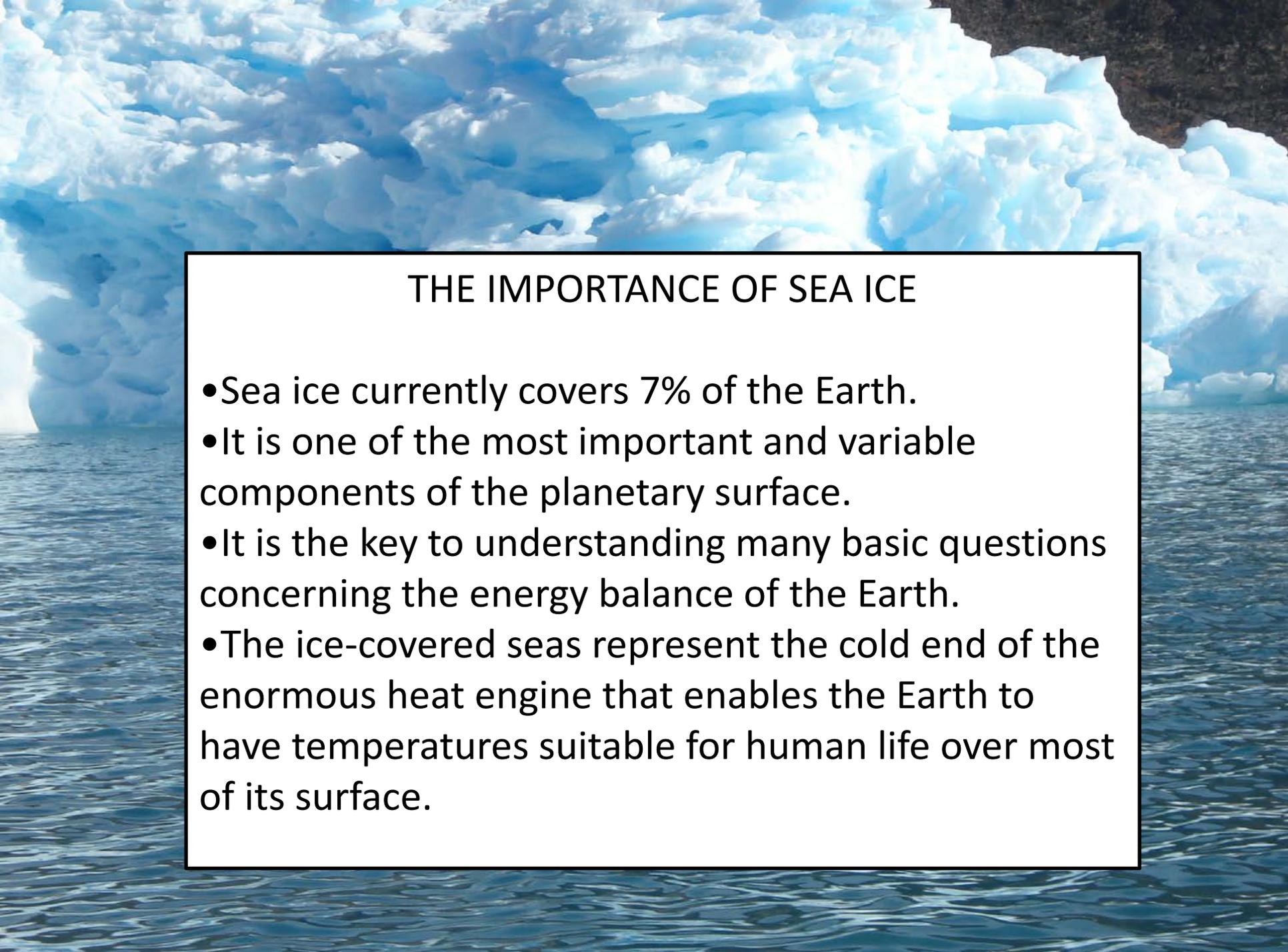




SEA ICE OFF THE COASTS OF ICELAND AND LABRADOR: PAST AND PRESENT

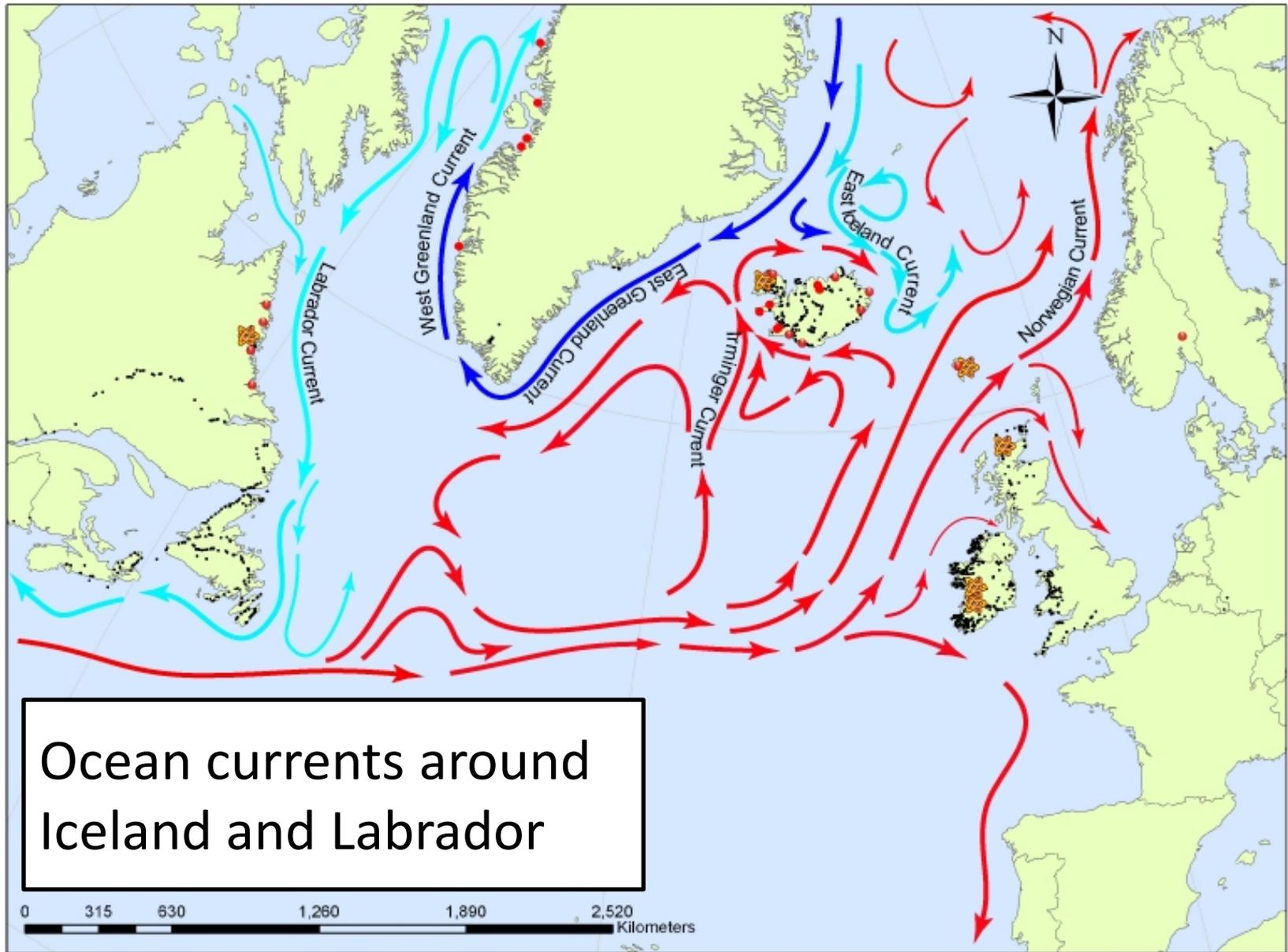
Astrid E.J. Ogilvie

NABO General Meeting
Stefansson Arctic Institute/University of Akureyri
12-13 July 2013



THE IMPORTANCE OF SEA ICE

- Sea ice currently covers 7% of the Earth.
- It is one of the most important and variable components of the planetary surface.
- It is the key to understanding many basic questions concerning the energy balance of the Earth.
- The ice-covered seas represent the cold end of the enormous heat engine that enables the Earth to have temperatures suitable for human life over most of its surface.



