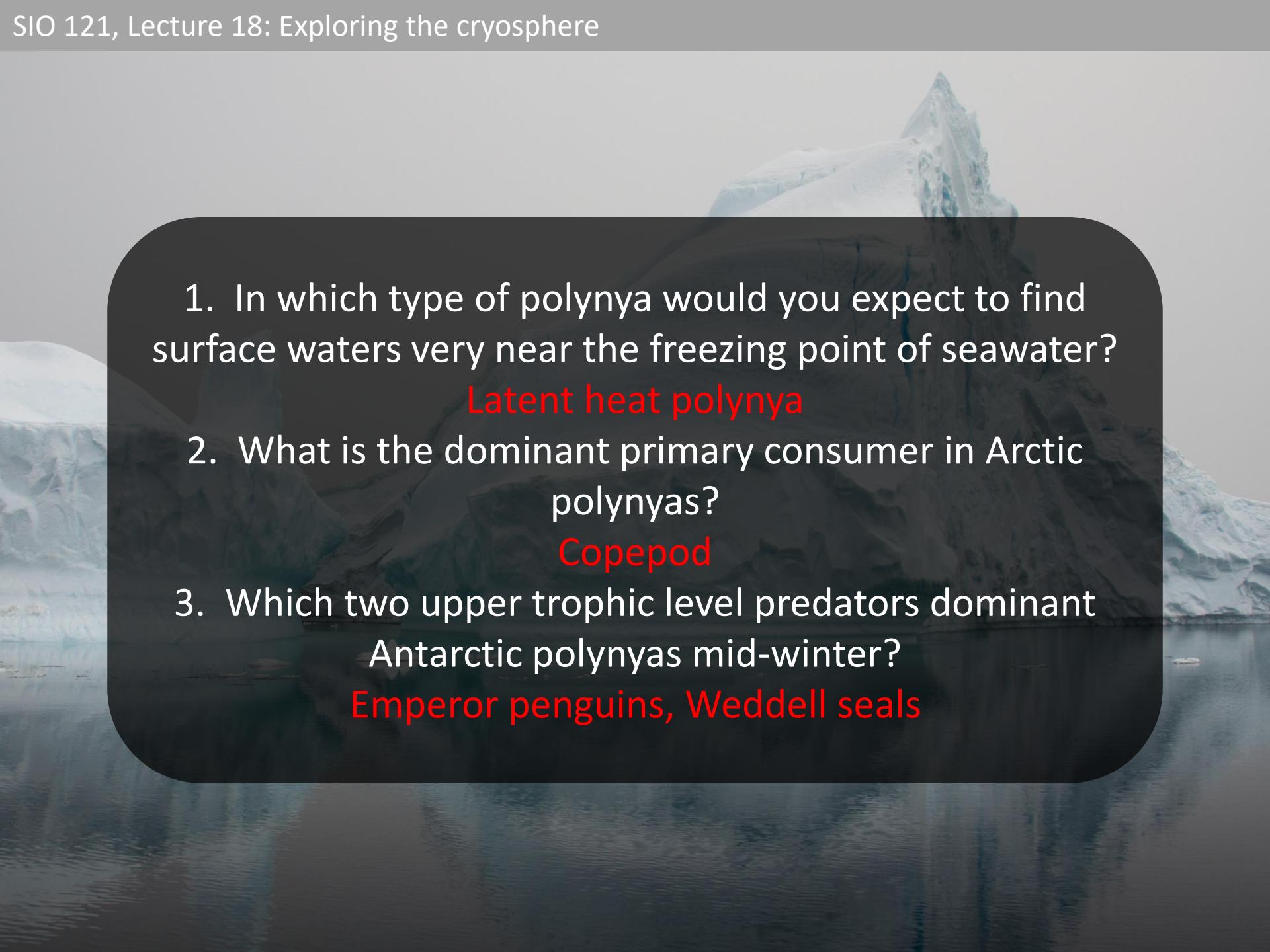


A photograph of a massive, light blue iceberg floating in a dark, calm body of water. The iceberg has a complex, jagged shape with several peaks and ridges. The water in the foreground is dark and reflects the light from the sky. A large, dark, semi-transparent rectangular box covers the middle portion of the image, containing the title text.

Exploring the cryosphere

- 
- A large, jagged iceberg floats in a body of water, serving as a background for the slide. The iceberg is light blue and white, with sharp, rocky edges. The water in the foreground is dark and slightly rippled.
1. In which type of polynya would you expect to find surface waters very near the freezing point of seawater?
Latent heat polynya
 2. What is the dominant primary consumer in Arctic polynyas?
Copepod
 3. Which two upper trophic level predators dominate Antarctic polynyas mid-winter?
Emperor penguins, Weddell seals

SIO 121, Lecture 18: Exploring the cryosphere

Central observatory:
RV *Polarstern*



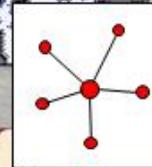
Operations with
research aircrafts
and helicopters



→ Extend vertical and
geographical
coverage

Drift: autumn 2019 to
autumn 2020

Distributed network
of satellite stations



Rendezvous with
Icebreakers from
MOSAiC partners



→
Broader geographic
coverage & supply

Exploration vs. habitation

- The cryosphere has been continually inhabited from at least 3200 BC by the pre-Dorset, Dorset, Thule, and modern Inuit cultures
 - Technologically and culturally distinct
 - Subsequent waves of migration (involving exploration)
 - Each of these groups explored the cryosphere as they inhabited, but did not leave a written record of their findings
- Other non-European explorers include Ui-te-Rangiora, an 8th century Polynesian explore who (according to Maori legend) led a fleet of boats into the Southern Ocean, which he likened to the color of arrowroot (white).



Exploration vs. habitation

- We can more narrowly define exploration as the action of exploring an unknown area with the purpose of recording and disseminating this knowledge
- ...those regions in which there was no longer any proper land nor sea nor air, but a sort of mixture of all three of the consistency of a jellyfish in which one can neither walk nor sail, holding everything together, so to speak... (Pytheas of Massalia, 4th Century BC)



Renaissance reconstruction of map by Ptolemy (100 AD)

