A circumpolar assessment of Arctic marine mammals and sea ice loss, with conservation recommendations for the 21st century

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Originated from the CAFF ABA Mammals Chapter (Reid, Berteaux, and Laidre 2013), talk on Wednesday Dec 3 at 10:30

16 marine mammal expert authors from 5 Arctic nations

Expanded to include assessment of sea ice habitat and recommendations for Arctic marine mammal conservation

Objectives

Summarize available data on population abundance and trend for each Arctic marine mammal species and subpopulation

Quantify species richness, the extent of human use, and a comparative circumpolar measure of habitat loss

Make conservation recommendations relative to data gaps, sea ice forecasts, and anthropogenic activities

Motivation

Warming in the Arctic over the past few decades has been about two times greater than the global mean

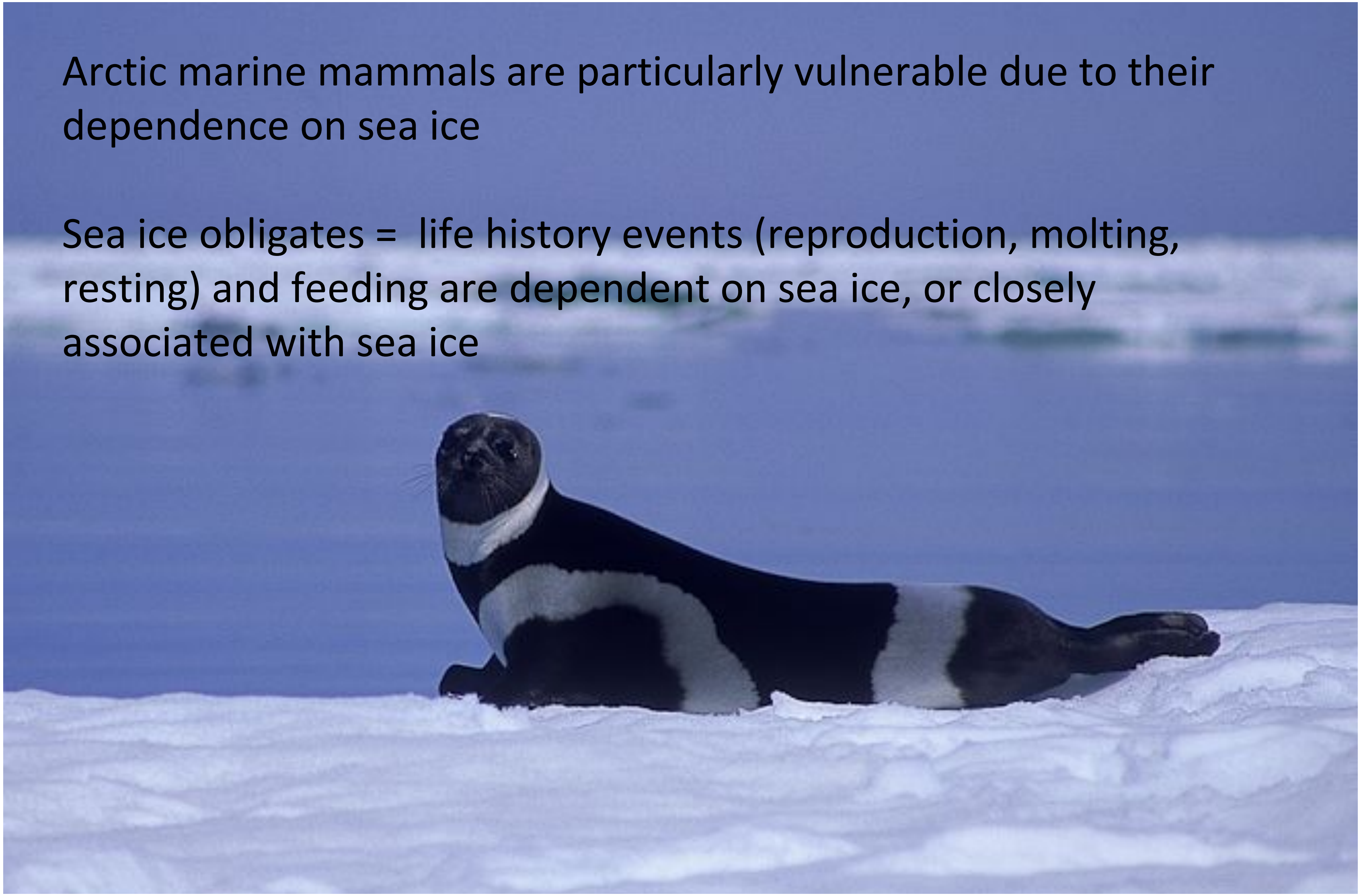
The rate of loss of Arctic sea ice is faster than predicted by climate models and projections suggest a nearly ice-free Arctic in summer by 2040

(Stroeve et al. 2012, Overland & Wang 2013, IPCC 2013)

Ice-dependent or ice-associated

Arctic marine mammals are particularly vulnerable due to their dependence on sea ice

Sea ice obligates = life history events (reproduction, molting, resting) and feeding are dependent on sea ice, or closely associated with sea ice



Motivation

The environmental changes affecting the Arctic are not expected to abate in the immediate future

Scientists, managers, conservationists, industry, and local communities dependent on AMMs must prepare to deal with unprecedented environmental change

Arctic Marine Mammals (AMMs)

1) species that occur north of the Arctic Circle for most of the year and depend on the Arctic marine ecosystem for all aspects of life, and

2) selected species that seasonally inhabit Arctic waters, but may live outside the Arctic for part of the year

11 species

Ringed seal, bearded seal, spotted seal, ribbon seal, harp seal, hooded seal, and walrus

Narwhal, beluga, and bowhead whale

Polar bear

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Methods: AMM Abundance and trend

Compiled estimates of abundance and trend using published and unpublished sources