An aerial photograph showing a vast expanse of sea ice off the coast of Iceland. The ice consists of numerous small, white, irregular floes scattered across a dark blue sea. In the background, the rugged, dark coastline of Iceland is visible, with mountains and a river winding through the landscape. The sky is filled with heavy, grey clouds, creating a dramatic and somewhat somber atmosphere. The overall scene captures the scale and texture of the ice formation in a high-latitude environment.

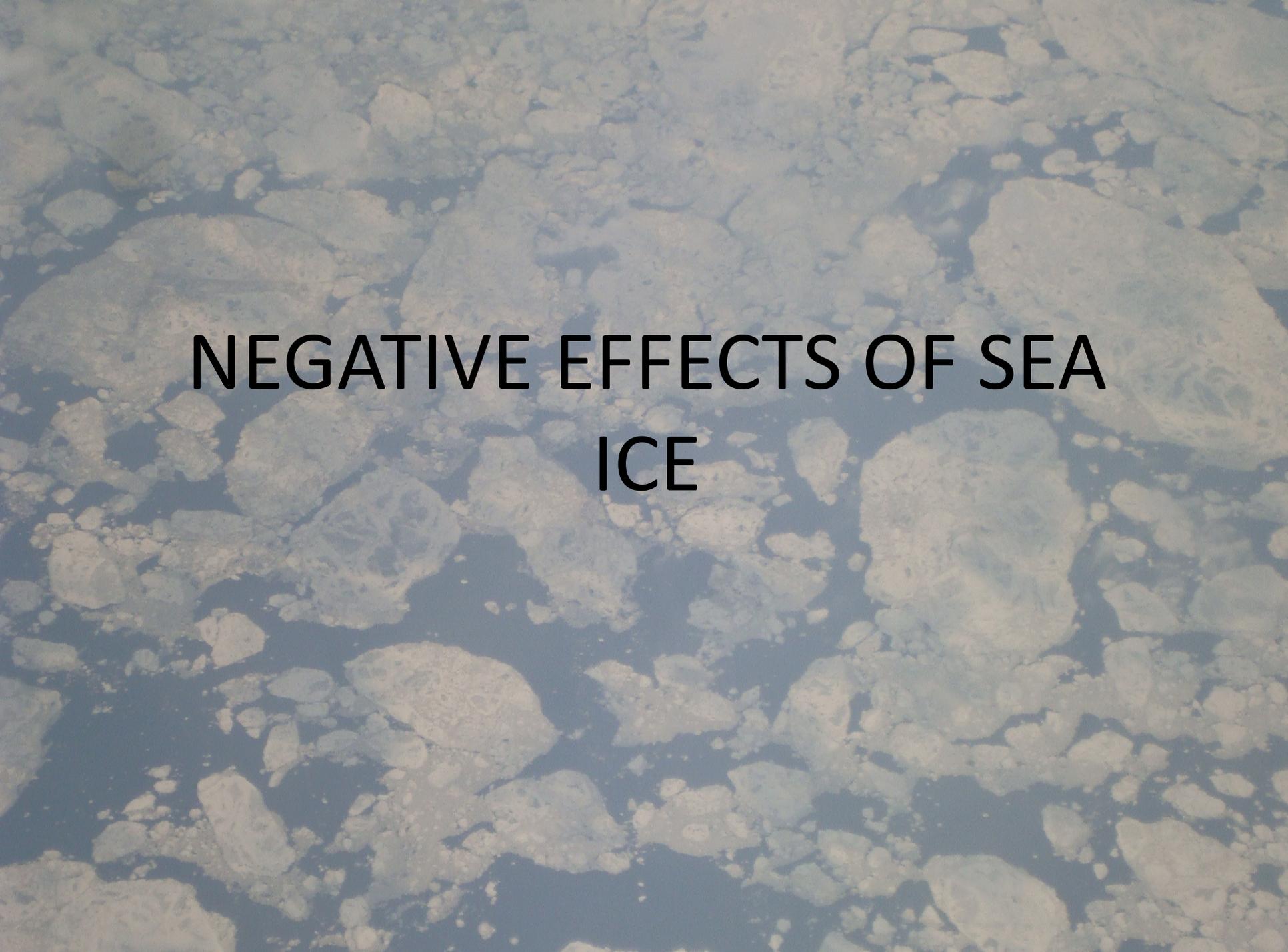
SEA ICE OFF THE COASTS OF
ICELAND

- Sea Ice is brought to the coasts of Iceland on the East Greenland current.
- It mainly affects the northwest, northern and eastern coasts.
- It is very rare that it reaches the south of Iceland.
- Because of the pattern of the ocean currents it rarely reaches the southwest.
- Ice most frequently occurs in the later winter and spring.