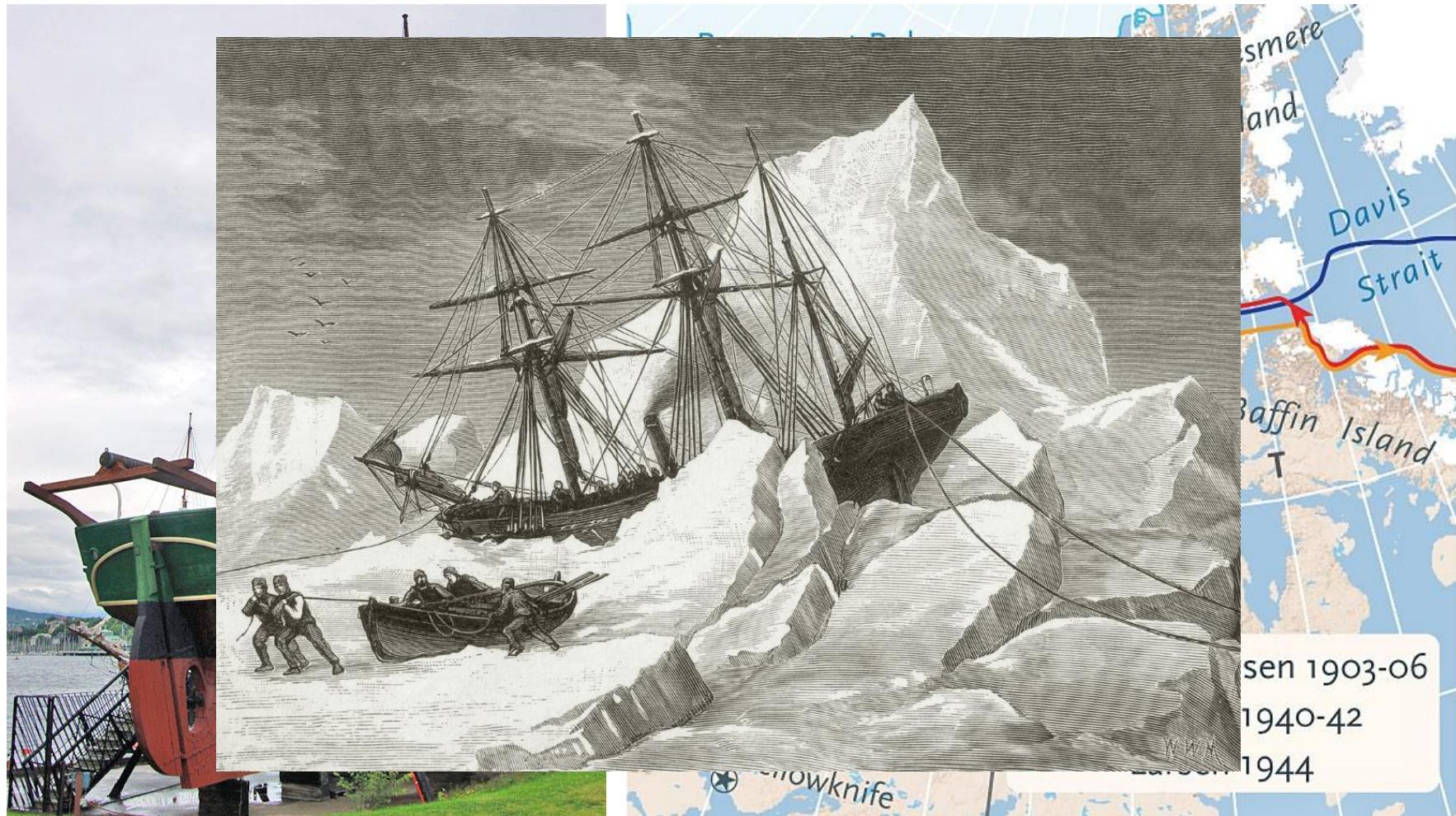
European explorations of the Arctic

- Russia exploration driven by the fur trade and missionary work starting in the 16th century
- Northern sea route (northeast passage) first completed by Semyon Dezhnen in 1648



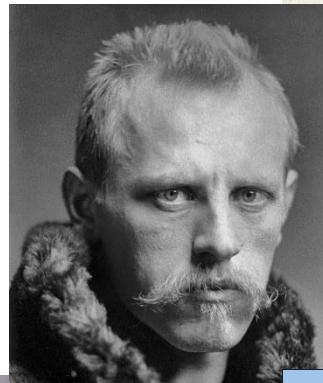
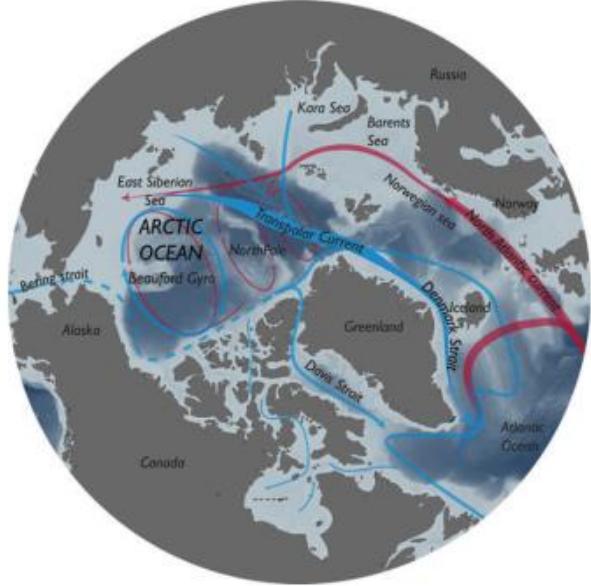
European explorations of the Arctic

- French and British exploration of the Canadian Arctic starting in 16th century
- Motivated by efforts to find the Northwest Passage
 - Much more difficult than finding the Northeast Passage – not completed until 1906 by Roald Amundsen

