



# Climate Change and Arctic Marine Ecosystems



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U.S. Arctic Research Commission

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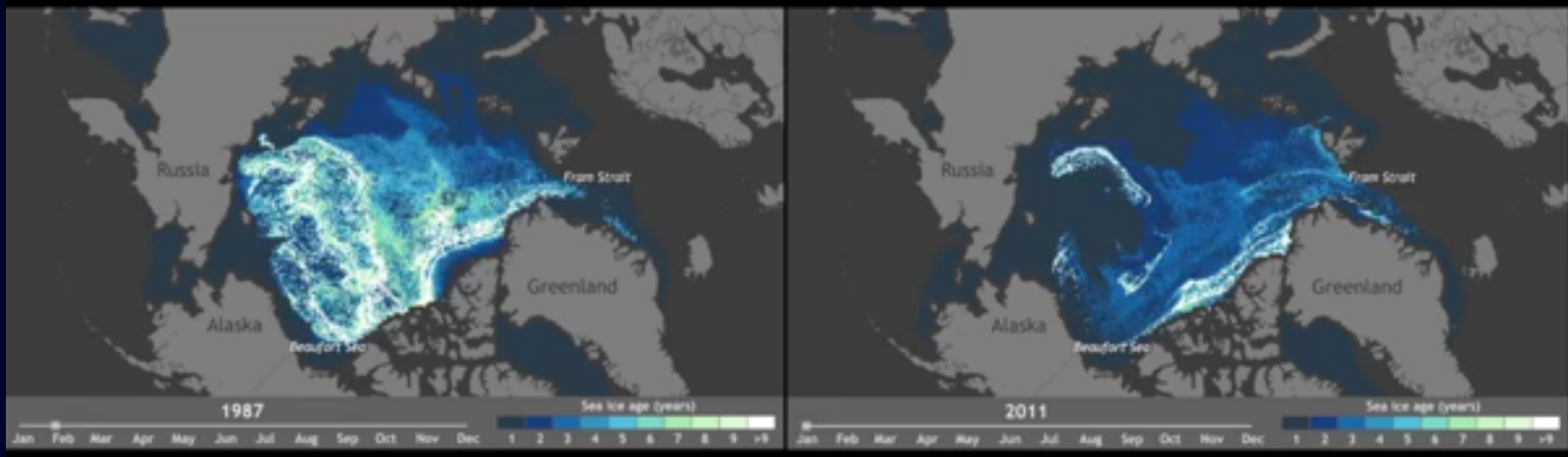
*3<sup>rd</sup> Meeting of Scientific Experts on Fish Stocks in the Arctic Ocean*

# Workshop Series History

- 1) First “workshop” meeting in Anchorage, 2012
- 2) 2<sup>nd</sup> Scientific Meeting on Arctic Fish Stocks, Tromsø, October 28-31, 2013
- 3) 3<sup>rd</sup> Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean, Seattle, WA, April 14-16, 2015

*Main Purpose: to enhance cooperative research in the international waters of the Central Arctic Ocean*





## Rapidly changing environment

- Warming temperatures (twice the global rate)
- Declining sea ice (50% area, 75% volume in 30 yr)
- Evolving ecosystems (winners and losers, subsistence)
- Thawing permafrost/carbon release
- Increasing human activity (fishing, oil and gas, shipping, tourism)
- Diminishing ice is making areas open to potential exploratory fishing in areas that have previously been inaccessible

A photograph of a walrus resting on a piece of sea ice. The walrus is the central focus, looking towards the camera. The background shows a vast expanse of sea ice under a blue sky with scattered white clouds. The overall color palette is dominated by blues and whites.

## REDUCTION IN SEA ICE

“Step Change”  
noted in 2000-2002  
then lowest sea ice  
extent recorded in  
September 2012

50% reduction in ice  
extent

“Step Change” in  
multi-year ice noted  
in 2008. Lowest  
amount ever  
recorded in 2012  
with a 75% loss in  
volume

Photo: National Geographic

# Productivity in the Arctic

The future: ~2035 NO summer sea ice  
What happens to productivity?

Forecasts for a 30% increase in annual production

**\*\*but we are approaching this level NOW in the shallow OCS\*\***

- Spring algal blooms are happening earlier and earlier
- Changing phenology
- Consequences for the dependent species and the ecosystem
- What does this mean for predator/prey relationships?

“Polar Bears are repackaged arctic cod.”



Arctic cod may serve as “bellwethers” of climate change

# Ocean acidification

- The Arctic Ocean is particularly sensitive to OA.
- Widespread acidification is occurring in the central Arctic Ocean and its surrounding seas.
- Because Arctic marine food webs are relatively simple, Arctic marine ecosystems are vulnerable to change when key species are affected by external factors.