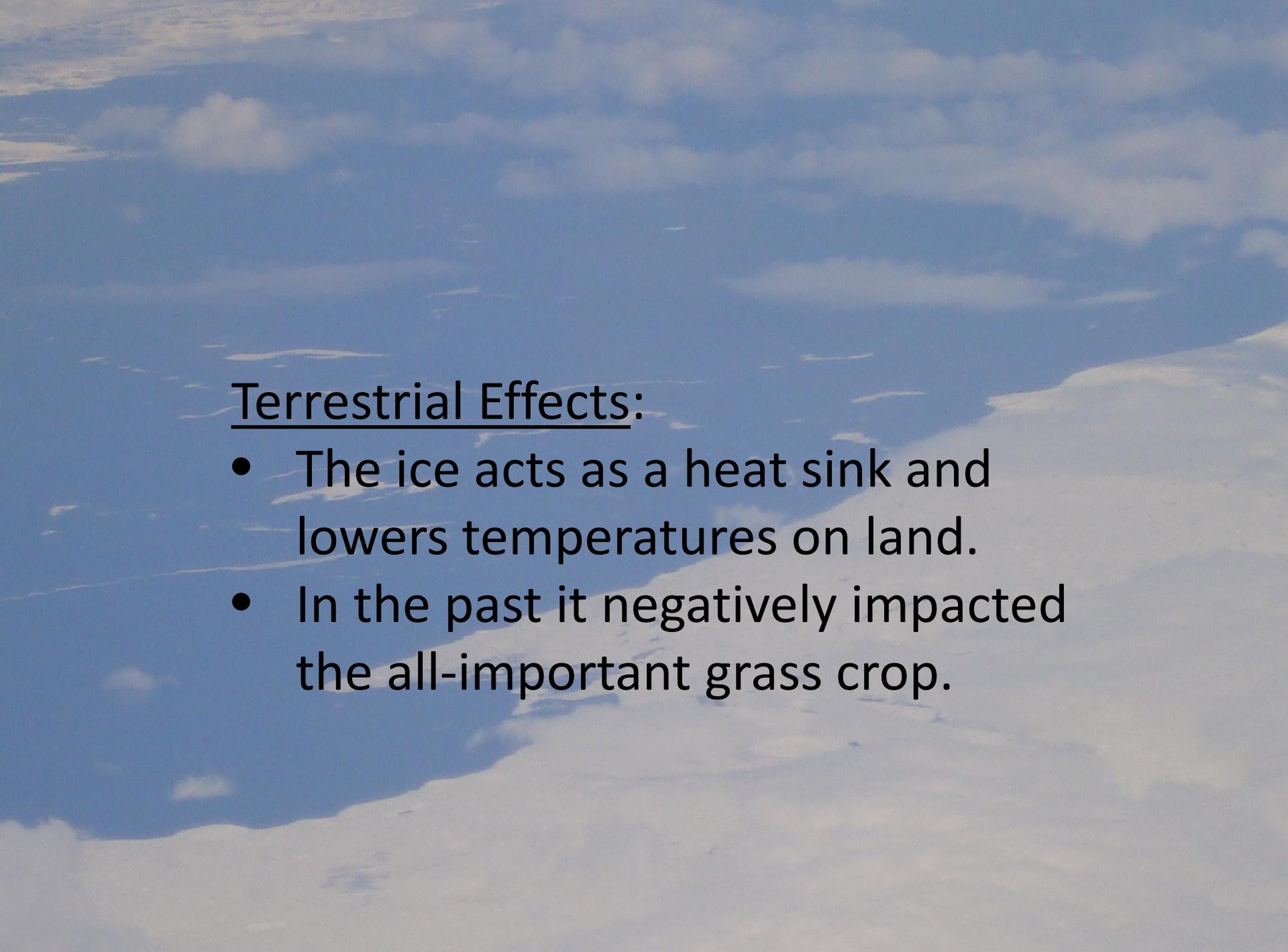
HISTORICAL/DOCUMENTARY RECORDS

***Written* records of climate change from Iceland**

- **Diaries**
- **Annals**
- **Official (State) Records**
- **Ecclesiastical Records**
 - **Farming records**
 - **Early Newspapers**
- **Travellers' accounts**

An aerial photograph of sea ice, showing a complex pattern of ice floes and leads. The ice is a mix of light blue and white, with dark blue water visible in the leads. A semi-transparent blue overlay is applied to the entire image, making the text stand out.

NEGATIVE EFFECTS OF SEA ICE



Terrestrial Effects:

- The ice acts as a heat sink and lowers temperatures on land.
- In the past it negatively impacted the all-important grass crop.



Marine Effects:

- Prevented fishing
- Prevented trading ships landing



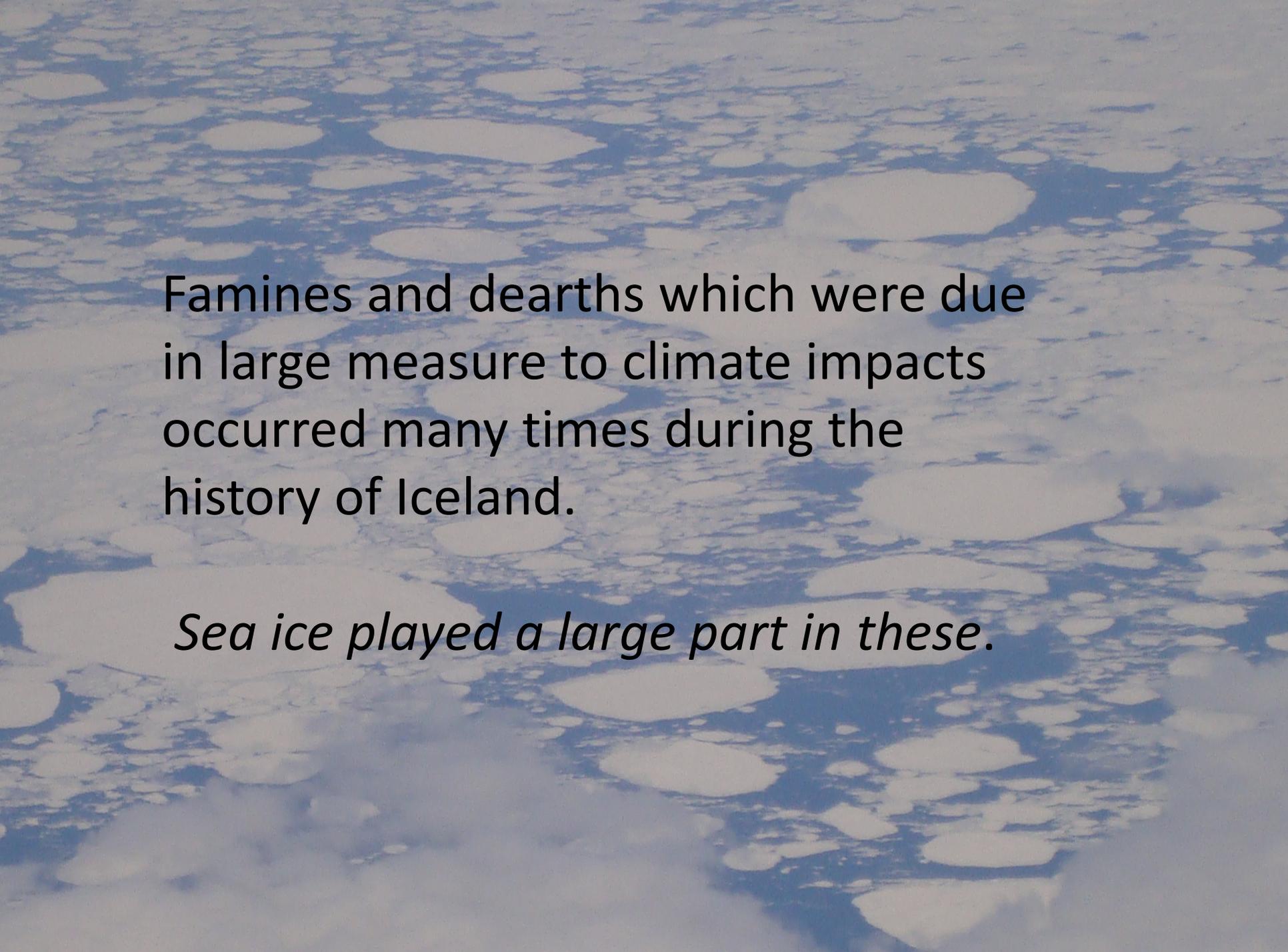
BENEFITS OF THE ICE

- Marine mammals such as seals and whales (food supplement)
- Driftwood



JÓN JÓNSSON. Bær, Hrútafirði, Strandasýsla, 1816

...the winter was among the best, but the spring was very cold, especially after the sea ice, which lay here for some time, had embraced the coasts. In the similarly cold summer, the grass growth was thus very poor. The hay harvest, which began in mid August, was hindered by frost, fog and cold chills as well as much snow on occasion, especially around 18 August and again on 19 to 26 September. It was also difficult to harvest the hay in the constant and severe rain in late September and early October...In the spring the inhabitants caught several sharks, and in the autumn a considerable number of cod and halibut. However, on 19 October the fishing stopped due to encroaching drift ice. *The two whales washed up in the jurisdictional areas of Broddanes and Bær by the sea ice in June, helped much in preventing hunger deaths in the dearth at that time.*

An aerial photograph of a vast expanse of sea ice, showing numerous irregular, light-colored ice floes scattered across a darker blue-grey water surface. The text is overlaid on the center of the image.

Famines and dearths which were due in large measure to climate impacts occurred many times during the history of Iceland.

Sea ice played a large part in these.