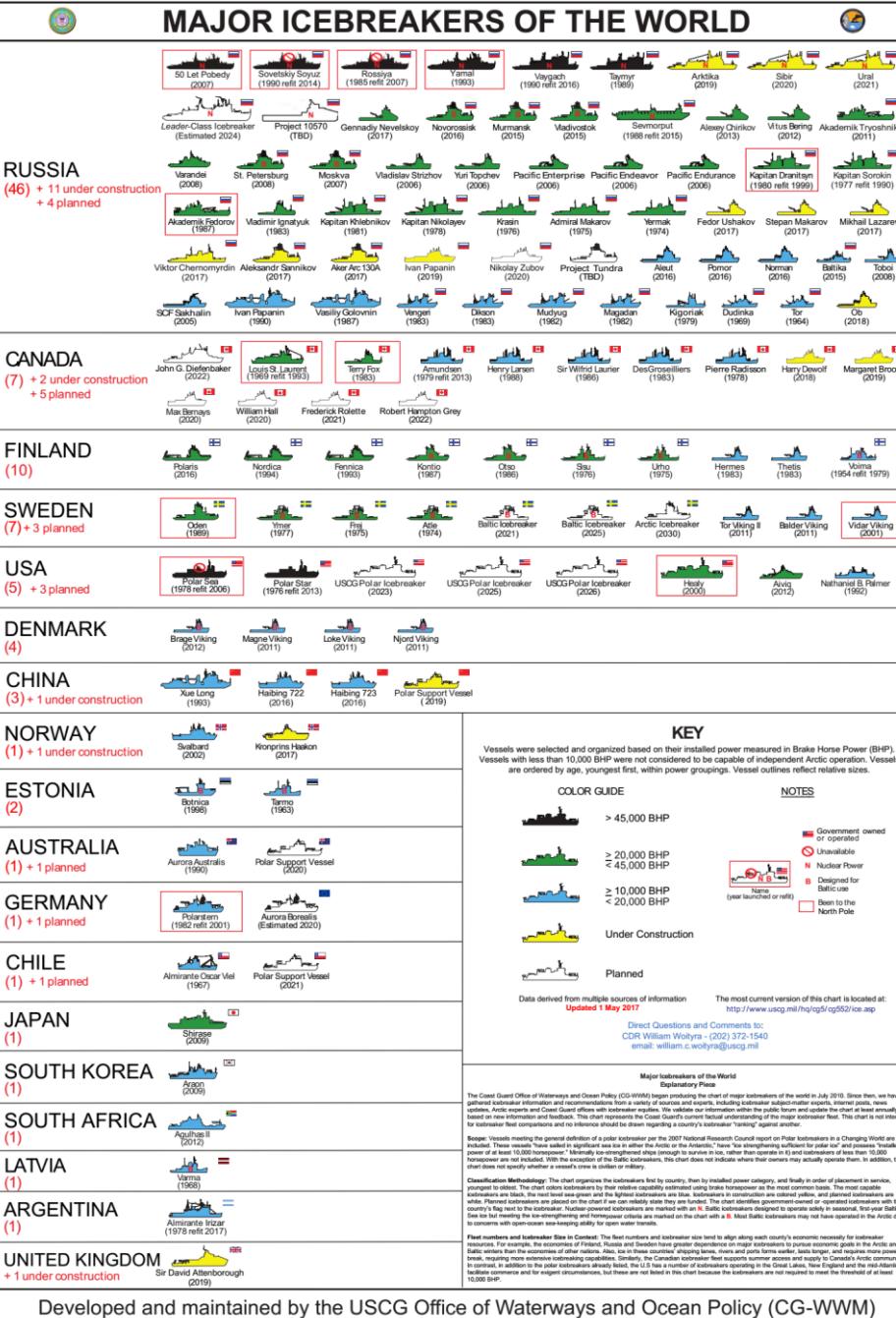


European explorations of the Arctic

- Modern age of exploration begins with Fridtjof Nansen (Amundsen's mentor) and the voyage of the *Fram* (1893-1896)

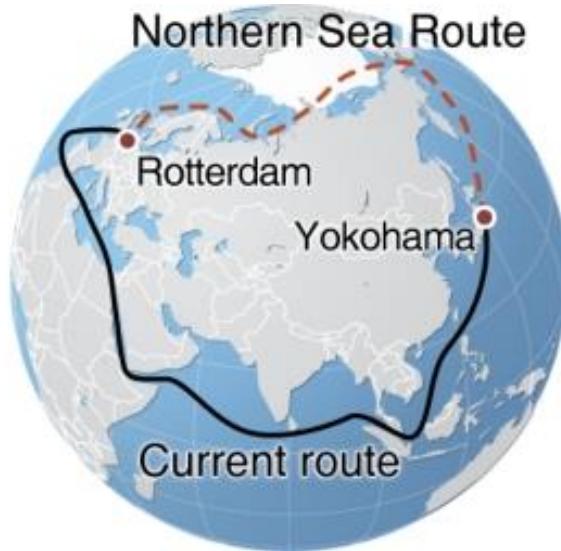


SIO 121, Lecture 18: Exploring the cryosphere



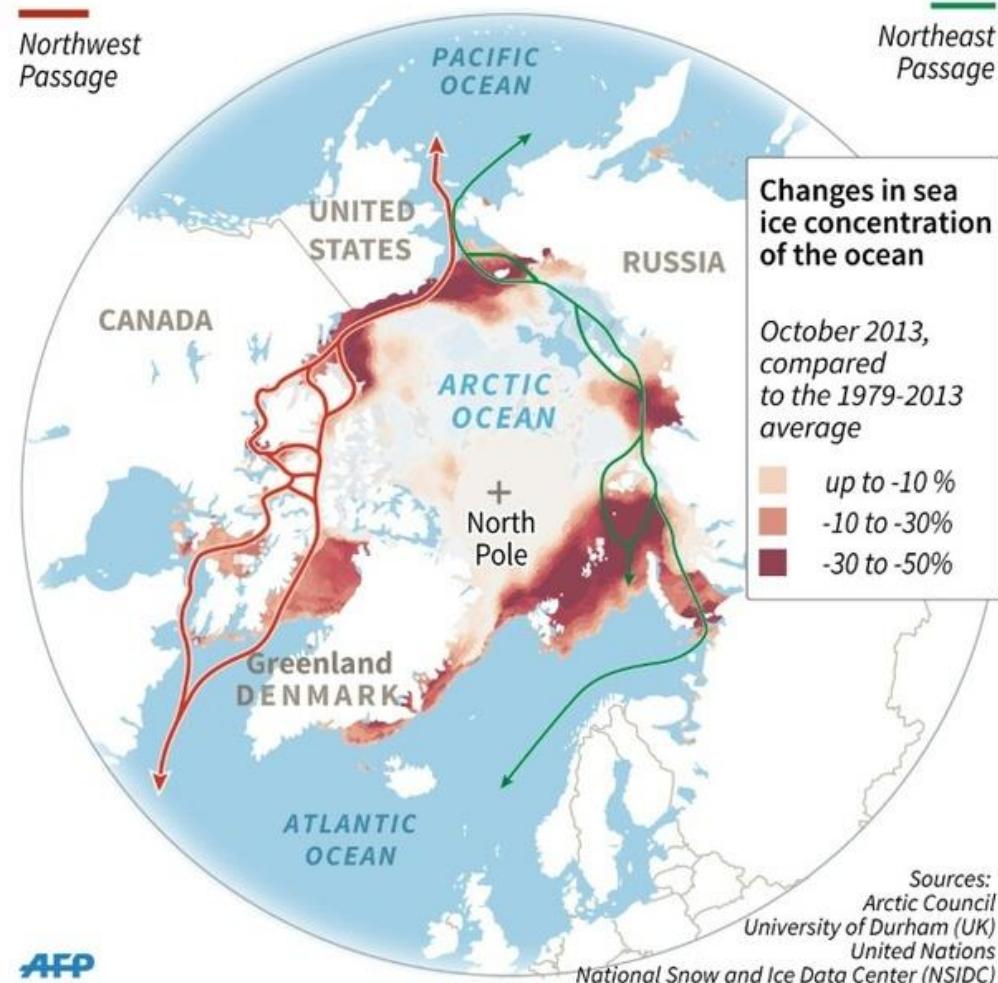
Q: Which nation has invested most heavily in infrastructure to explore the cryosphere?



