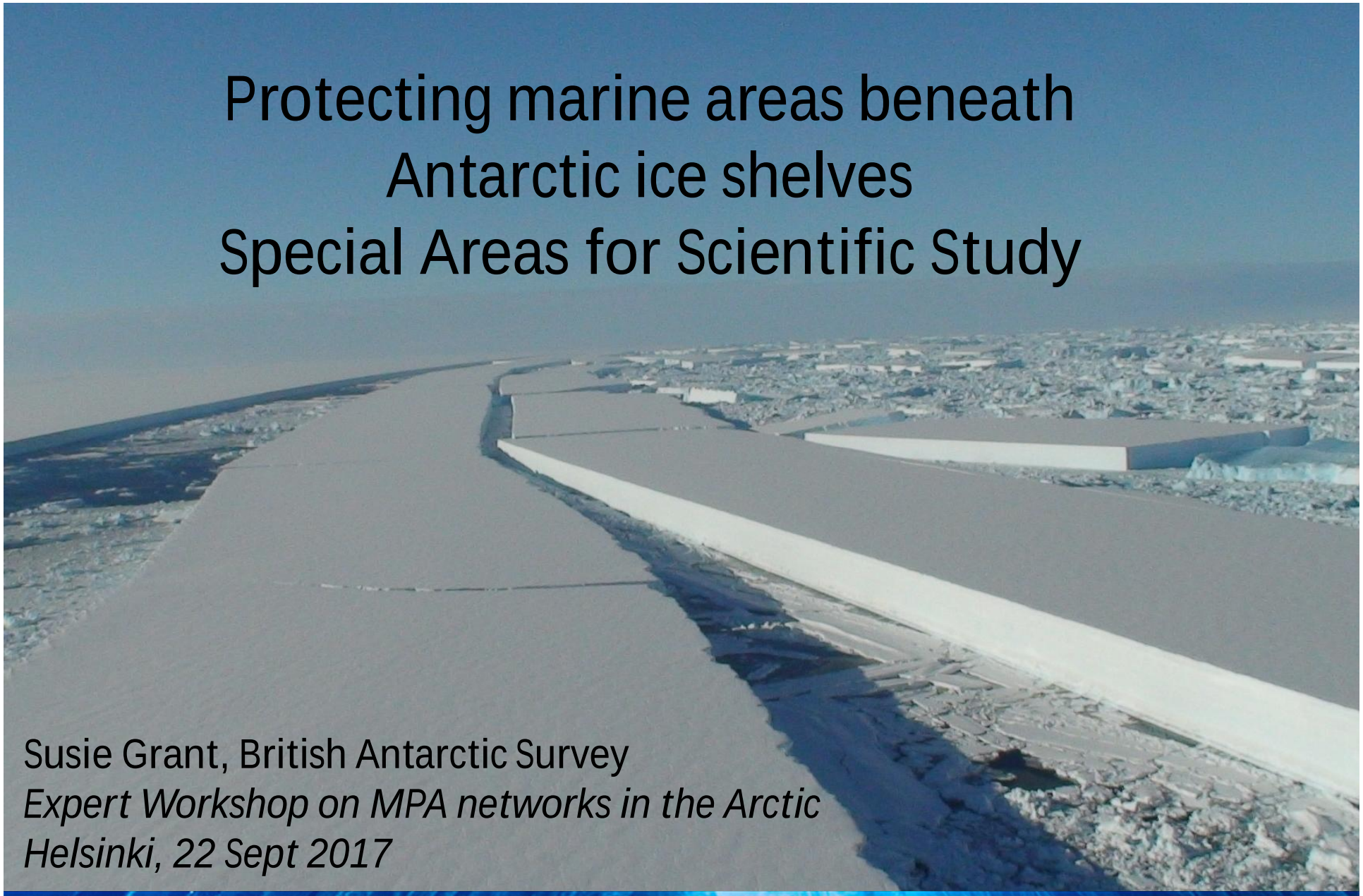
Protecting marine areas beneath Antarctic ice shelves
Special Areas for Scientific Study