PATTERN OF CLIMATE IMPACTS

- Lack of winter grazing – freeze/thaw cycle
- Poor grass growth
- Too dry or (usually) rainy summer or harvest

CUMULATIVE IMPACTS

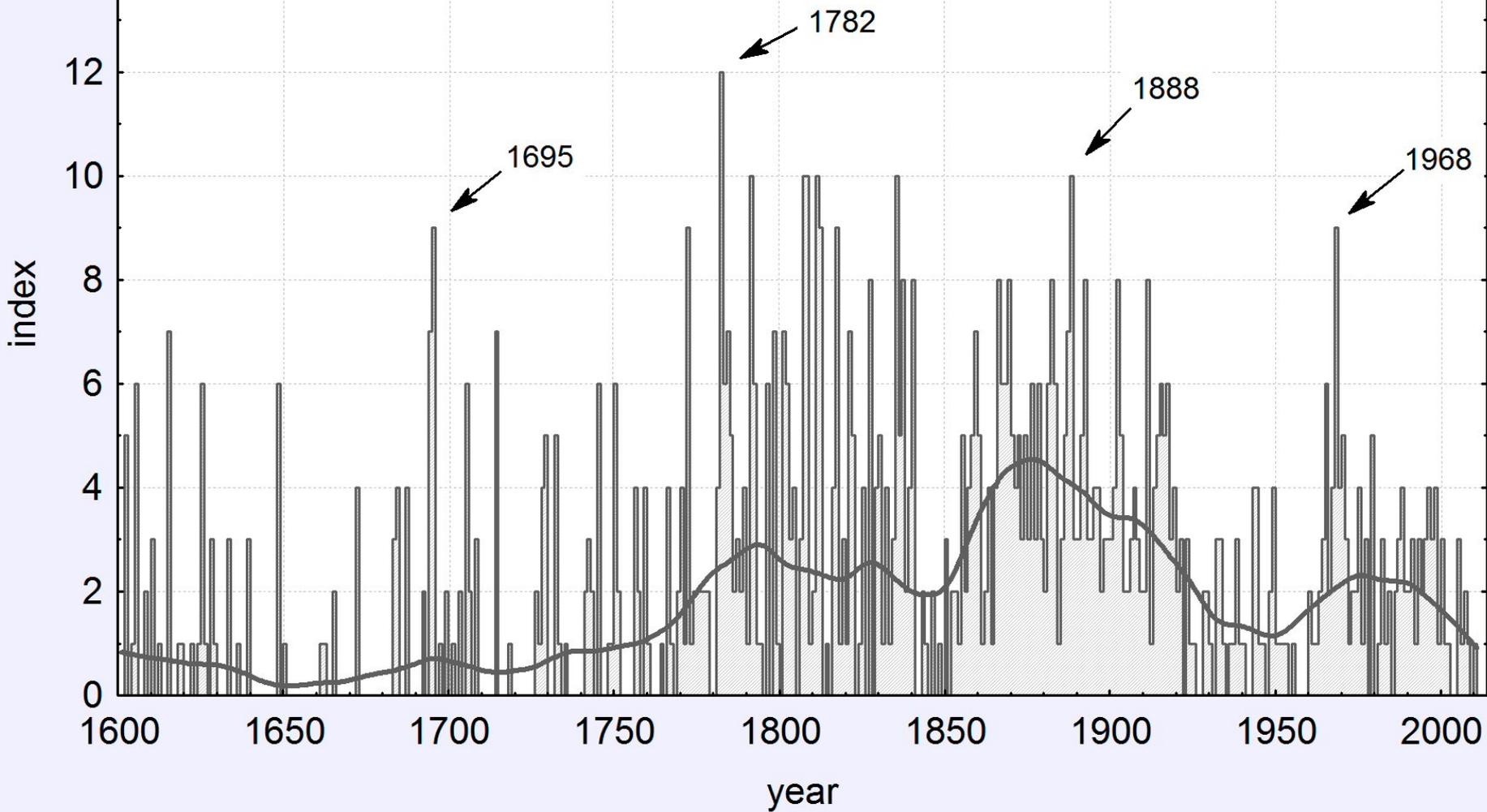
- Livestock die
- Farms deserted
- Humans become malnourished and may also die

SEA-ICE VARIATIONS SUMMARY

- During the period 1600 to the present, the decades with most ice probably the 1690s, 1780s, early 1800s and 1830s.
- There were also several heavy sea-ice years in 1880s – a time of hardship and emigration.
- In recent times, little ice except for the “ice years” of the late 1960s.