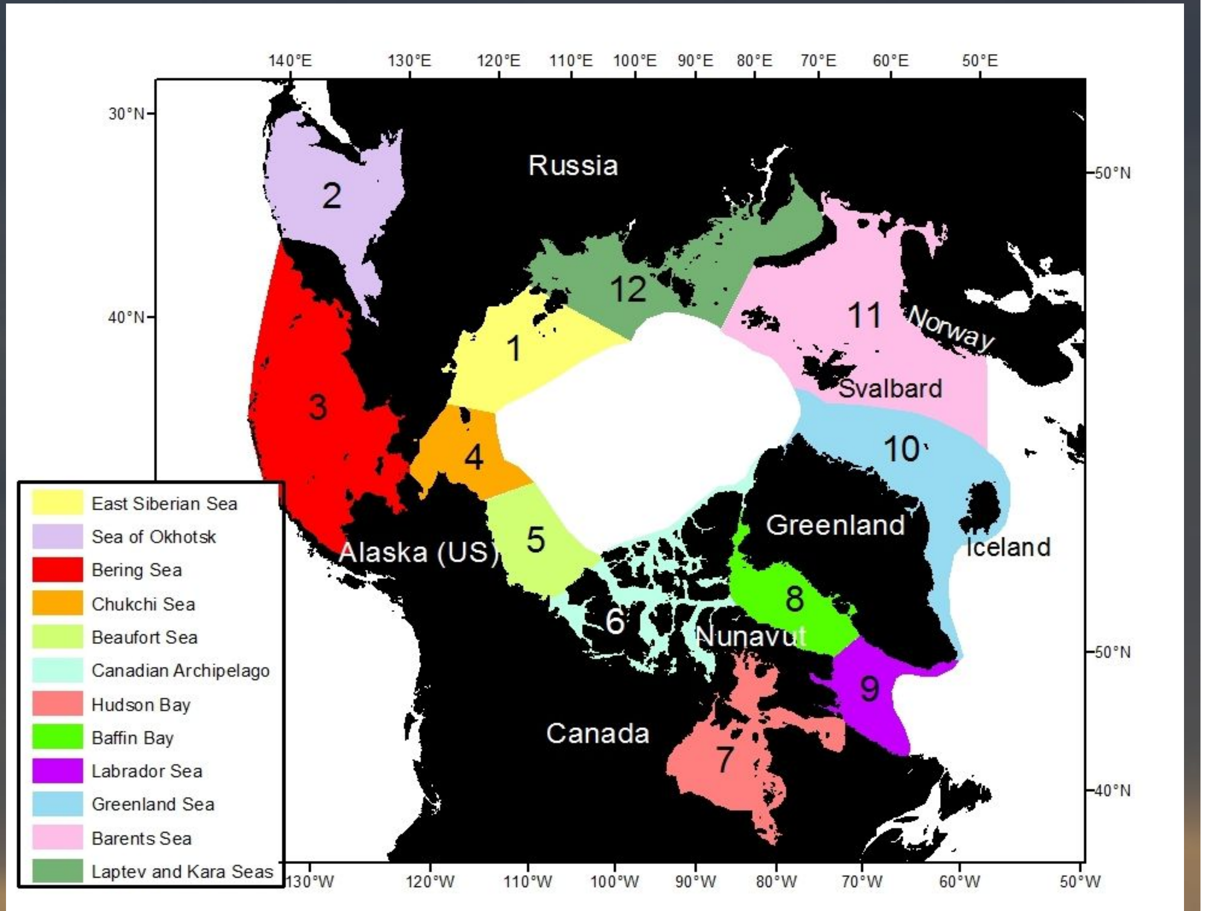
Subpopulations recognized by management bodies and advisory groups (e.g., International Whaling Commission, the North Atlantic Marine Mammal Commission, and International Union for the Conservation of Nature)

Trends and associated timeframes reported by advisory groups or authors

Methods: Regional assessments

Delineated 12 regions, modified from the CAFF Circumpolar Biodiversity Monitoring Plan

The central Arctic Basin was excluded due to lack of data

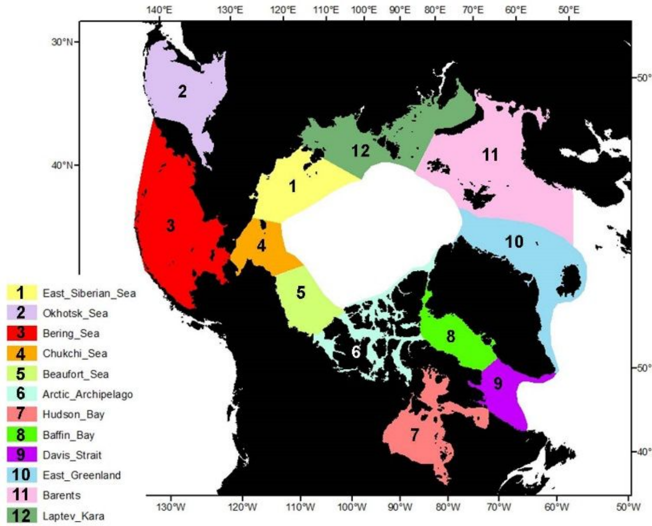


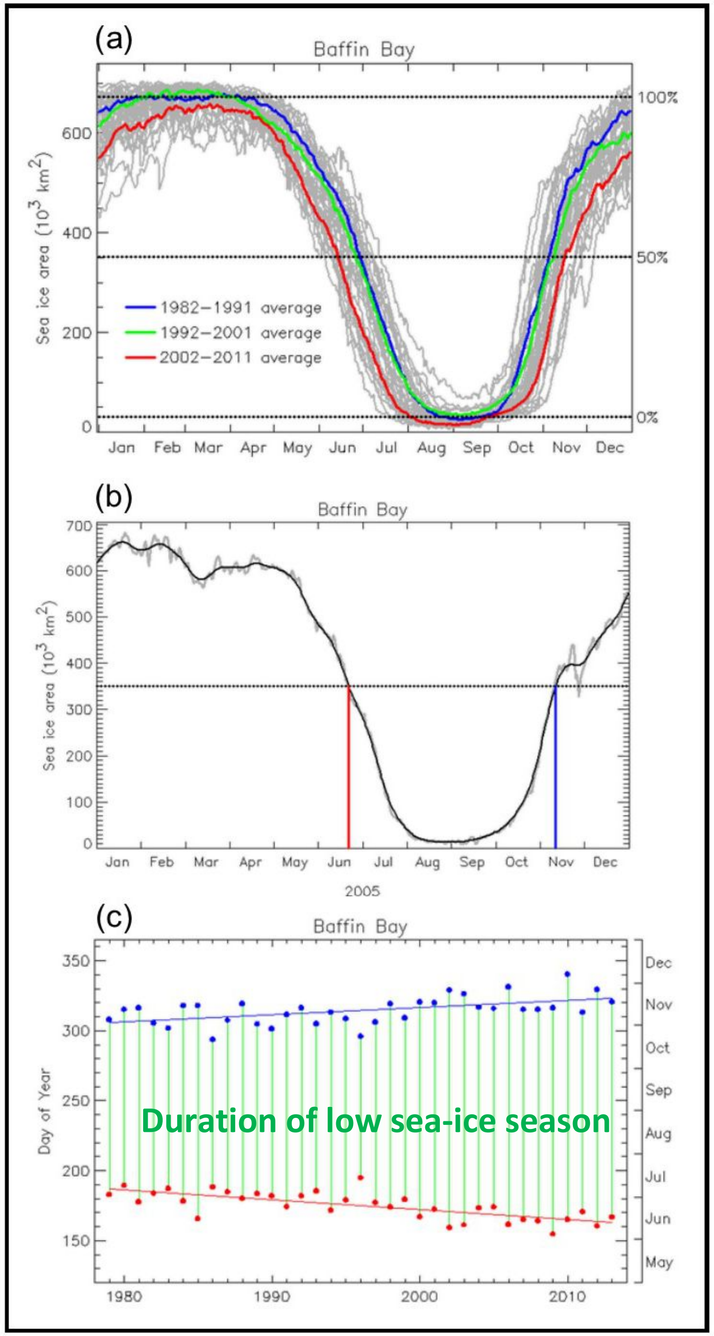
Methods: Circumpolar habitat loss

Calculated dates of spring sea ice break-up and fall sea ice freeze-up in each region, 1979-2013

SSM/I daily sea ice concentration data (25 x 25 km) from the US National Snow and Ice Data Center, Boulder CO