Susie Grant, British Antarctic Survey

Expert Workshop on MPA networks in the Arctic
Helsinki, 22 Sept 2017

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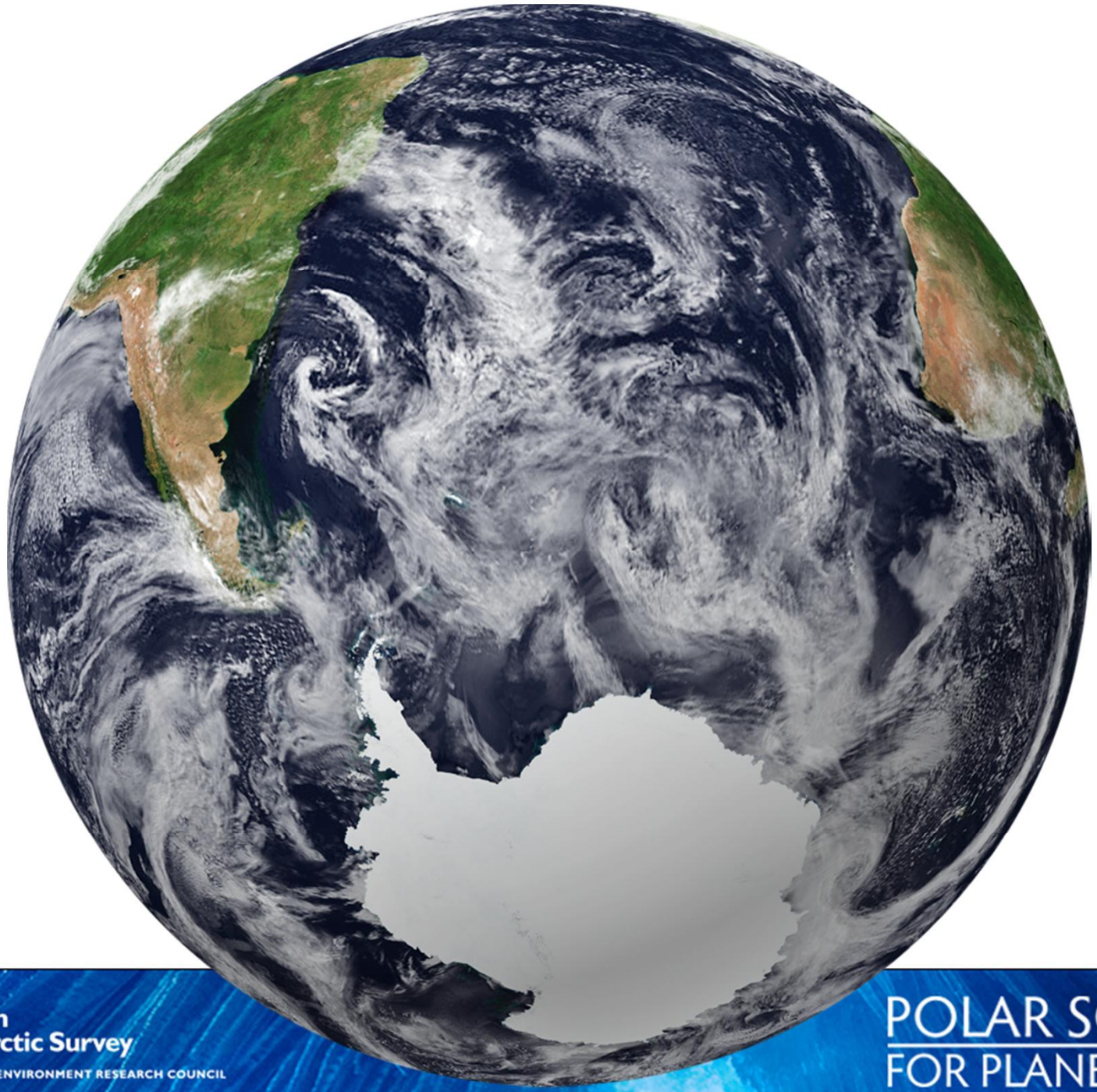
POLAR SCIENCE FOR PLANET EARTH