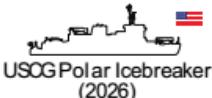
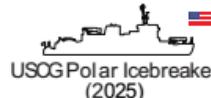
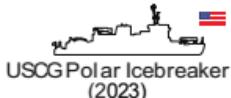


The Northwest Passage

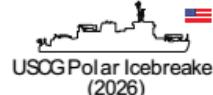
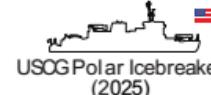
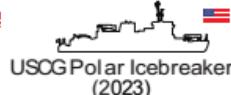
A cargo vessel took this route for the first time in 2013: by 2030, a quarter of the world's maritime traffic could use it



SIO 121, Lecture 18: Exploring the cryosphere



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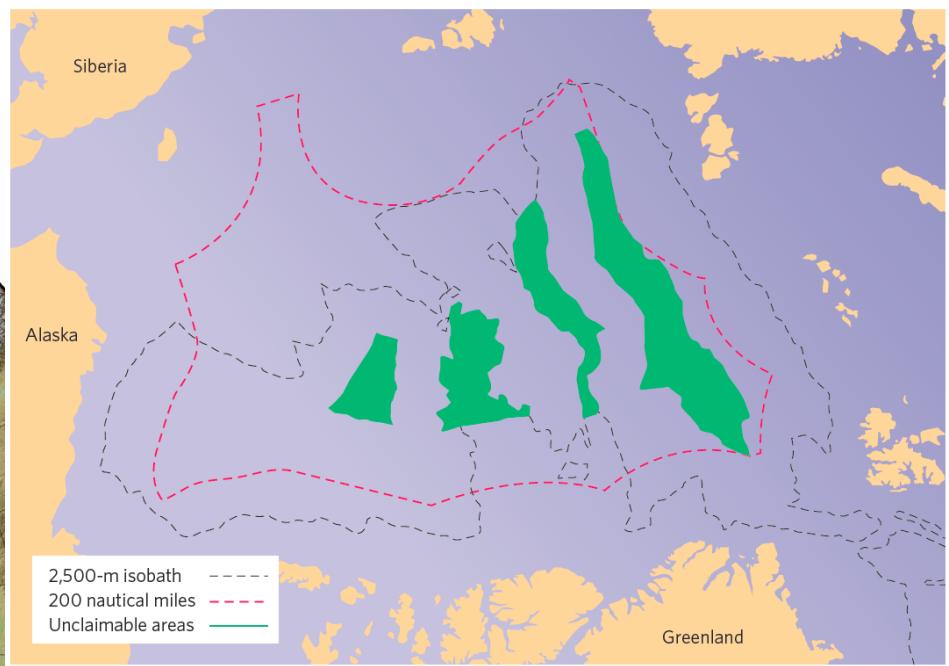
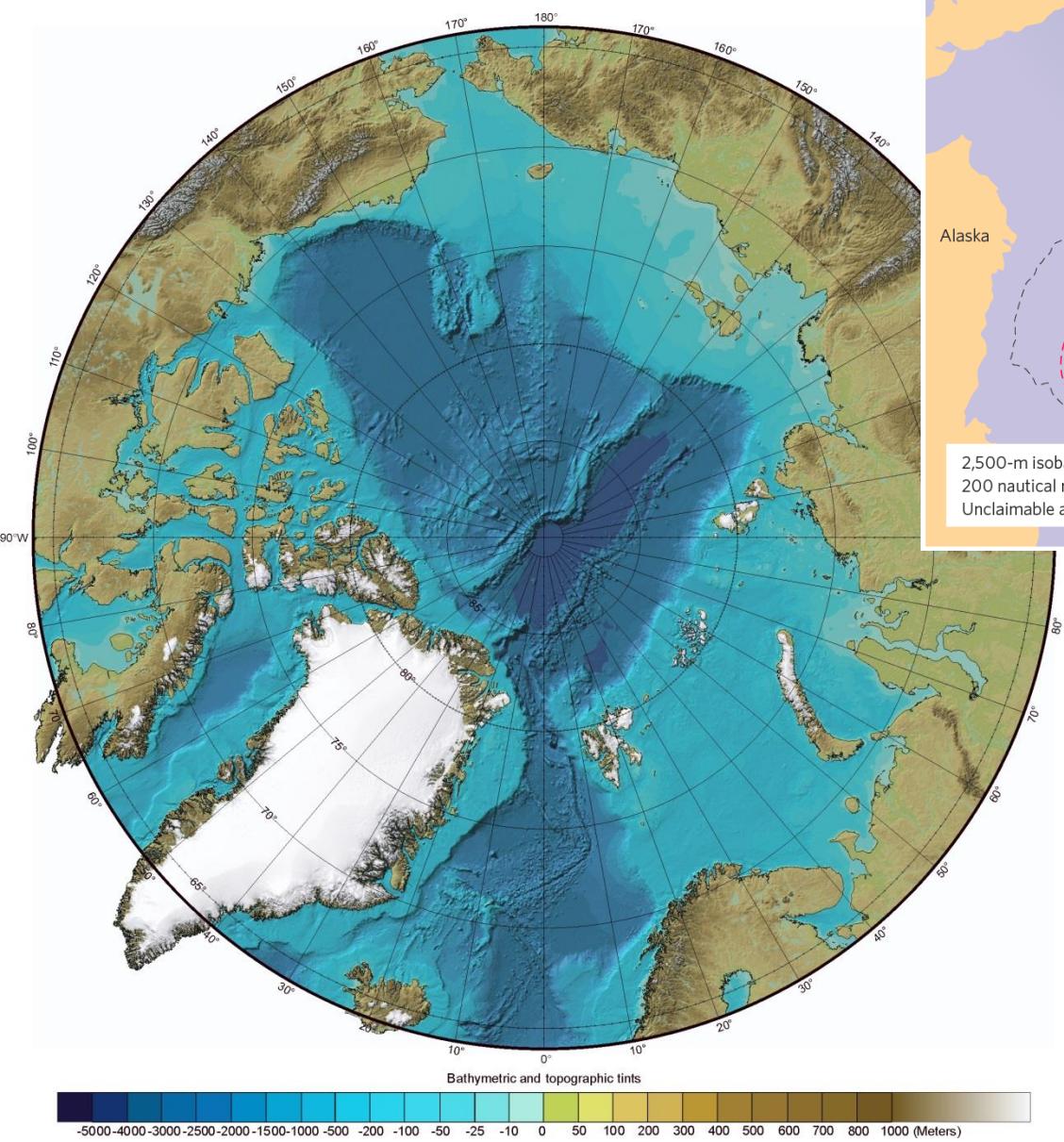