1. Delineate 12 regions





2. Calculate the daily sea-ice area in each region, 1979-2013

3. For each year, find the date in spring when sea-ice area drops below 50% in the region

and the date in fall when sea-ice area rises above 50% in the region

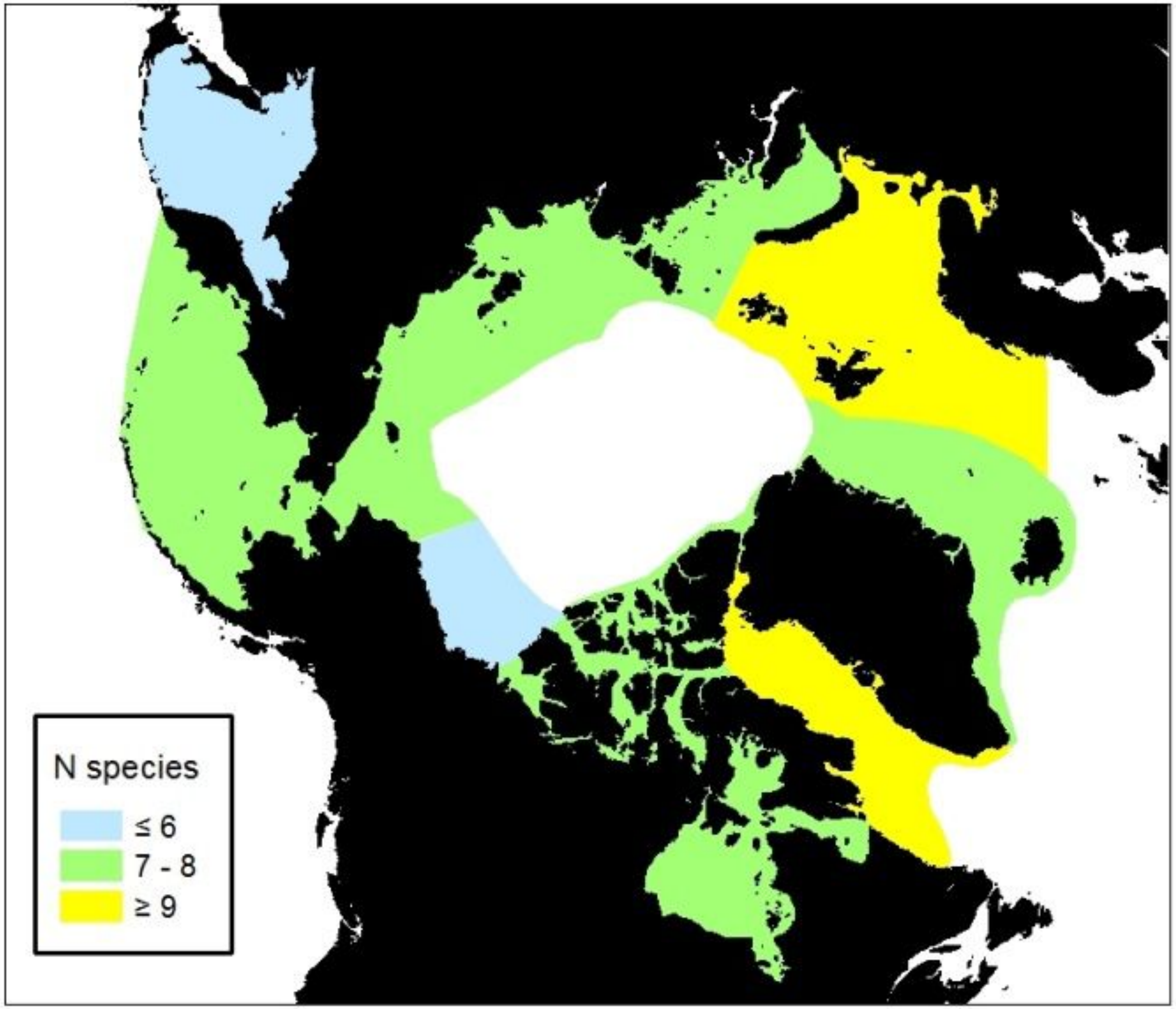
4. Regress dates over time series and calculate trends

Methods: Circumpolar habitat loss

Monthly changes in sea ice extent do not capture shifts in spring and fall sea ice timing, which are critical for AMMs

Quantifies change in the seasonal open-water period

AMM species (n=11)

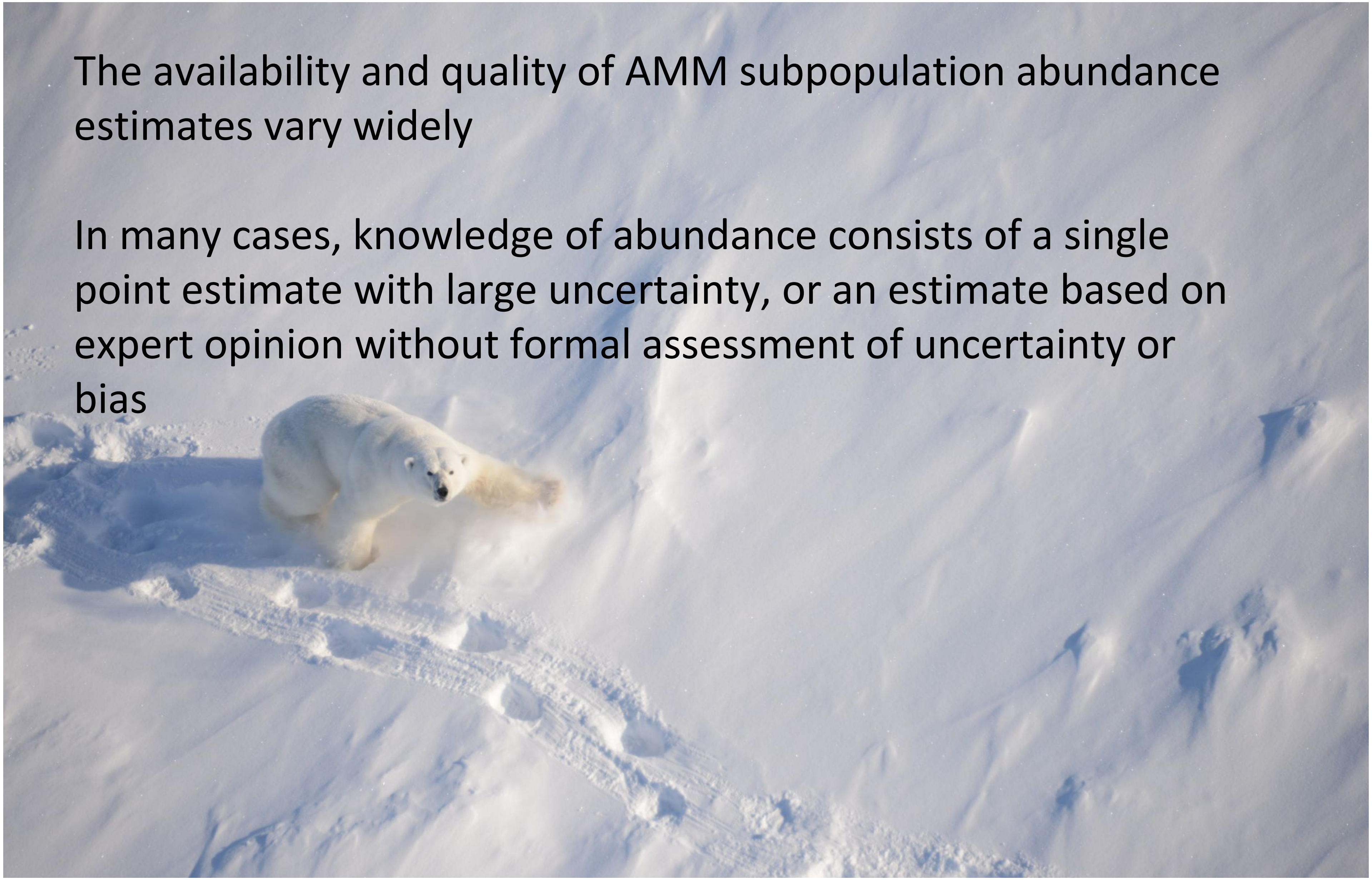


Baffin Bay
Davis Strait
Barents Sea

Results: Abundance and trends for 78 subpopulations

The availability and quality of AMM subpopulation abundance estimates vary widely