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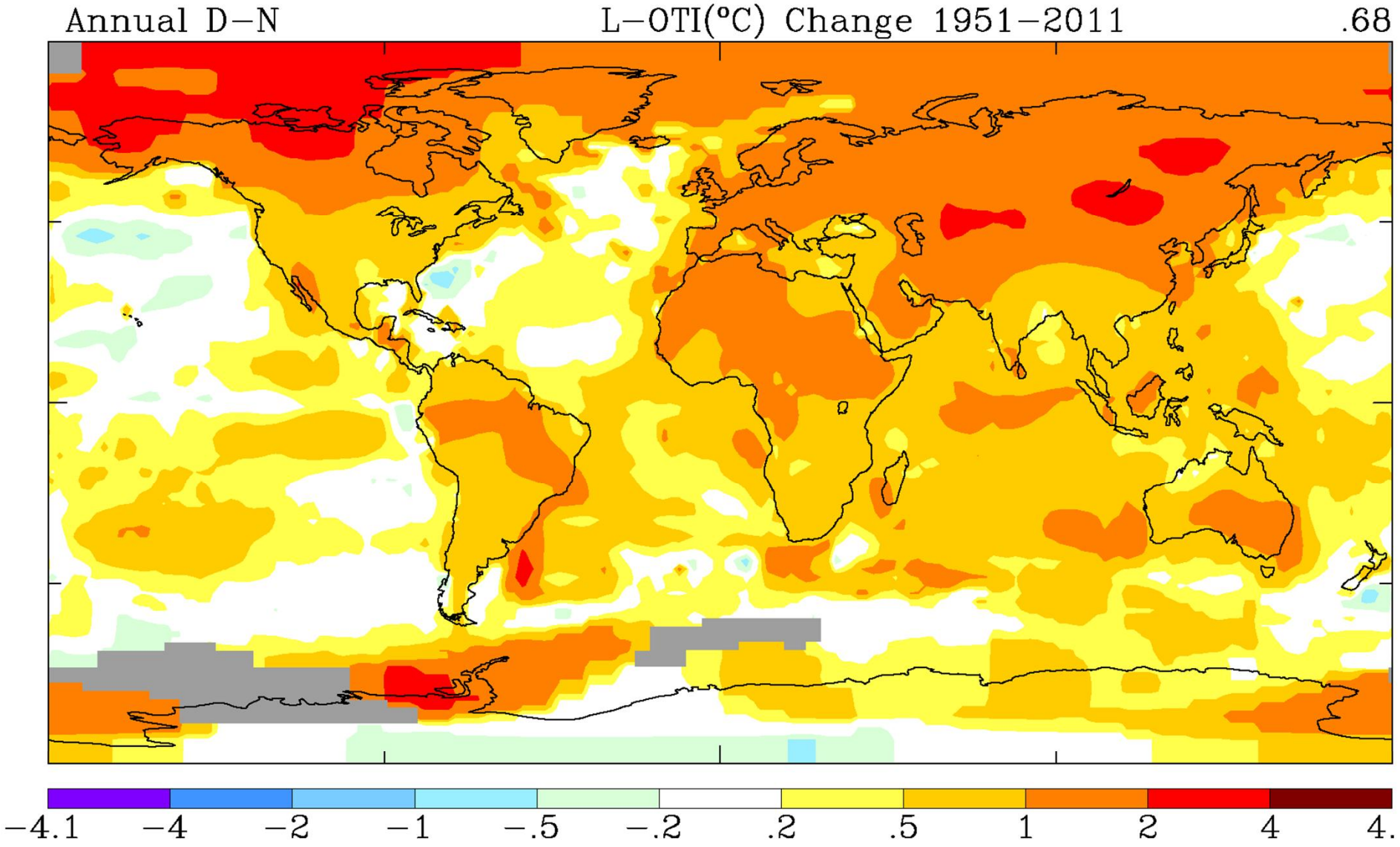
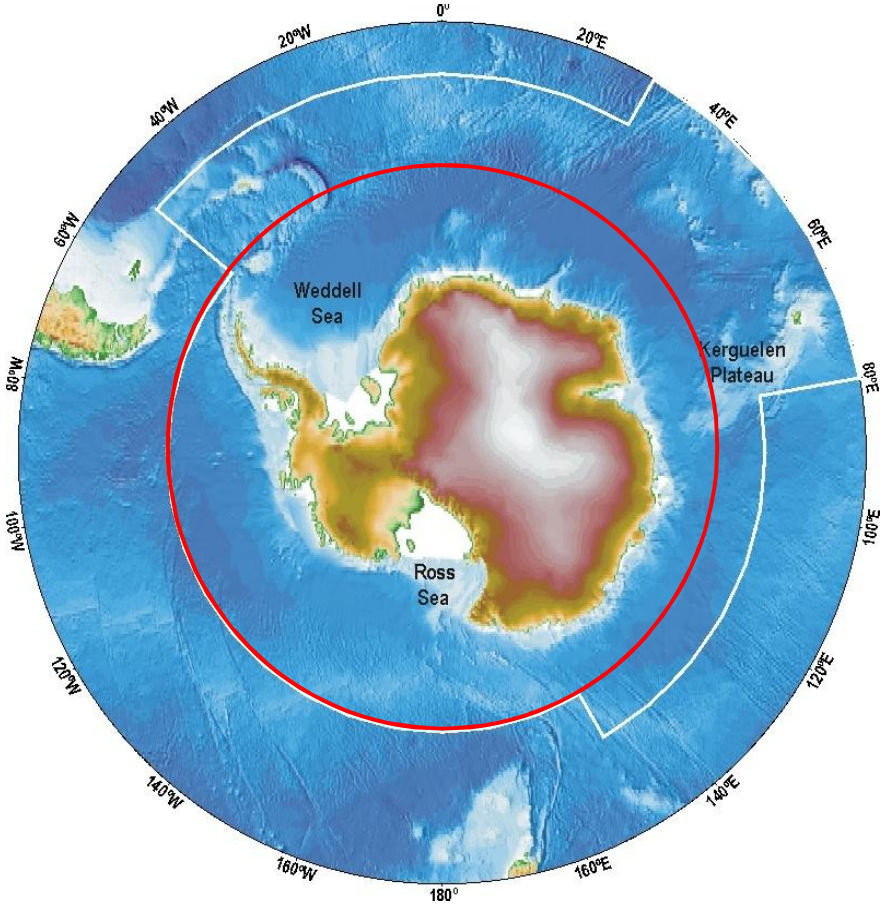