LOMROGII – 2009

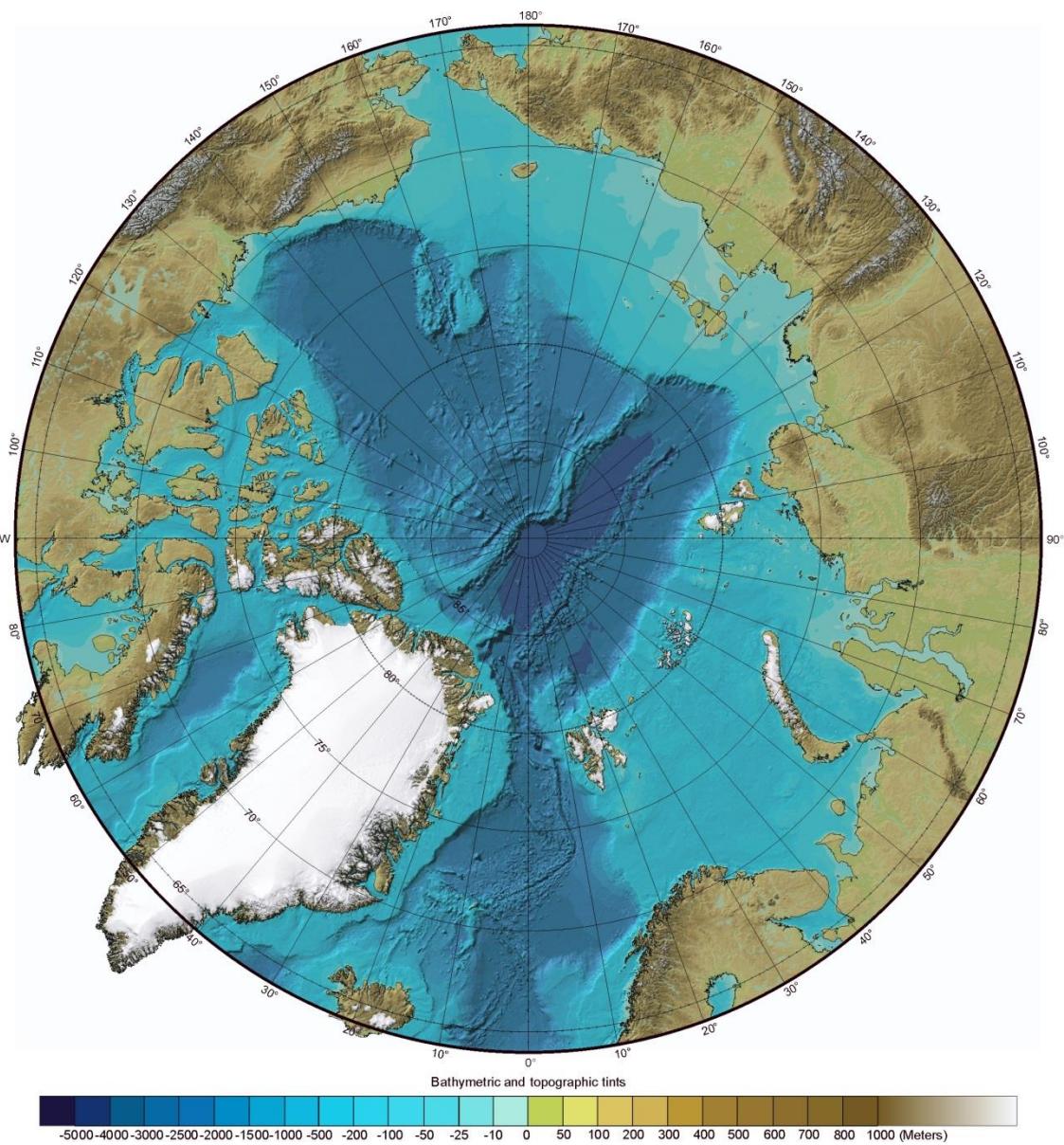
- Danish expedition on the Swedish icebreaker *Oden*