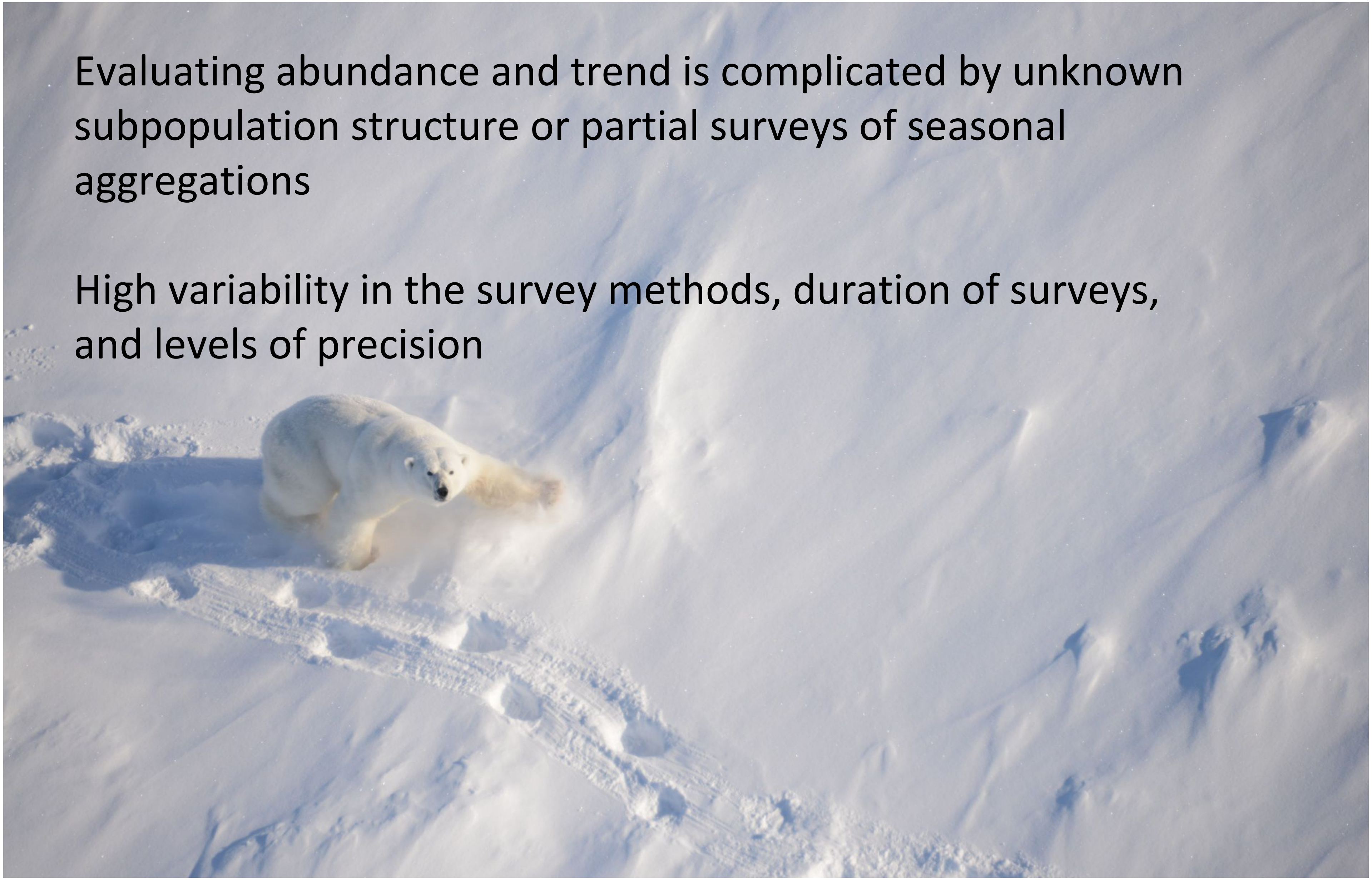
In many cases, knowledge of abundance consists of a single point estimate with large uncertainty, or an estimate based on expert opinion without formal assessment of uncertainty or bias



Results: Abundance and trends

Evaluating abundance and trend is complicated by unknown subpopulation structure or partial surveys of seasonal aggregations

High variability in the survey methods, duration of surveys, and levels of precision



Results: Cetaceans

N=34 subpopulations

Trend data are available for 5 of 19 beluga subpopulations, 0 of 11 narwhal subpopulations, and 2 of 4 bowhead subpopulations

