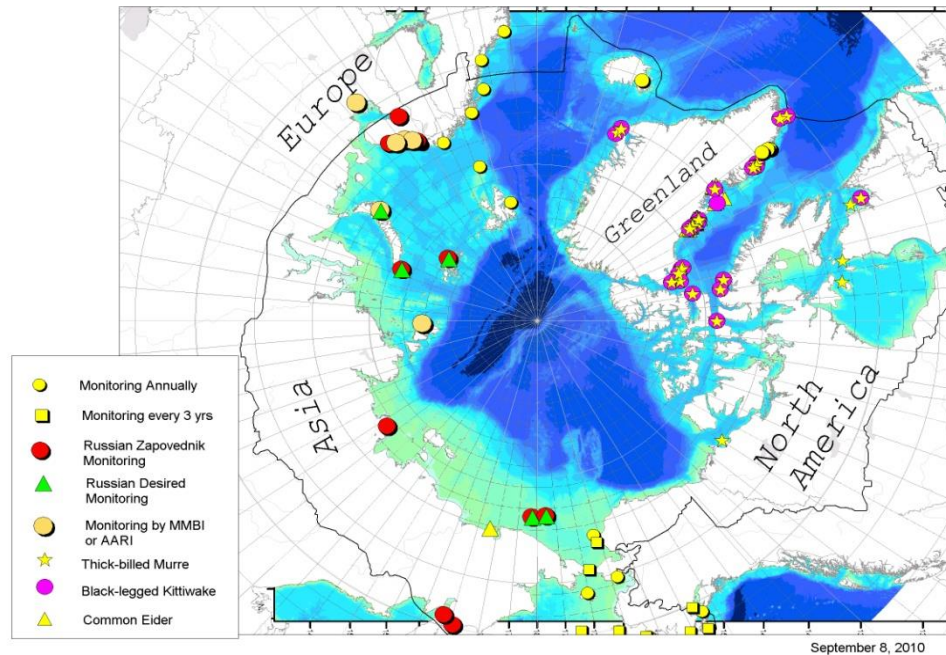


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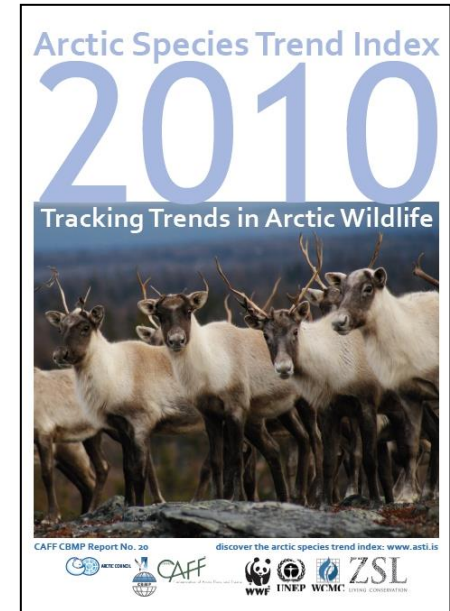
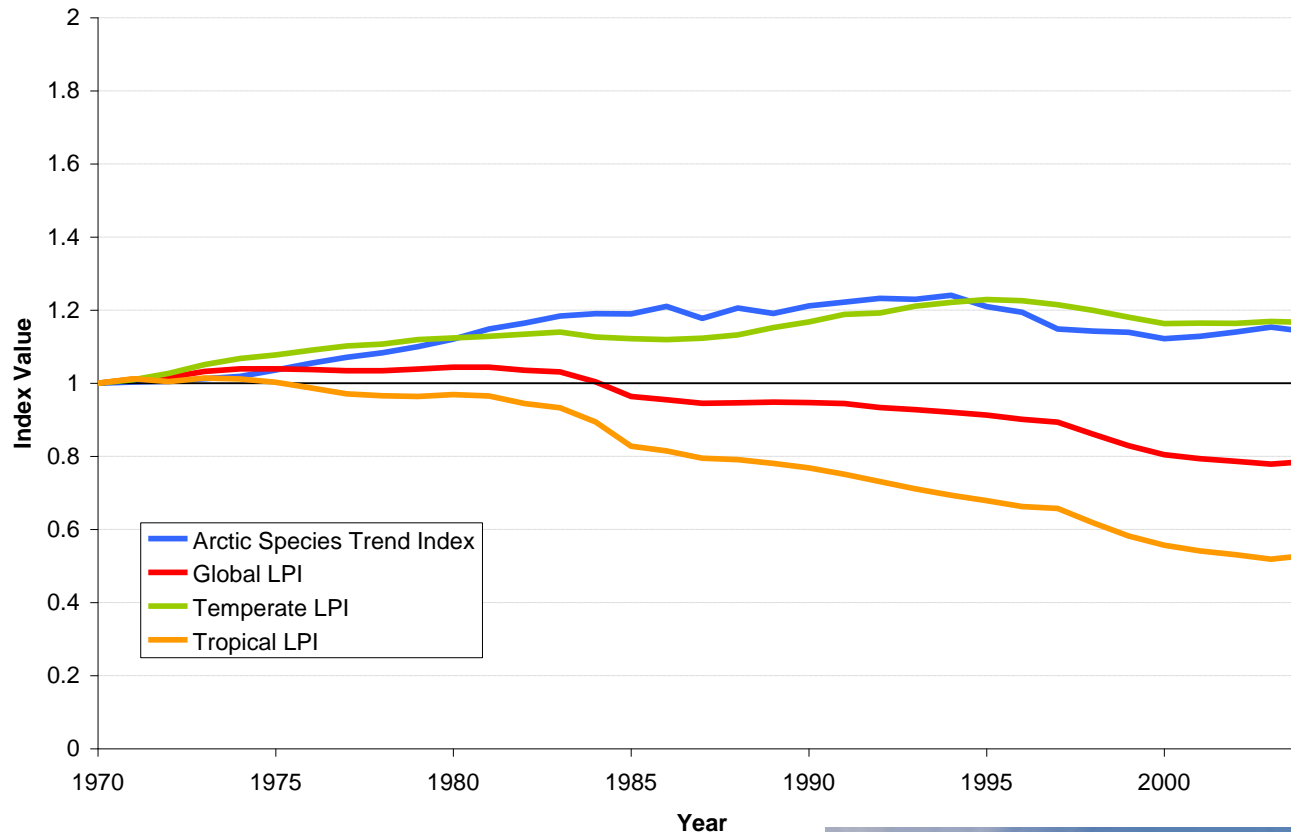
# Pan-Arctic Collaboration

**Sentinel Seabird Monitoring Sites**



From Gill et al. 2011.  
Arctic Marine  
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Plan