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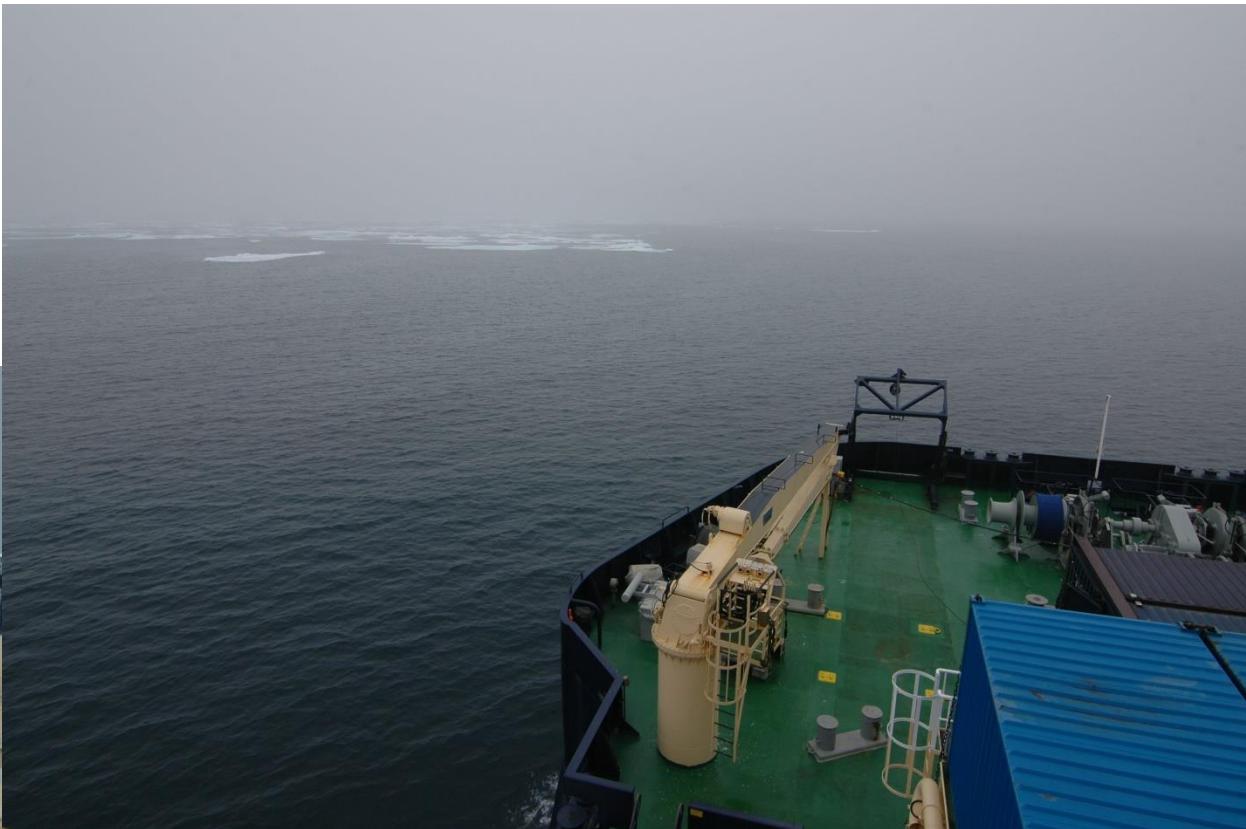
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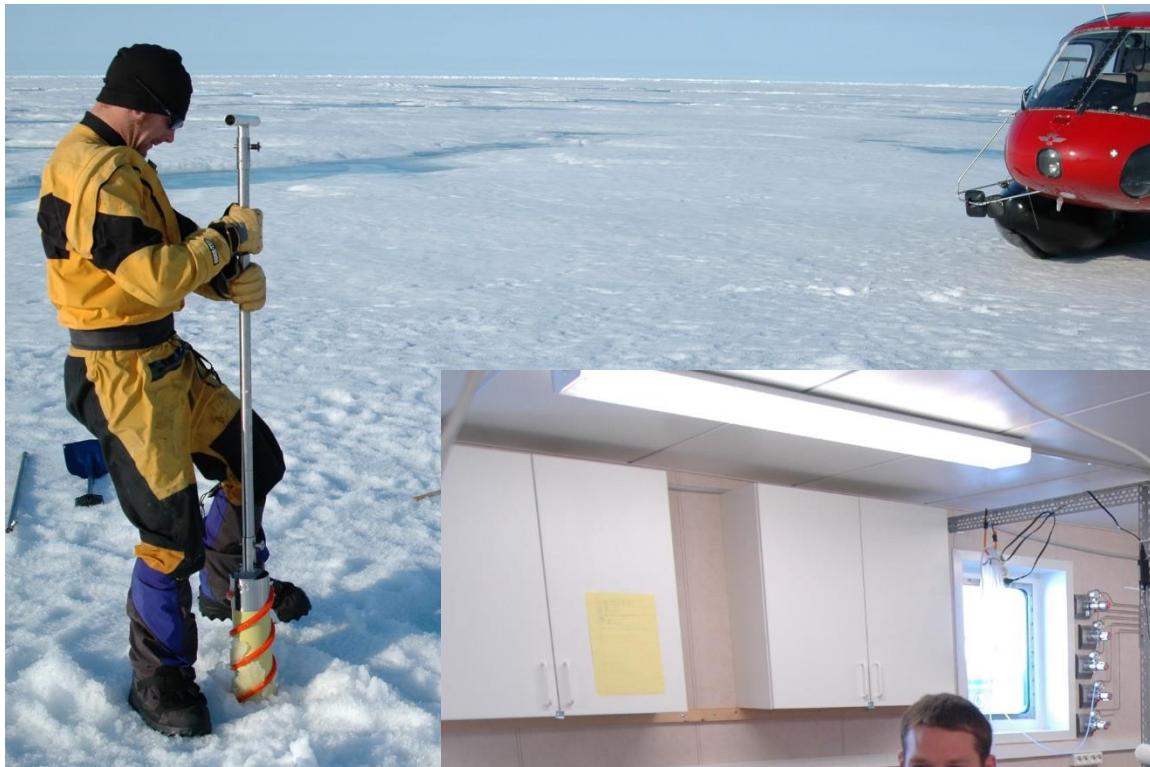
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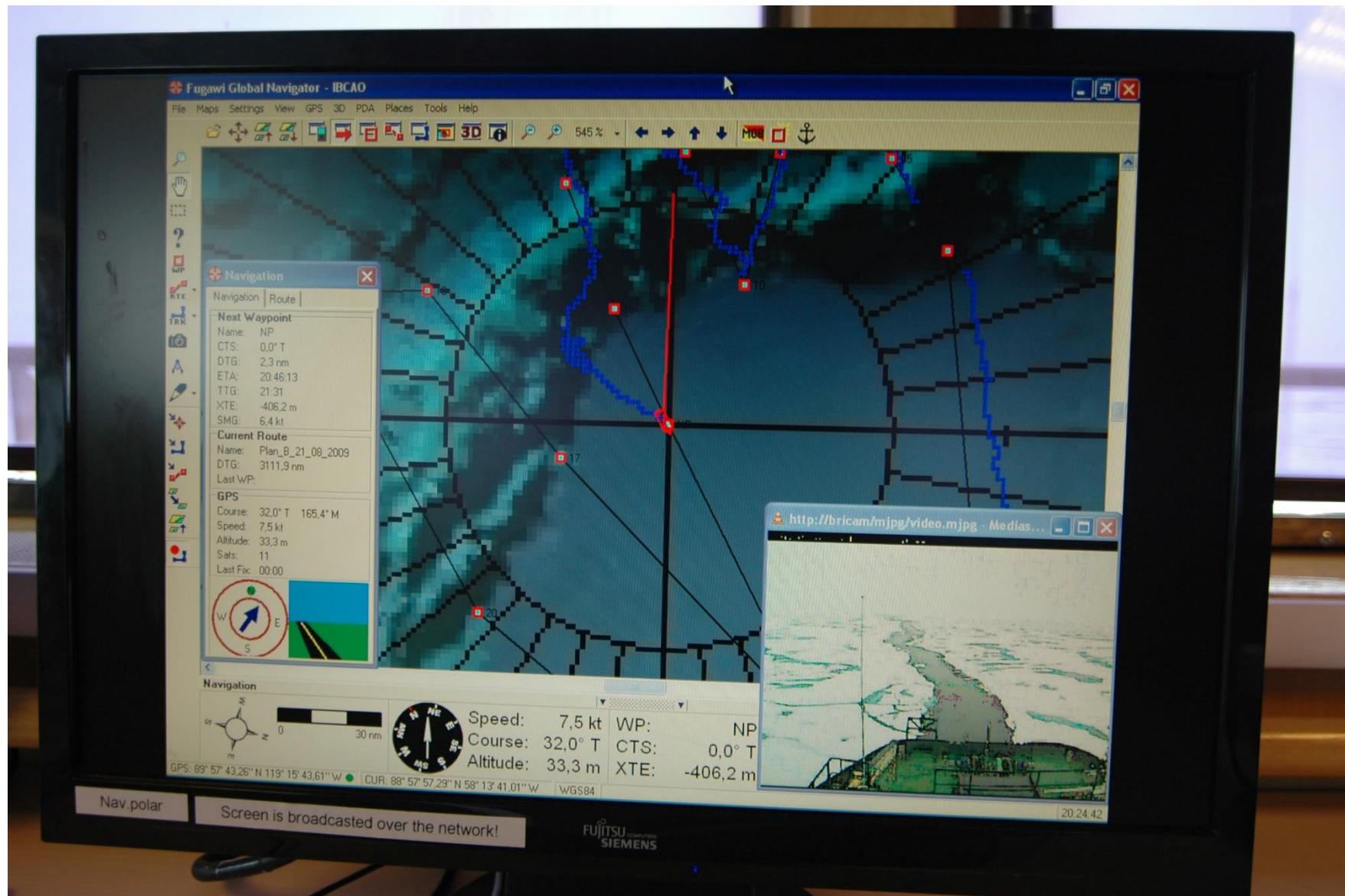
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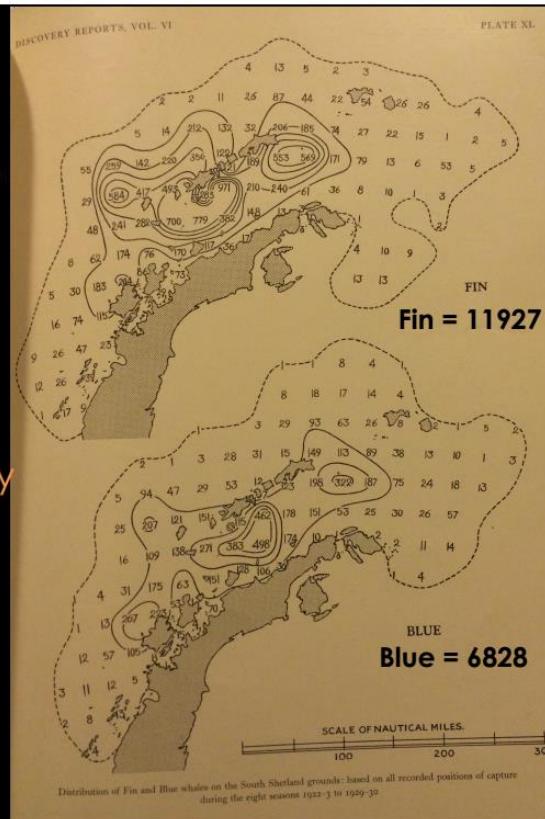
What about the Antarctic?