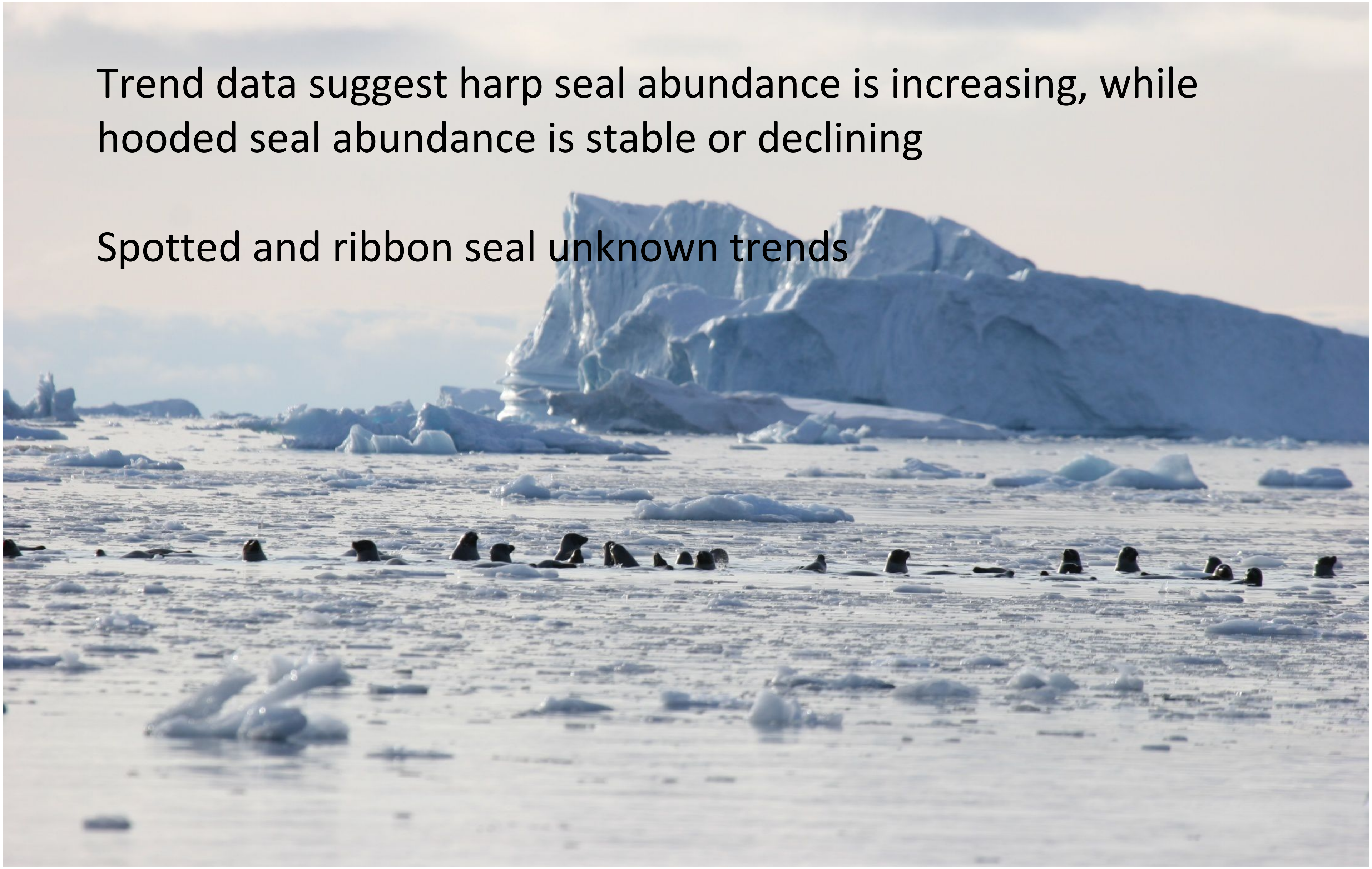
Results: Arctic ice seals

Abundance estimates for ringed and bearded seal are poor and outdated, and trends are not available except for some small areas surveyed repeatedly (for ringed seals)

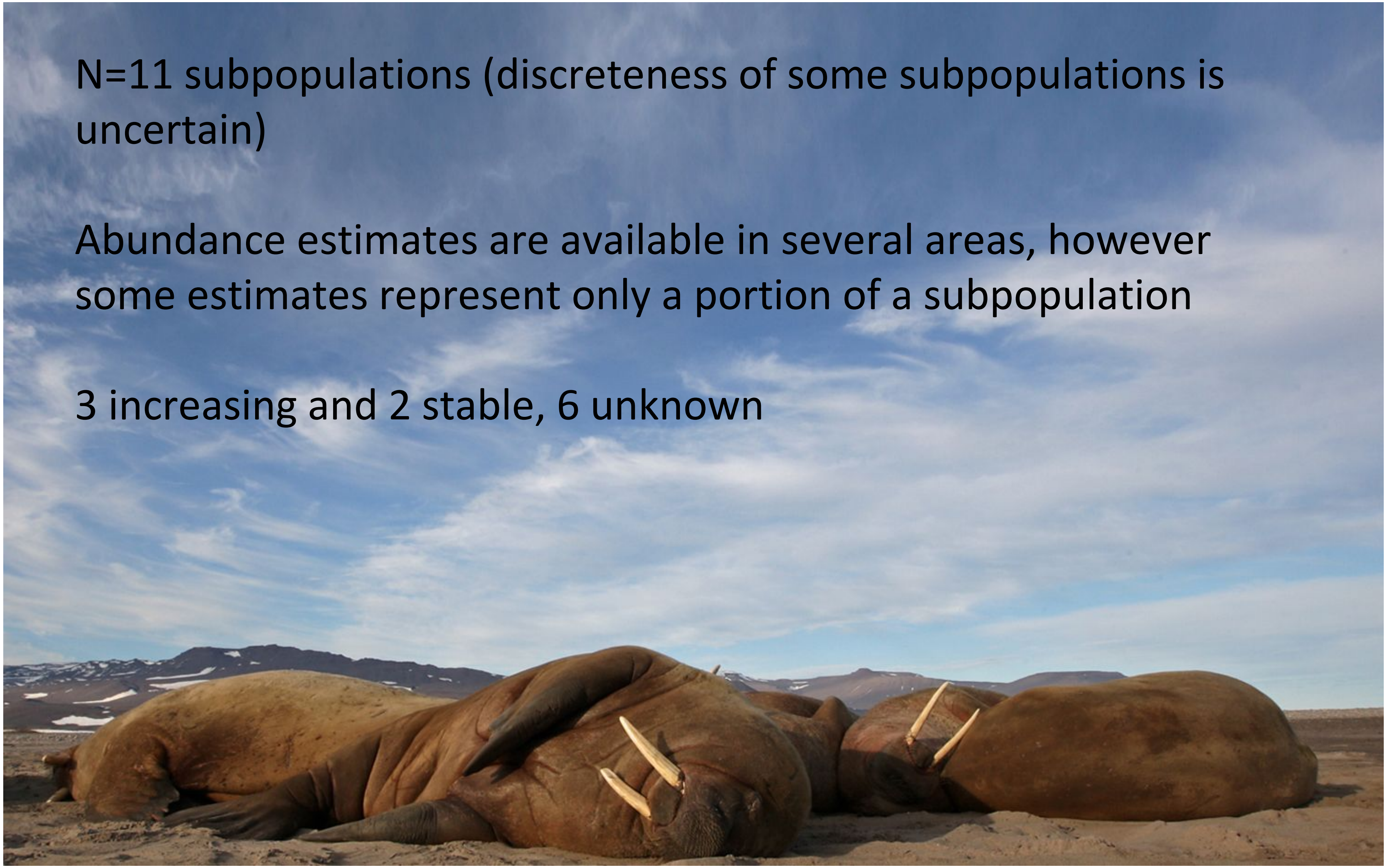
Results: Sub-Arctic ice seals

Trend data suggest harp seal abundance is increasing, while hooded seal abundance is stable or declining

Spotted and ribbon seal unknown trends



Results: Walrus



N=11 subpopulations (discreteness of some subpopulations is uncertain)

Abundance estimates are available in several areas, however some estimates represent only a portion of a subpopulation