# CBMP Output: Indices & Indicators

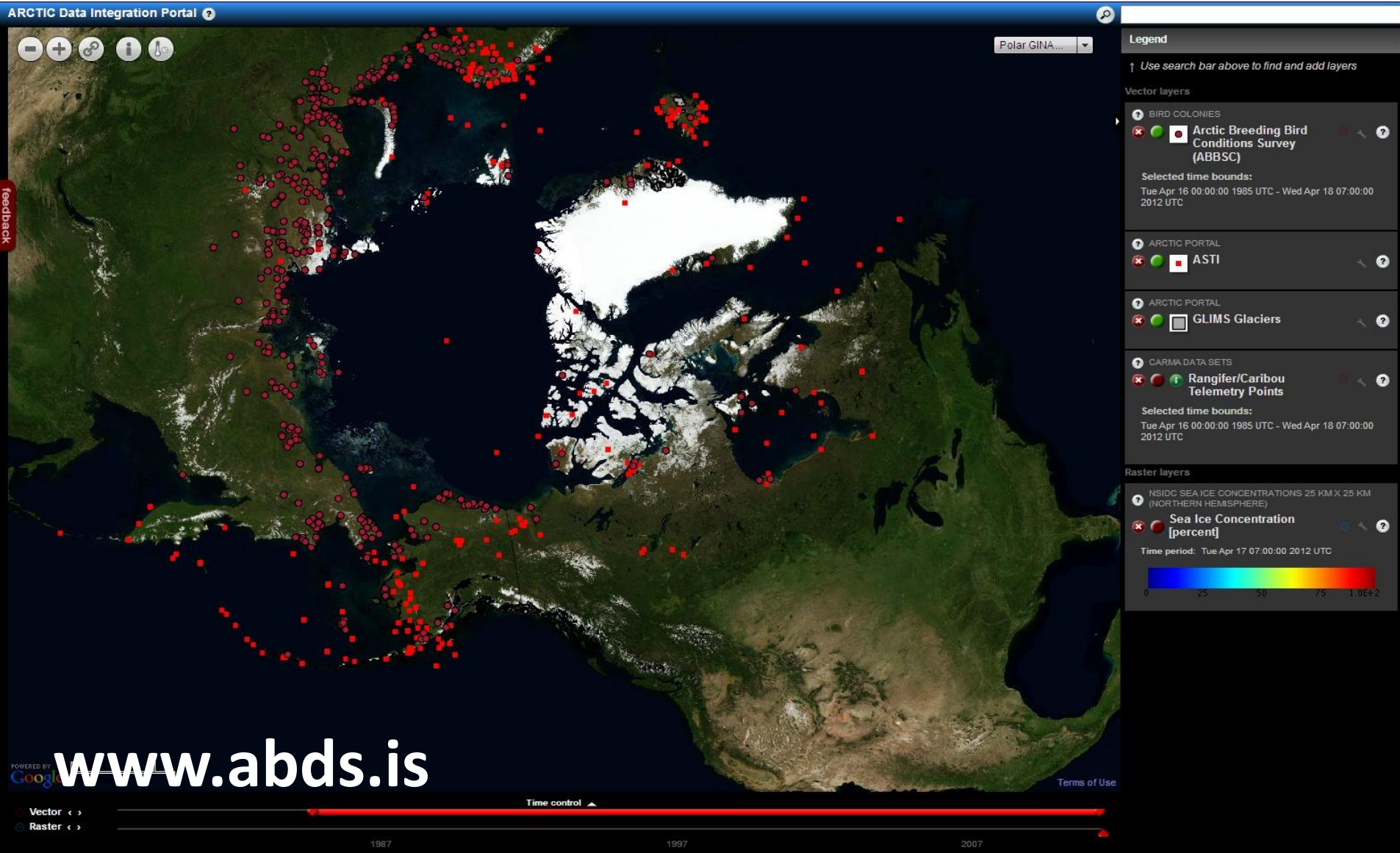


[www.asti.is](http://www.asti.is)