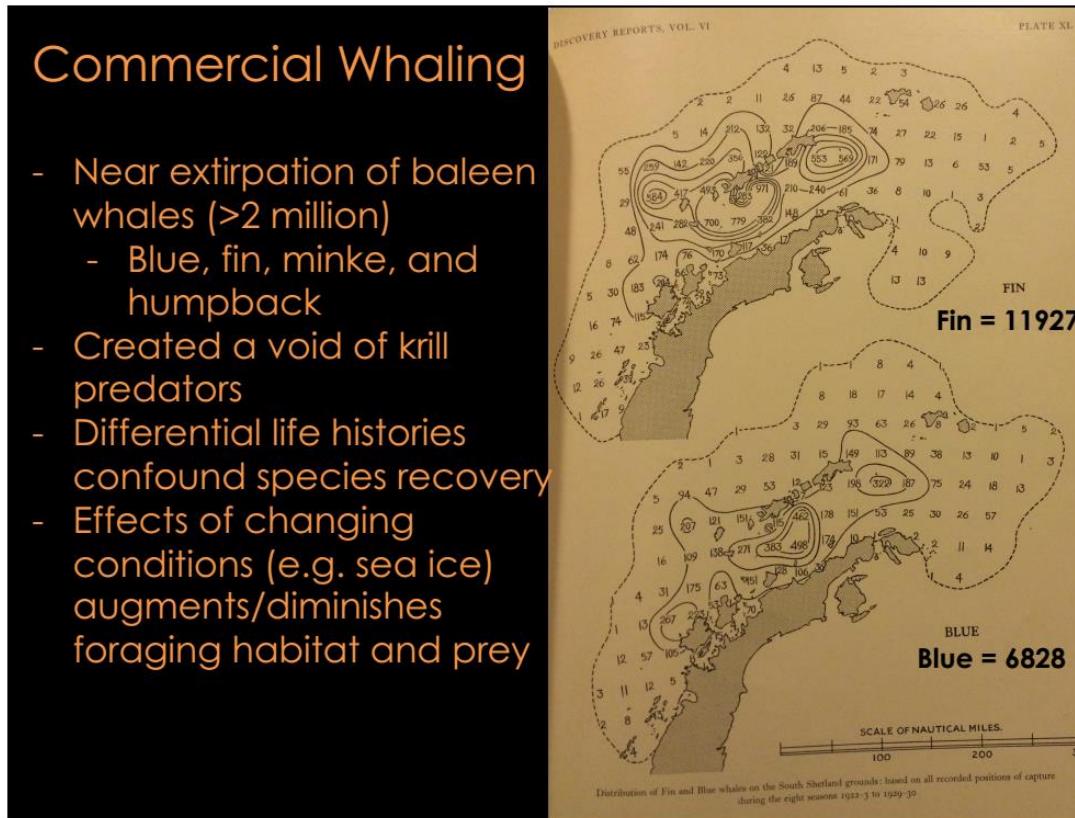
- Exploration of the Antarctic interior was largely driven by scientific interest, not economic potential