3 increasing and 2 stable, 6 unknown

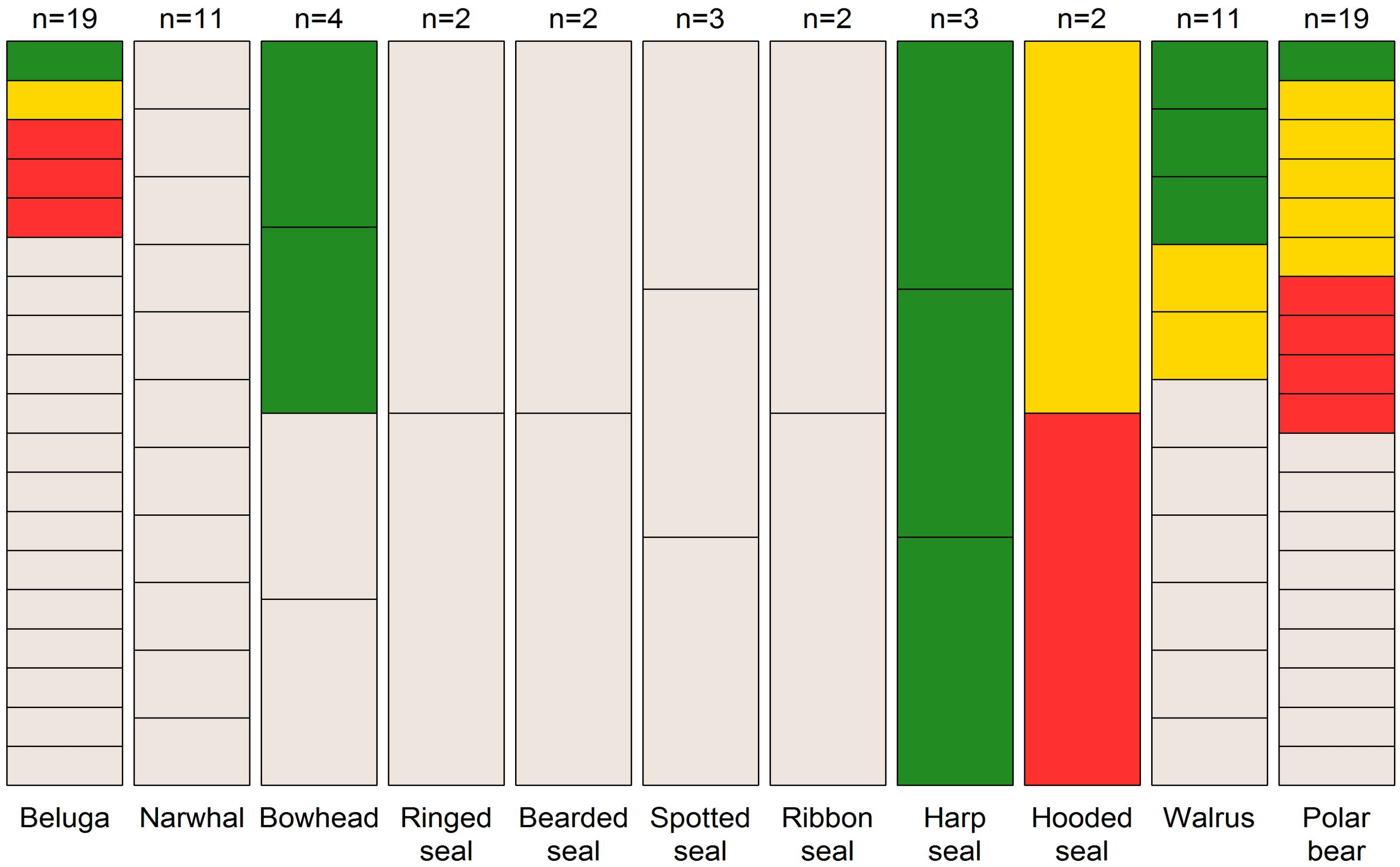
Results: Polar bears

19 subpopulations

Abundance estimates are available for 14 subpopulations, though many are out of date or have large uncertainty

Trends available for 10 subpopulations, though several are derived from projection models with untested assumptions

Overall, some assessment of trend is available for 35% of the 78 identified AMM subpopulations



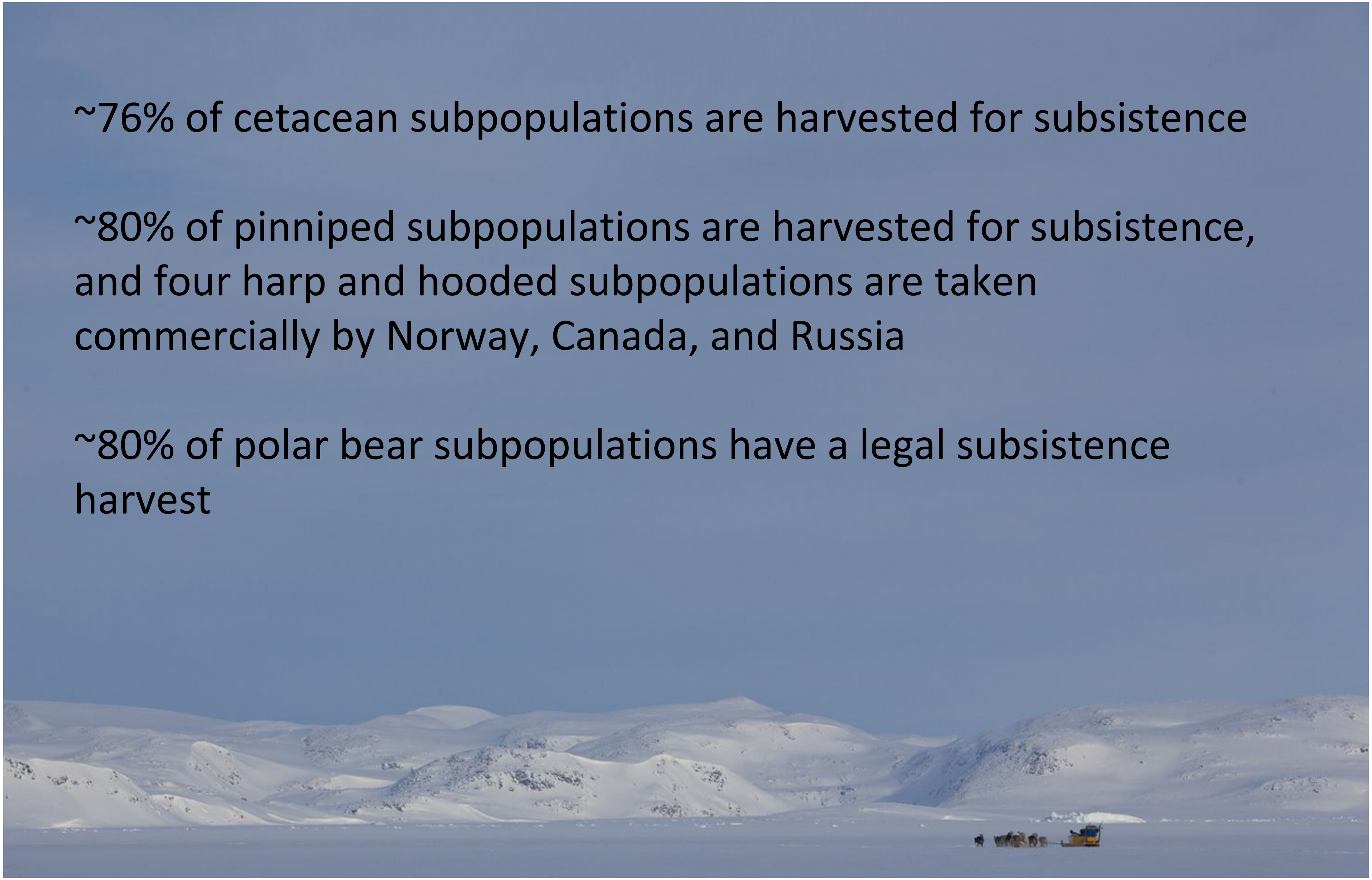
Increase, Stable, Decline, Unknown

Results: Human use

Throughout their range, AMMs are important renewable resources for humans

78% of subpopulations (n=61) are regularly and legally harvested for subsistence

Results: Human use



~76% of cetacean subpopulations are harvested for subsistence

~80% of pinniped subpopulations are harvested for subsistence, and four harp and hooded subpopulations are taken commercially by Norway, Canada, and Russia