# WHAT IS AT STAKE?

- Fish and Wildlife

Mortality, distribution, rate of reproduction/population size, body condition/size at maximum length, health, competition

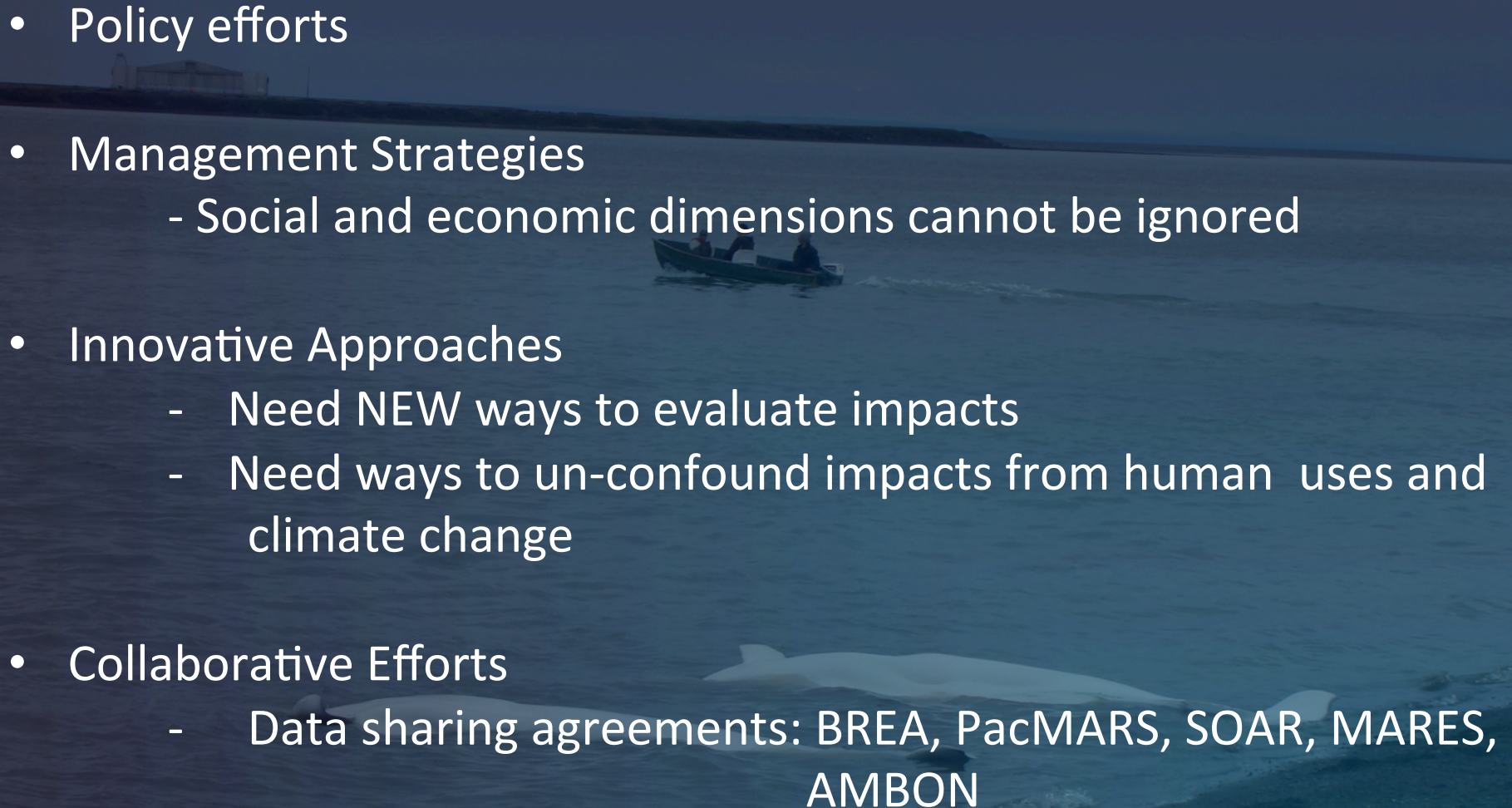
- Residents of the Arctic

Winter storms, ice changes making hunting dangerous or impossible, reduced access to subsistence resources and increased risk and reduced hunting efficiency, shipping and fisheries interest, impacts to infrastructure/economy

- The non-Arctic Population/mid-latitudes: What gets their attention?

Sea level rise? Maybe. Increased severity of storms? To some extent.

# What's in the toolbox?

- Policy efforts
  - Management Strategies
    - Social and economic dimensions cannot be ignored
  - Innovative Approaches
    - Need NEW ways to evaluate impacts
    - Need ways to un-confound impacts from human uses and climate change
  - Collaborative Efforts
    - Data sharing agreements: BREA, PacMARS, SOAR, MARES, AMBON
- 
- A small boat with three people is on the water, with a coastline in the background. The image is a dark, blue-toned photograph of a coastal scene. In the foreground, a small boat with three people is on the water. In the background, a coastline with some buildings is visible under a dark sky. The overall tone is dark and moody.

# Approaches

- Design and support policy measures and management strategies that protect populations at risk
- Conduct research to better understand the Arctic ecosystem *holistically*
- Collect information on how underlying ecosystem productivity changes with sea ice loss and its impact on arctic species
- Develop methods to un-confound human and climate change impacts
- Researchers need to communicate needs/research gaps



# Fisheries management requires reliable data

- Each Arctic country has its own management approach and data requirements
  - Often the way science informs management differs, as well
- How do we best bridge these differences?
- How do we find the most effective way to discuss common problems and potential solutions?