Ogilvie Iceland ice-index 1601 to 2011

Thick line: Lowess filter - for visual enhancement only

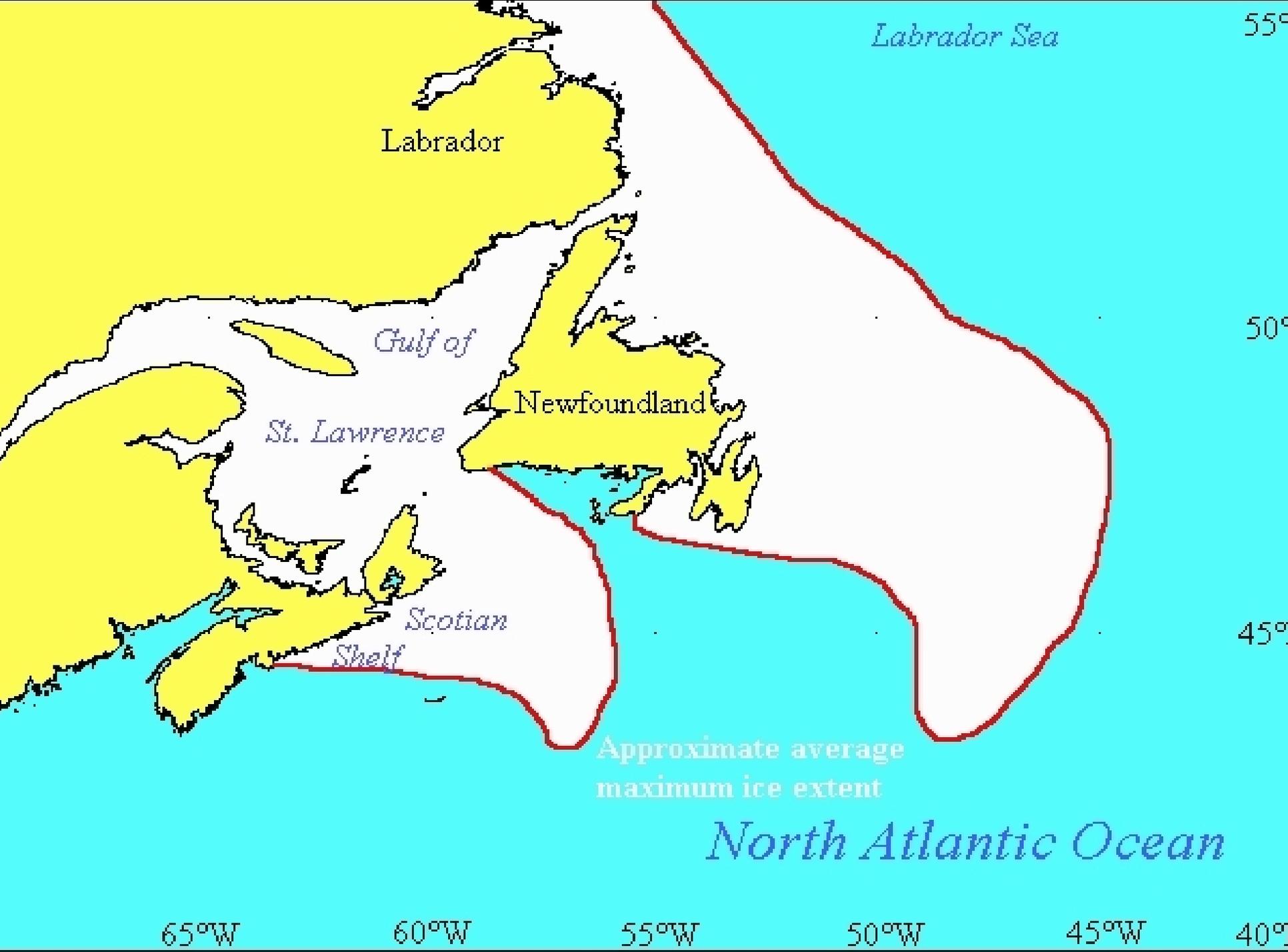


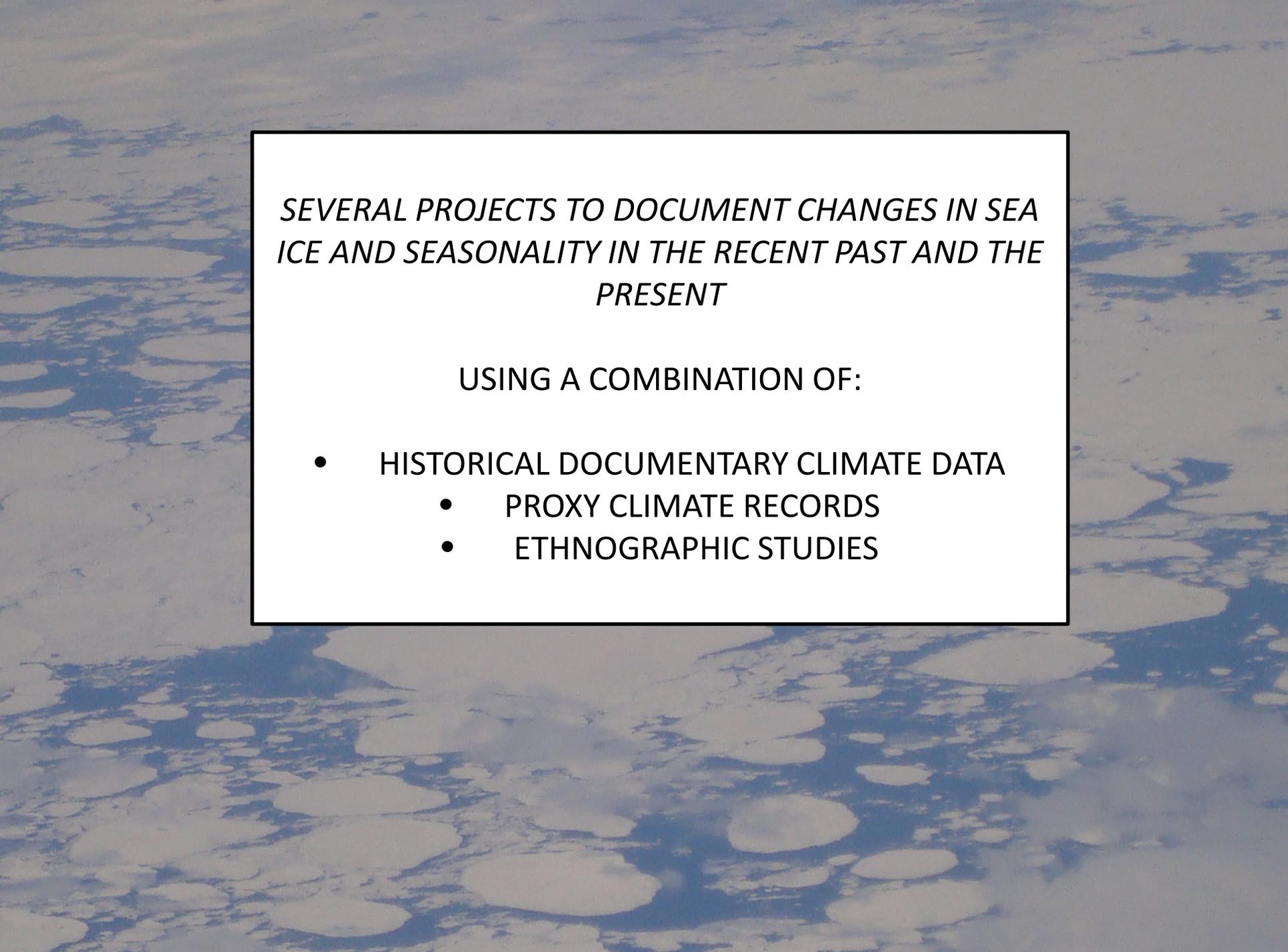
An aerial photograph showing a vast expanse of fragmented sea ice. The ice consists of numerous irregular, light-colored floes of varying sizes, scattered across a deep blue ocean. The perspective is from a high altitude, looking down on the ice field.

**DATA FOR
LABRADOR/NEWFOUNDL
AND**

- The coast of Labrador and the east coast of the island of Newfoundland are exposed to the cold Labrador Current.
- This distributes sea ice and icebergs across the Grand Banks of Newfoundland and into the North Atlantic Ocean.
- Ice appears through local formation and drift from further north off the Labrador coast in late autumn.





The background of the slide is an aerial photograph of sea ice, showing numerous irregular, light-colored ice floes scattered across a darker blue ocean. A white rectangular box with a black border is centered on the slide, containing the text.

*SEVERAL PROJECTS TO DOCUMENT CHANGES IN SEA
ICE AND SEASONALITY IN THE RECENT PAST AND THE
PRESENT*

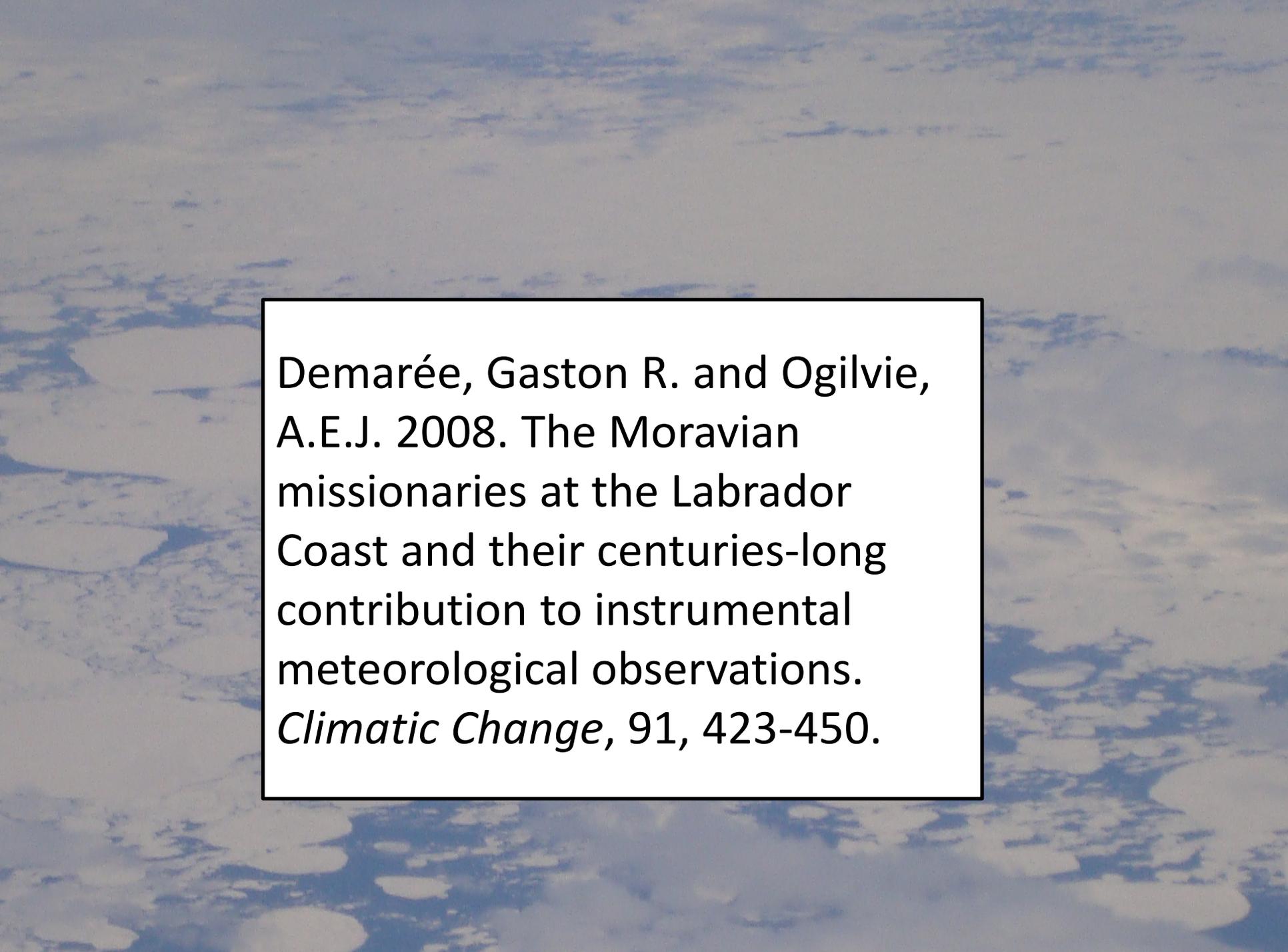
USING A COMBINATION OF:

- HISTORICAL DOCUMENTARY CLIMATE DATA
 - PROXY CLIMATE RECORDS
 - ETHNOGRAPHIC STUDIES

An aerial photograph of a wide, frozen river. The ice is a mix of white and light blue, with visible cracks and textures. The water in the center is dark blue. A white rectangular box with a black border is centered on the image, containing text.