The Antarctic Treaty System

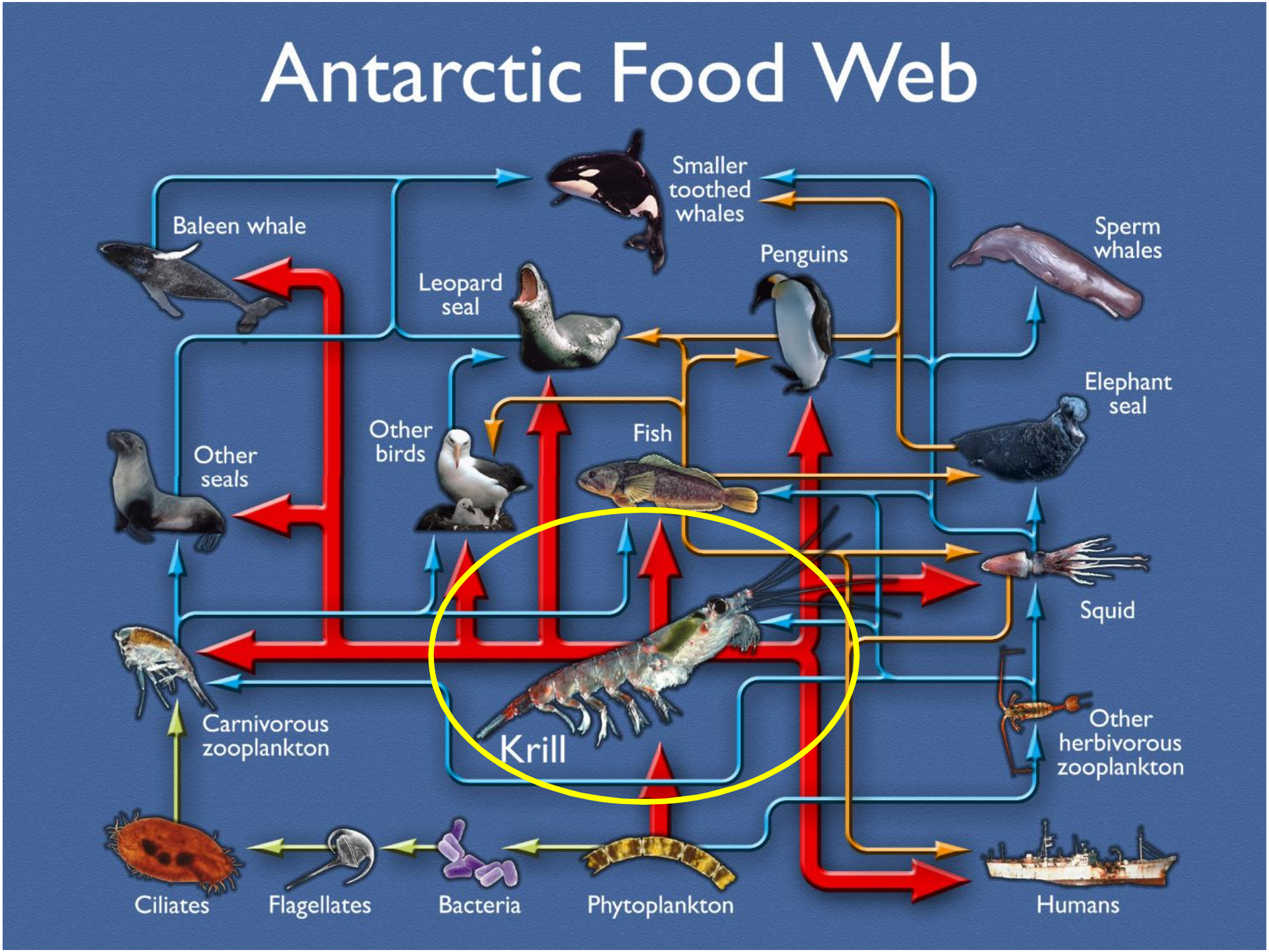


The area south of 60°S is designated as a “natural reserve, devoted to peace and science”.

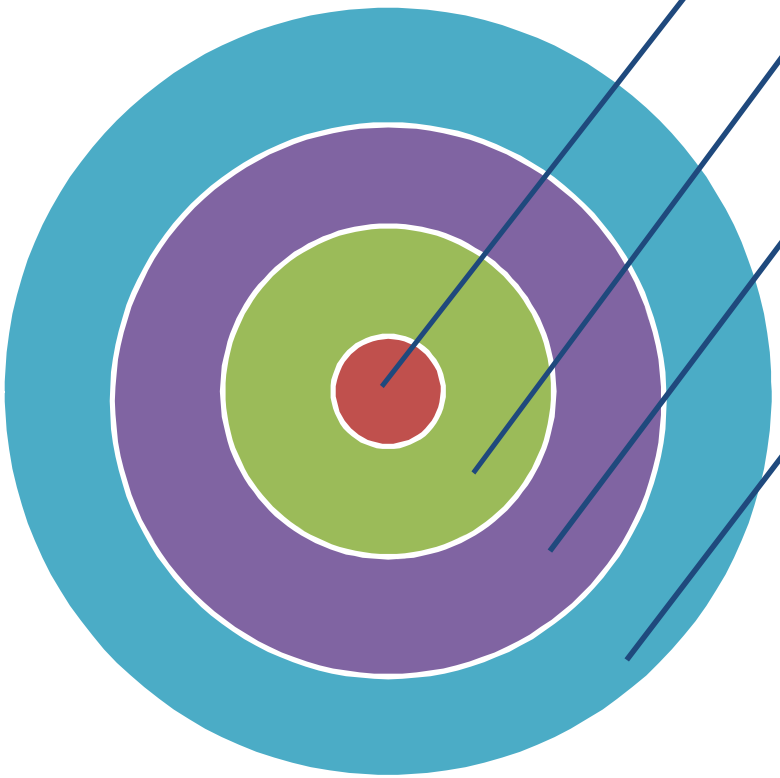
Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) regulates fisheries.

Protocol on Environmental Protection manages all other human activities.

Decision-making *by consensus*, and underpinned by scientific advice.


Antarctic Food Web
Smaller toothed whales
Baleen whale
Sperm whales
Penguins
Leopard seal
Elephant seal
Other birds
Fish
Other seals
Squid
Carnivorous zooplankton
Krill
Other herbivorous zooplankton
Ciliates
Flagellates
Bacteria
Phytoplankton
Humans

MPAs as part of CCAMLR's ecosystem approach



Marine Protected Areas

Other area-based Conservation Measures, e.g. SASSs, VMEs, fishery closed areas

Regulations not associated with spatial management, e.g. bycatch & incidental mortality mitigation

Ecosystem-based approach to fisheries management

Based on Framework for a Pan-Arctic Network of MPAs, Figure 5

Impacts of climate change on Southern Ocean ecosystems

- Ocean warming, circulation patterns
- Biogeochemistry changes, acidification
- Changing sea ice dynamics – krill habitat, primary production, access to fishing areas
- Retreat and collapse of ice shelves and glaciers
- Changes to biodiversity and food web structure
- Range shifts – some areas losing species, others opening up to previously excluded species

However – implications for marine ecosystems remain poorly understood, especially how rapidly physical changes might cascade through marine foodwebs.