~80% of polar bear subpopulations have a legal subsistence harvest

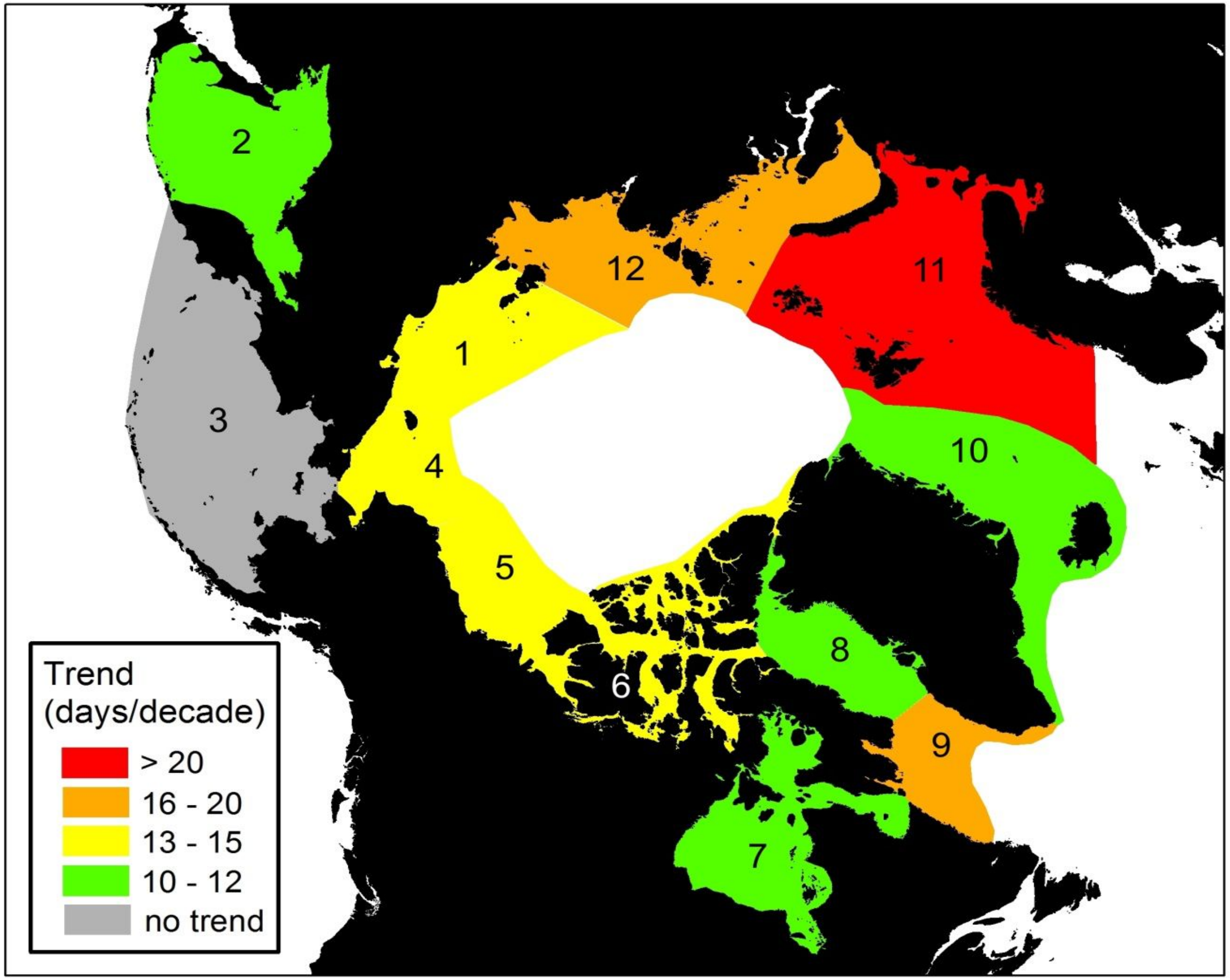
Results: Sea ice habitat

Statistically significant trends in 11 of 12 regions toward earlier spring sea ice retreat, later fall sea ice advance, and longer low sea-ice seasons