HISTORICAL RECORDS

- Climate and sea-ice observations by Moravian missionaries to Labrador
- Hydrographic Bulletins
- A variety of other sources such as newspapers and coastguard observations



Demarée, Gaston R. and Ogilvie,
A.E.J. 2008. The Moravian
missionaries at the Labrador
Coast and their centuries-long
contribution to instrumental
meteorological observations.
Climatic Change, 91, 423-450.

STUDY AREA

The population of Labrador is ca. 30,000.

Approximately 30% are Aboriginal peoples, including Inuit, Innu, Métis and Mi'kmaq.

The Inuit self-governing region of Nunatsiavut was recently created through agreements with the provincial and federal governments. The focus here is on Nunatsiavut and Inuit and Settler communities.



HOPEDALE

Population ca. 550



NAIN, Labrador/Nunatsiavut
Population ca. 1,034



MAKKOVIK

Population ca. 400



Interviews with local people



“THE WEATHER IS QUITE SCANDALOUS!”

- *The ice used to be our friend*
- *We can't trust the ice anymore*
- *We can't travel around our communities the way we used to*
- *We can't make snow houses anymore, the snow is “no good”*
- *If people don't believe in global warming, they should come and talk to us!*
- *We have noticed a change, particularly over the last 20 years*
- *Last winter was the latest freeze-up I have ever known (2010-11)*
- *The ice used to freeze up in November, last year it didn't freeze up til January!*

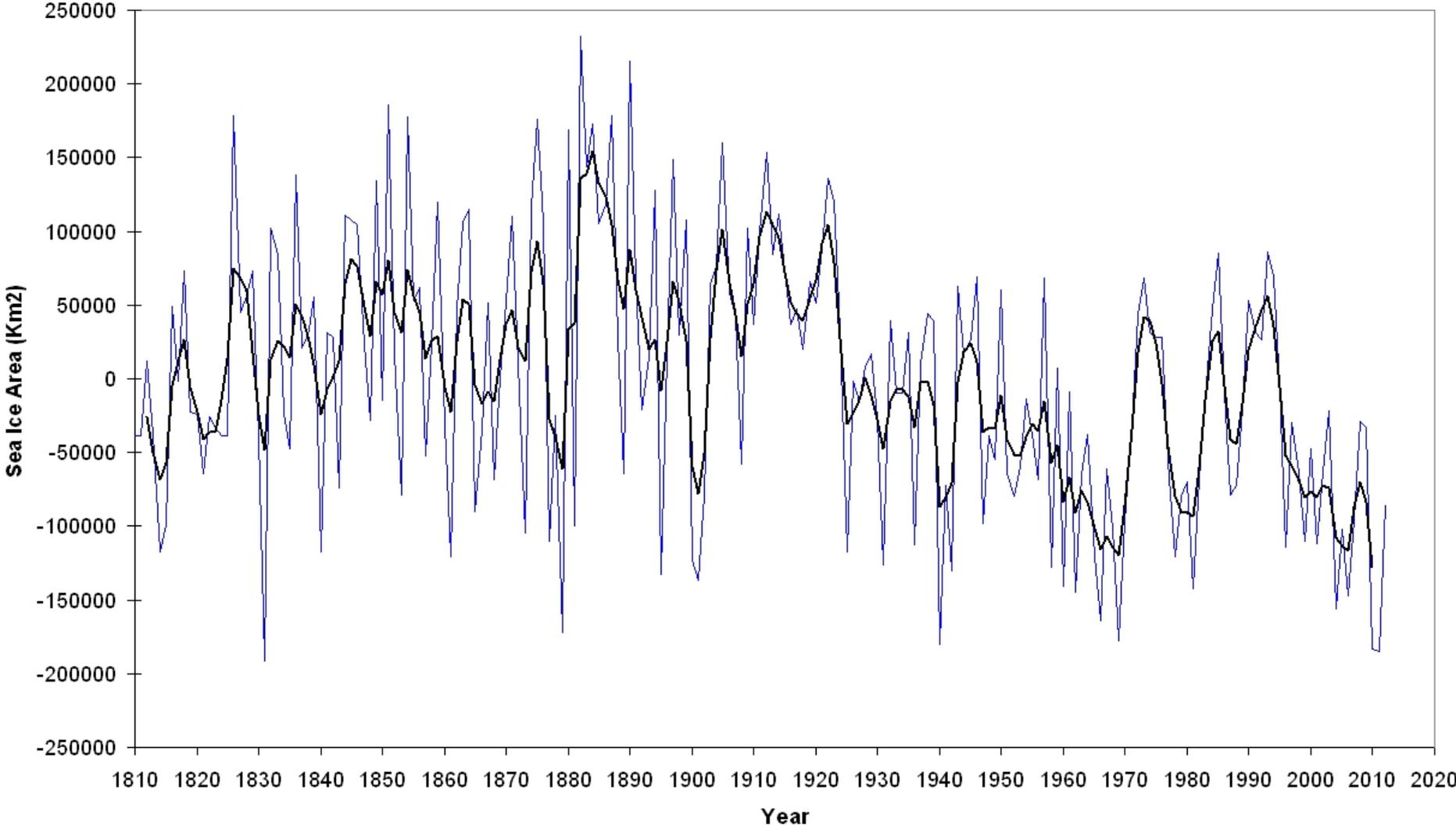
Everyone we spoke to – the story was the same!

SUMMARY: Labrador Regions

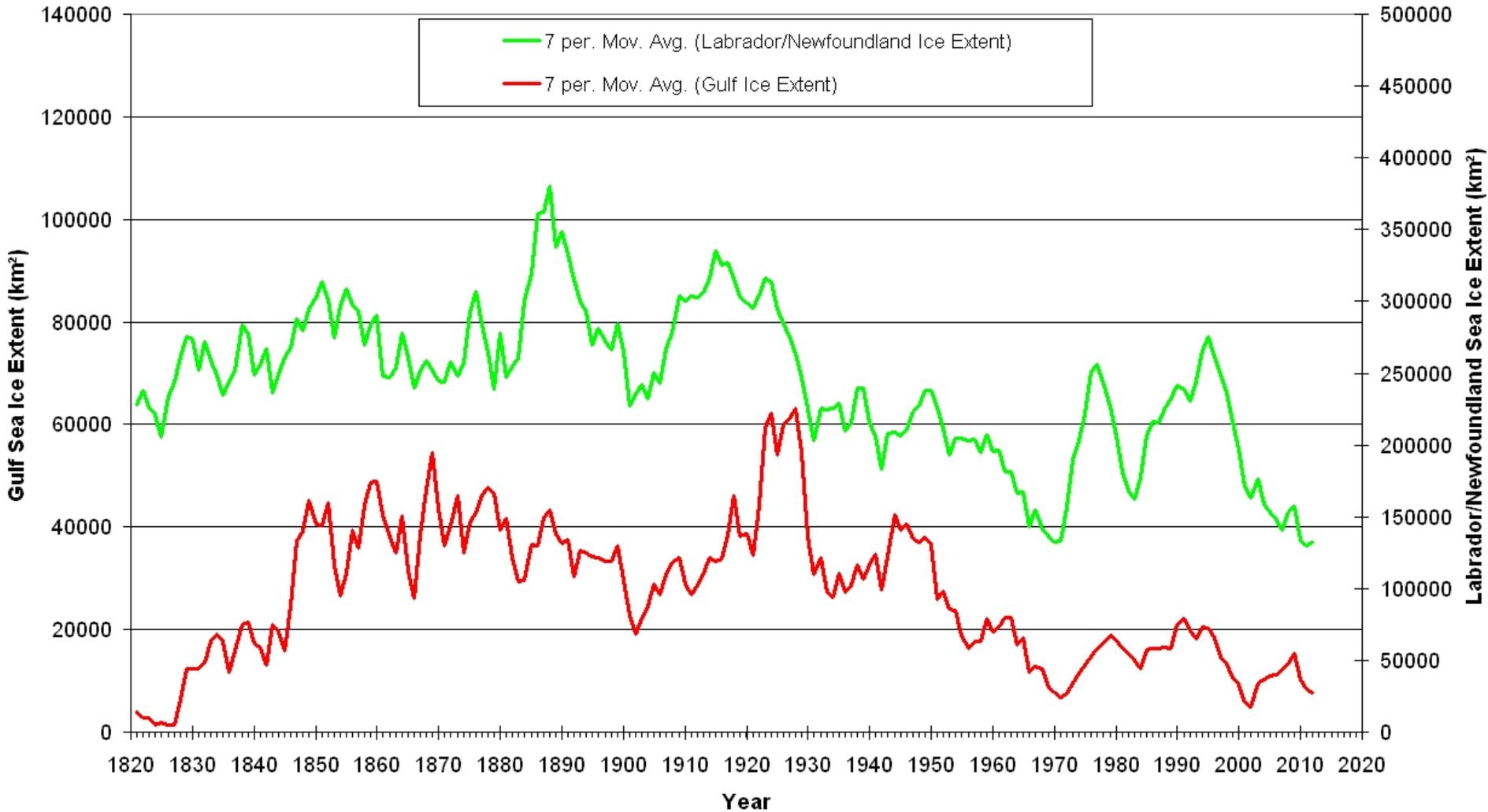
Recent changes in sea-ice extent and duration are having a profound effect on communities in Nunatsiavut/Labrador.