Commercial Whaling

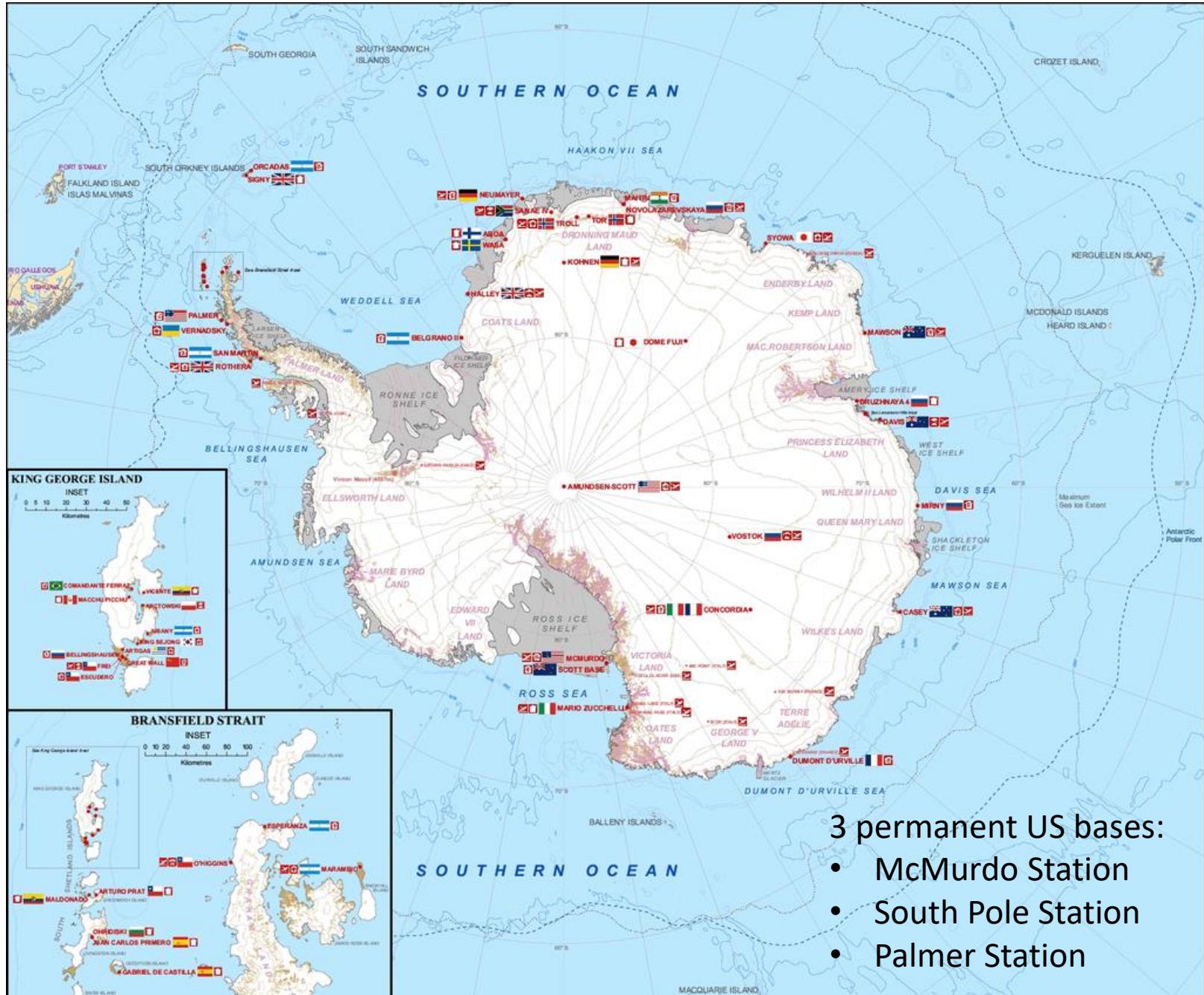
- Near extirpation of baleen whales (>2 million)
 - Blue, fin, minke, and humpback
- Created a void of krill predators
- Differential life histories confound species recovery
- Effects of changing conditions (e.g. sea ice) augments/diminishes foraging habitat and prey



- Exploration of the Antarctic interior was largely driven by scientific interest, not economic potential
- Antarctic continent not spotted until 1820 (Bellingshausen and Lazarev)
- First landing in 1821 (Davis)
- Oddly, south pole reached long before the north pole (Amundsen, 1911 vs. Amundsen, 1926)
 - Long distance travel over pack ice extremely difficult before the snowmobile



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- 3 permanent US bases:
- McMurdo Station
- South Pole Station
- Palmer Station

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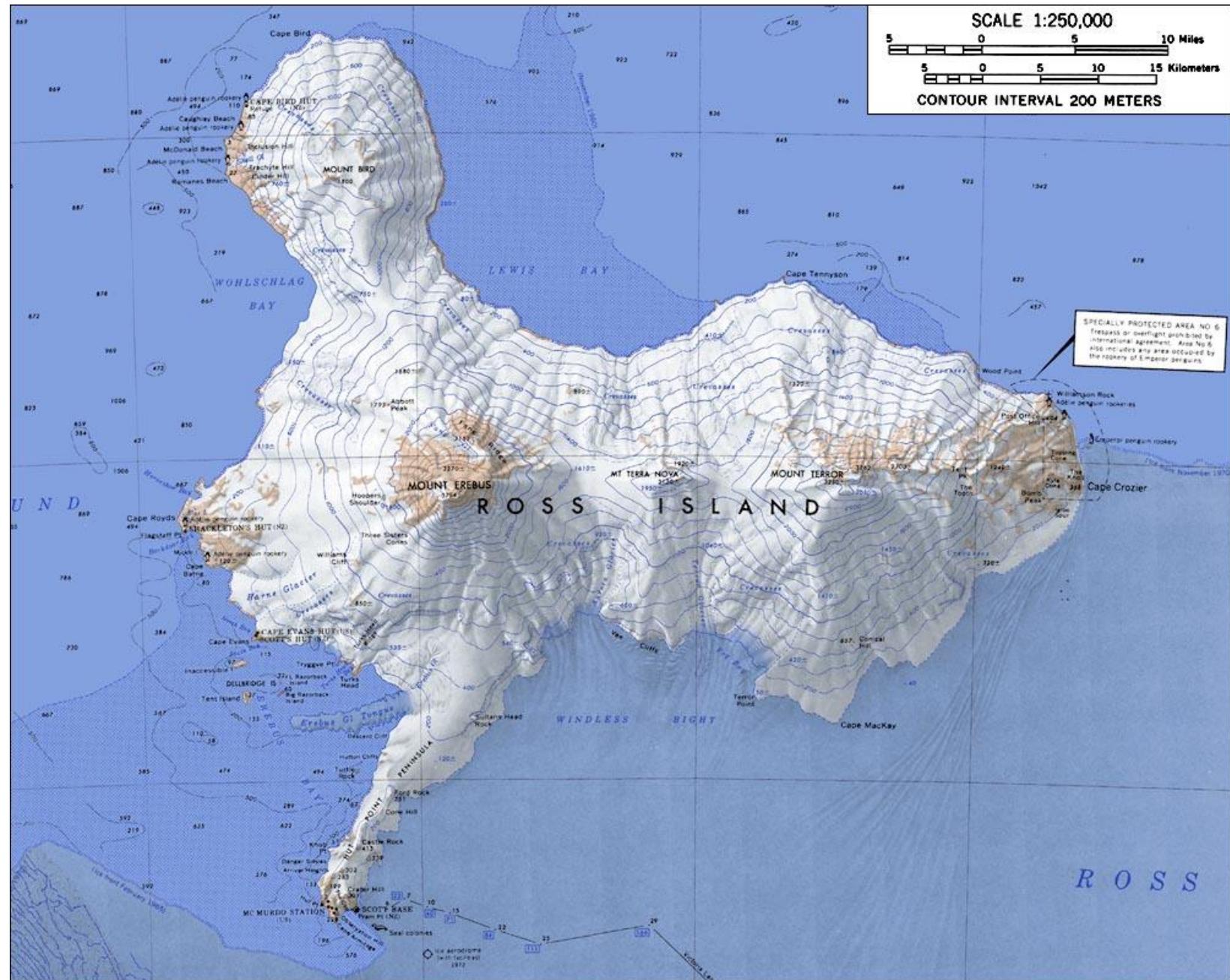
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