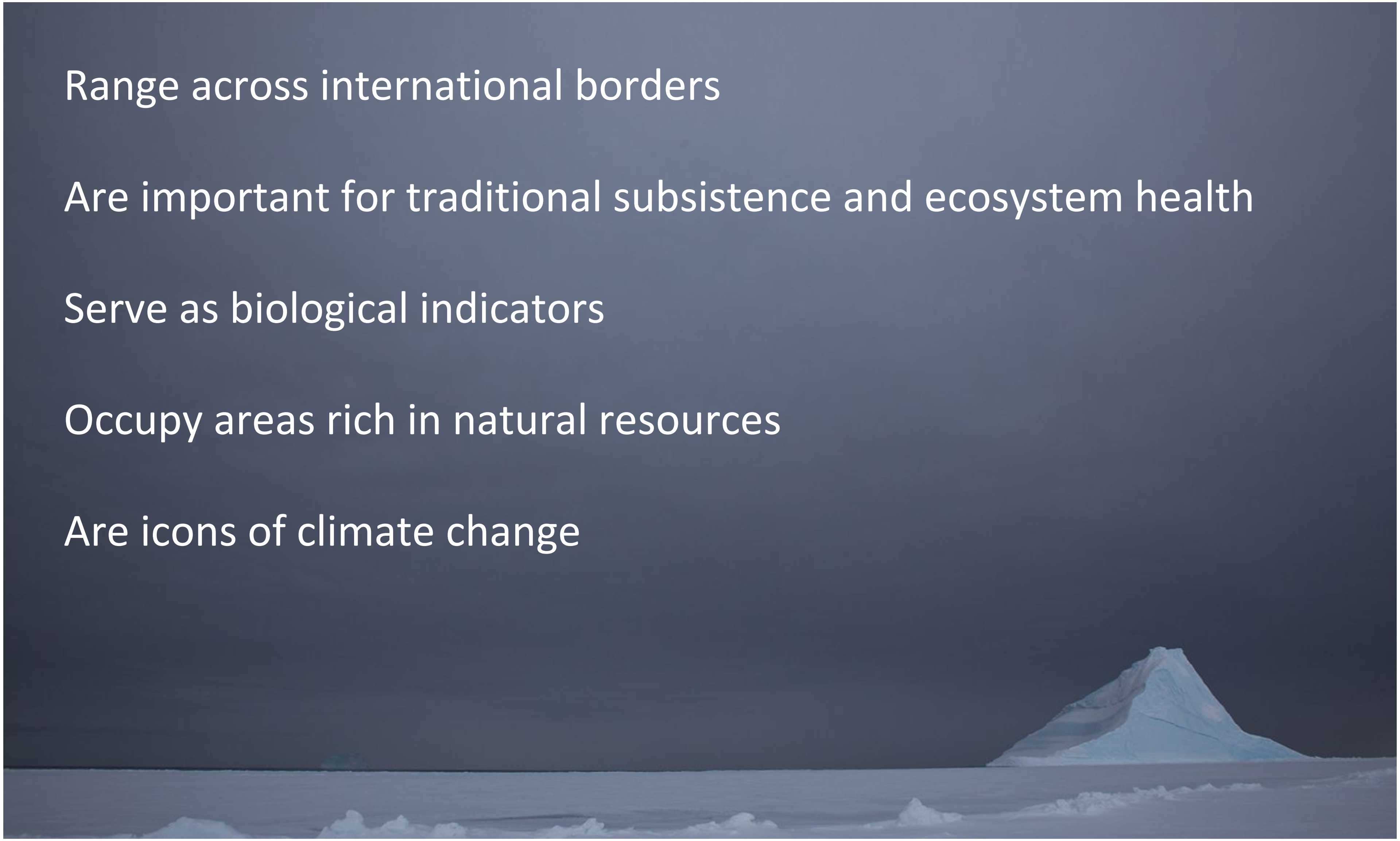
Only the Bering Sea showed no trend

In 10 regions, the low sea-ice season was 5-10 weeks longer in 2013 than in 1979. In the Barents Sea, it was 20 weeks longer

Change in duration of the low sea-ice season (days per decade)



Suggestions for AMM conservation



1) Maintain effective co-management by local and governmental entities

Co-management agreements directly involve people who use a resource and have a vested interest in it

Increased community participation in conservation, collection of TEK/LEK, compliance with harvest monitoring and local harvest restrictions, identification of science priorities, and opportunities for scientific sampling

These activities and benefits are prohibitively expensive or otherwise infeasible without local involvement

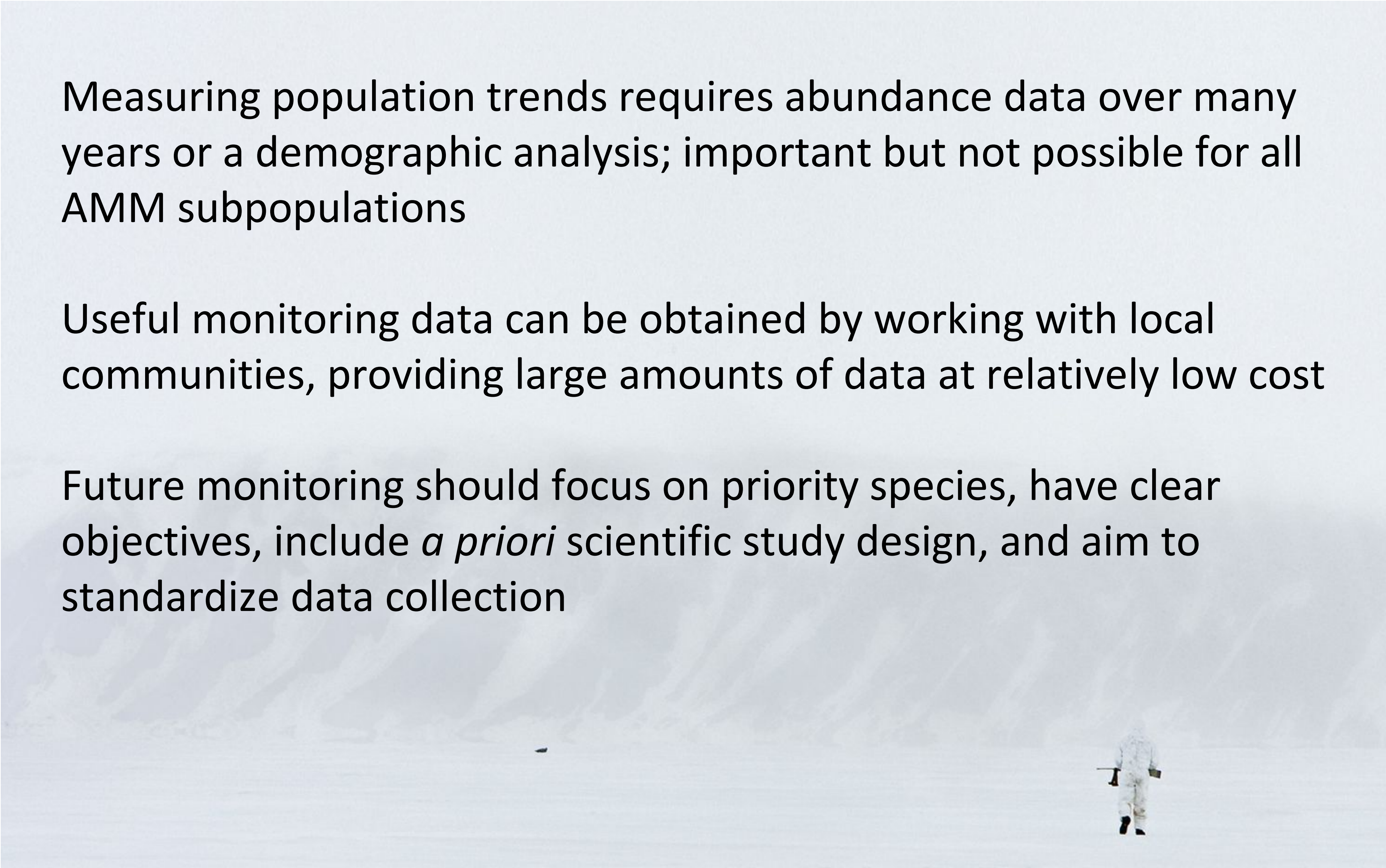
2) Incorporate variability of AMM responses to climate change into models and management plans

AMMs exhibit variable responses to climate change over time and space

Understanding variation is important to managing the effects of climate change at regional scales

Sea ice forecasts for the next 50-100 years indicate serious threats and inform long-term conservation status, but do not necessarily prescribe effective management in the near-term

3) Maintain existing monitoring programs and implement new programs with clear goals



Measuring population trends requires abundance data over many years or a demographic analysis; important but not possible for all AMM subpopulations

Useful monitoring data can be obtained by working with local communities, providing large amounts of data at relatively low cost

Future monitoring should focus on priority species, have clear objectives, include *a priori* scientific study design, and aim to standardize data collection

4) Understand and mitigate cumulative impacts from industrial activities

Conservation of AMMs is intertwined with development, resource extraction, and climate change

Multiple poorly-understood threats: underwater sound, ship strikes, displacement from critical habitats, and oil spill risk

Effective mitigation will require partnerships among scientists, local people, industry, NGOs, and government agencies

5) Recognize the utility and limitations of protected species legislation in a changing Arctic

Existing frameworks for protected species legislation (IUCN, SARA, ESA) have recently begun to include climate change

Most listings are made on the basis of long-term predictive models rather than observed population declines, which can make setting near-term conservation priorities difficult

5) Recognize the utility and limitations of protected species legislation in a changing Arctic

Agencies tasked with recovery planning do not have the authority to regulate GHGs. Therefore listings may focus on secondary factors (e.g., industrial development or subsistence use), which requires a balanced approach.

International legislation may be needed to protect key AMM habitats (e.g., NW and NE Passages, Bering Strait, Last Ice Area, and Arctic Basin)

Successful AMM conservation

Scientific data—missing for many AMM species and subpopulations—will be **key** to making informed and efficient decisions about the challenges facing AMMs in the 21st century

Acknowledgments