- Data from Moravian missionaries and other historical records will augment knowledge of changes in climate in the past providing a context for our knowledge of present and future changes.

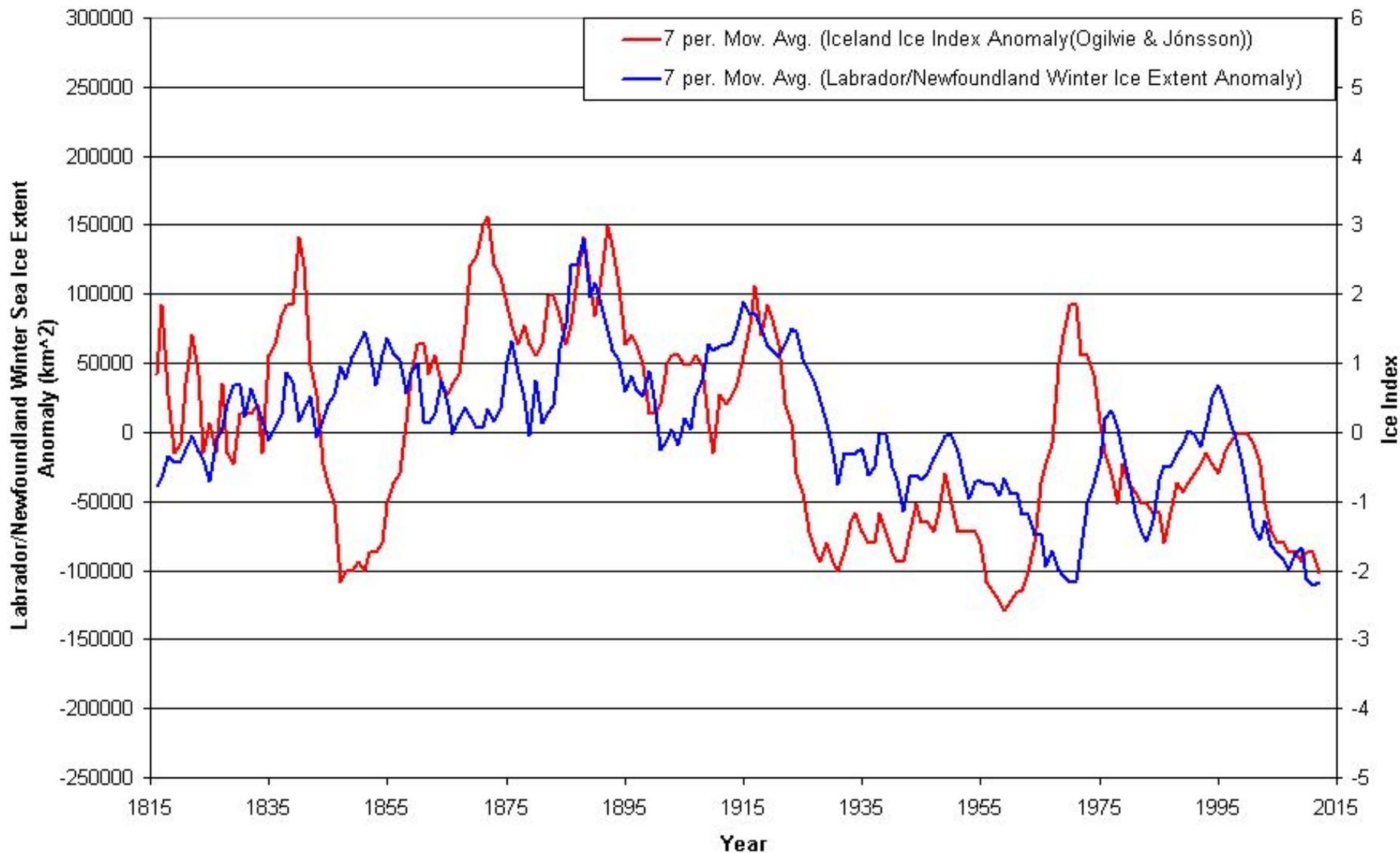
Labrador/Newfoundland Winter Sea Ice Extent Anomaly South of 55°N