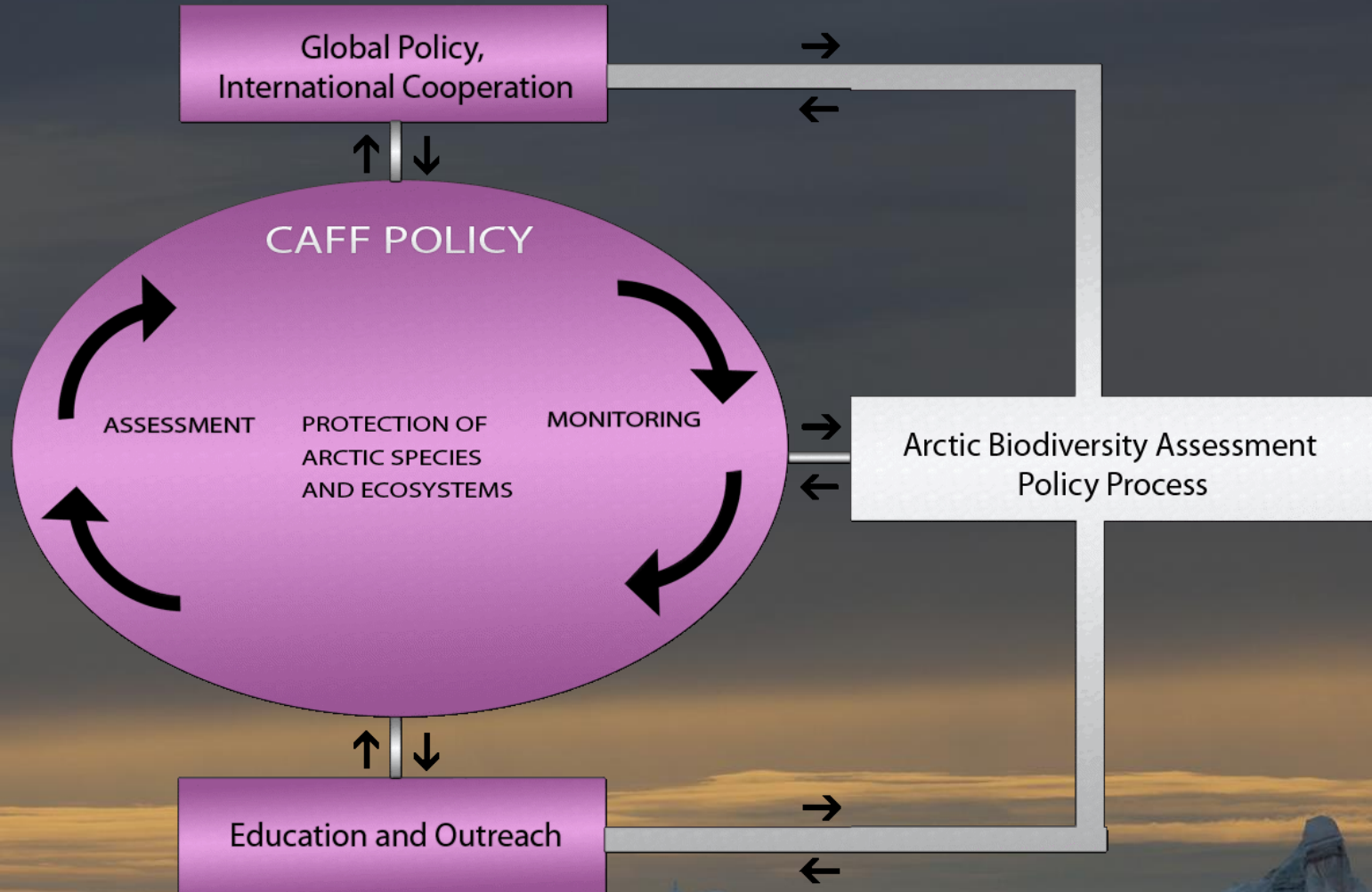
# CBMP Tools: Arctic Biodiversity Data Service





# Rapid assessments for rapid change

Move towards **dynamic, forward-looking** analysis



# Recommendations

- Early Detection:
  - Build on existing Arctic networks & focus efforts on areas of high potential for invasions
  - Deploy new technologies (e.g. smartphones) to increase community-based surveillance of Invasive Alien Species





# Recommendations

- Early Detection:
  - Utilize interoperable data systems and networks to share information on new or potential invasions





# Recommendations

- Prevention:
  - Build on Canada's Arctic Council 'Safe Arctic Shipping' initiative and/or International Maritime Organization's work towards Polar Shipping Standards





# Recommendations

- Draw on & contribute to global examples/tools:
  - Utilize/contribute to the Global Invasives Database
  - Develop Arctic Regional Invasive Species Indicator
  - Investigate Antarctic's approach to detecting and preventing Alien Invasive Species







# Tak!

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