GULF and LABRADOR/NEWFOUNDLAND ICE EXTENTS

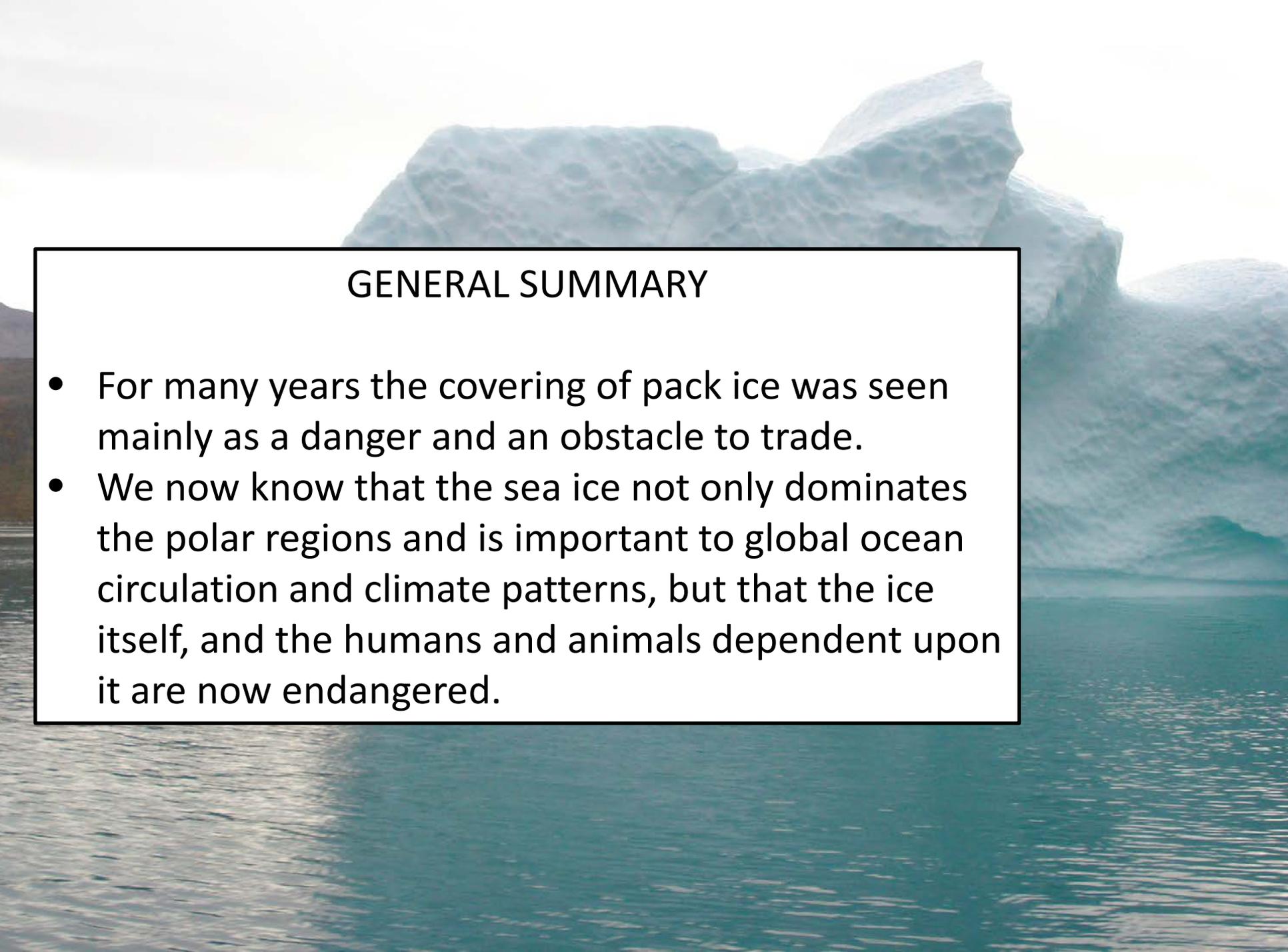


Comparison of the Labrador/Newfoundland, and Iceland Ice Extents



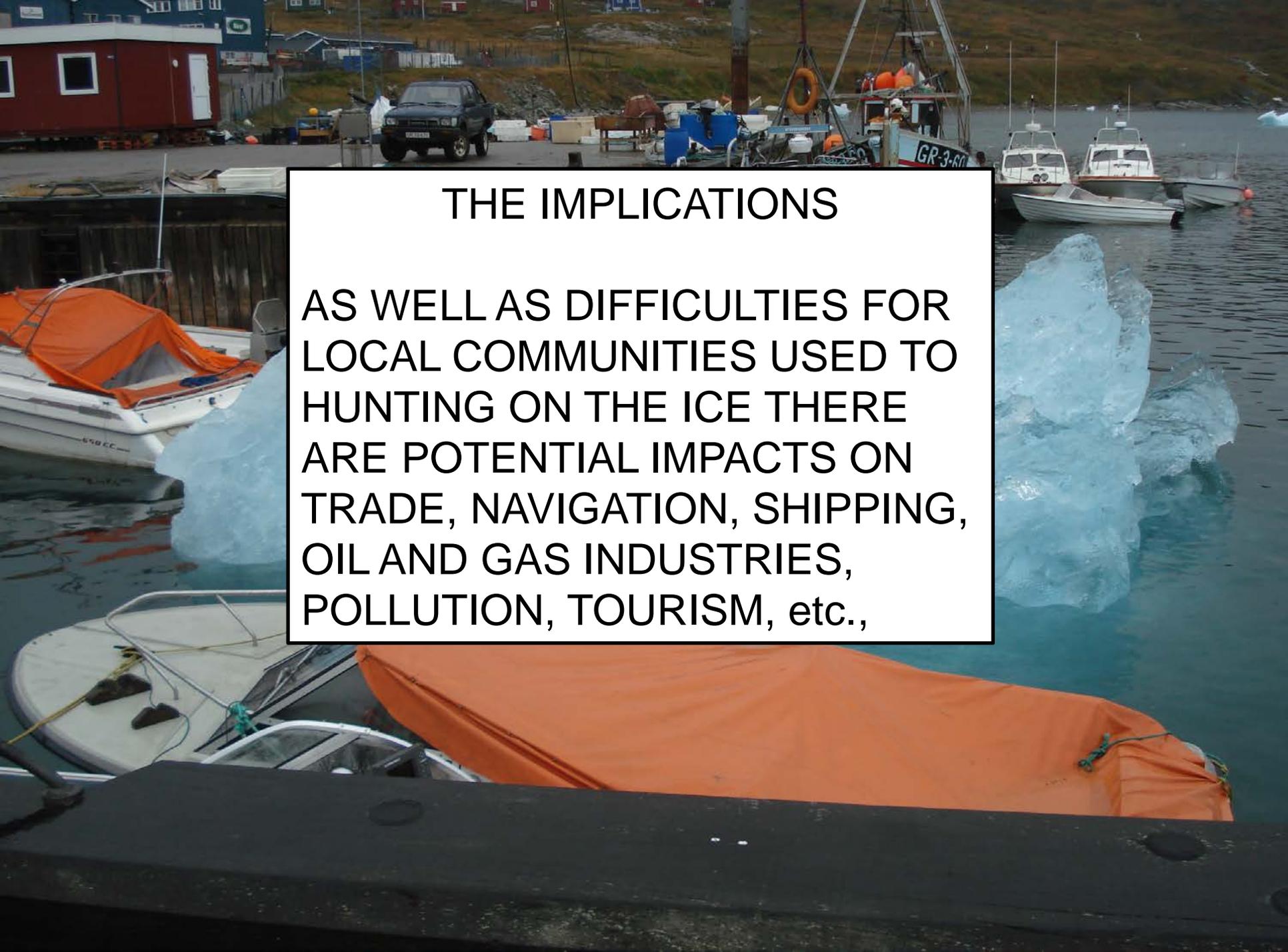
CLIMATE SUMMARY

Substantial climate variations occurred at high northern latitudes during the last few decades. In particular, Arctic summer sea-ice extent has declined by more than 10% per decade since the start of the satellite era, culminating in a new record low in September 2012.

A large, jagged iceberg floats in the middle of a calm, teal-colored sea. The sky is a pale, hazy blue, suggesting an overcast day. The water's surface is slightly rippled, reflecting the light from above. The iceberg's top surface is uneven and textured, with various shades of white and light blue. The overall scene is serene yet carries a sense of scale and isolation.

GENERAL SUMMARY

- For many years the covering of pack ice was seen mainly as a danger and an obstacle to trade.
- We now know that the sea ice not only dominates the polar regions and is important to global ocean circulation and climate patterns, but that the ice itself, and the humans and animals dependent upon it are now endangered.

A photograph of a coastal town, likely in a high-latitude region, showing a harbor with several boats, including a white boat with an orange cover and a larger boat with the registration GR-3-60. In the background, there are buildings, a dark SUV, and a hillside. Large, clear blue icebergs are floating in the water in the foreground and middle ground.

THE IMPLICATIONS

AS WELL AS DIFFICULTIES FOR LOCAL COMMUNITIES USED TO HUNTING ON THE ICE THERE ARE POTENTIAL IMPACTS ON TRADE, NAVIGATION, SHIPPING, OIL AND GAS INDUSTRIES, POLLUTION, TOURISM, etc.,

Sea Ice Extent

07/11/2013



near-real-time data

National Snow and Ice Data Center, Boulder, CO

median
1981-2010



TAKK FYRIR MIG!
And special thanks to my
“sea-ice colleagues”

Trausti Jónsson, Veðurstofa Íslands

Þór Jakobsson, Veðurstofa Íslands

Páll Bergþórsson, Veðurstofa Íslands

Ingibjörg Jónsdóttir, Háskóli Íslands

**Brian Hill, Institute of Ocean Technology,
Canada**

**William Patterson, University of Saskatchewan,
Canada**