Griffiths et al, 2017 – *More losers than winners in a century of future Southern Ocean seafloor warming.*

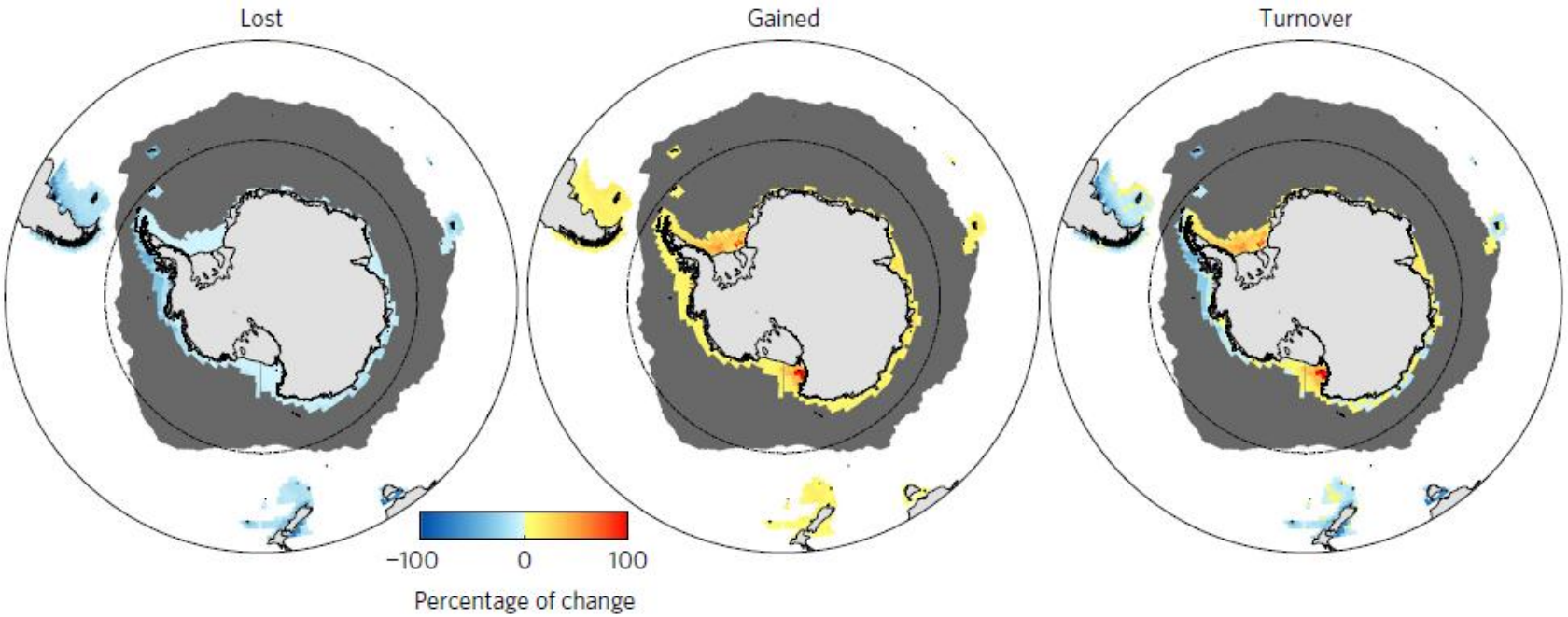


Figure 5 | Species change/turnover (gain + loss) by 2099 as a percentage of the original number of species potentially inhabiting each pixel (based on suitable present-day temperature ranges, using RCP8.5 mean ensemble projections). The dashed line is 60° S; the grey area is south of the Polar Front

Cook et al, 2016

Ocean forcing of glacier retreat in the western Antarctic Peninsula

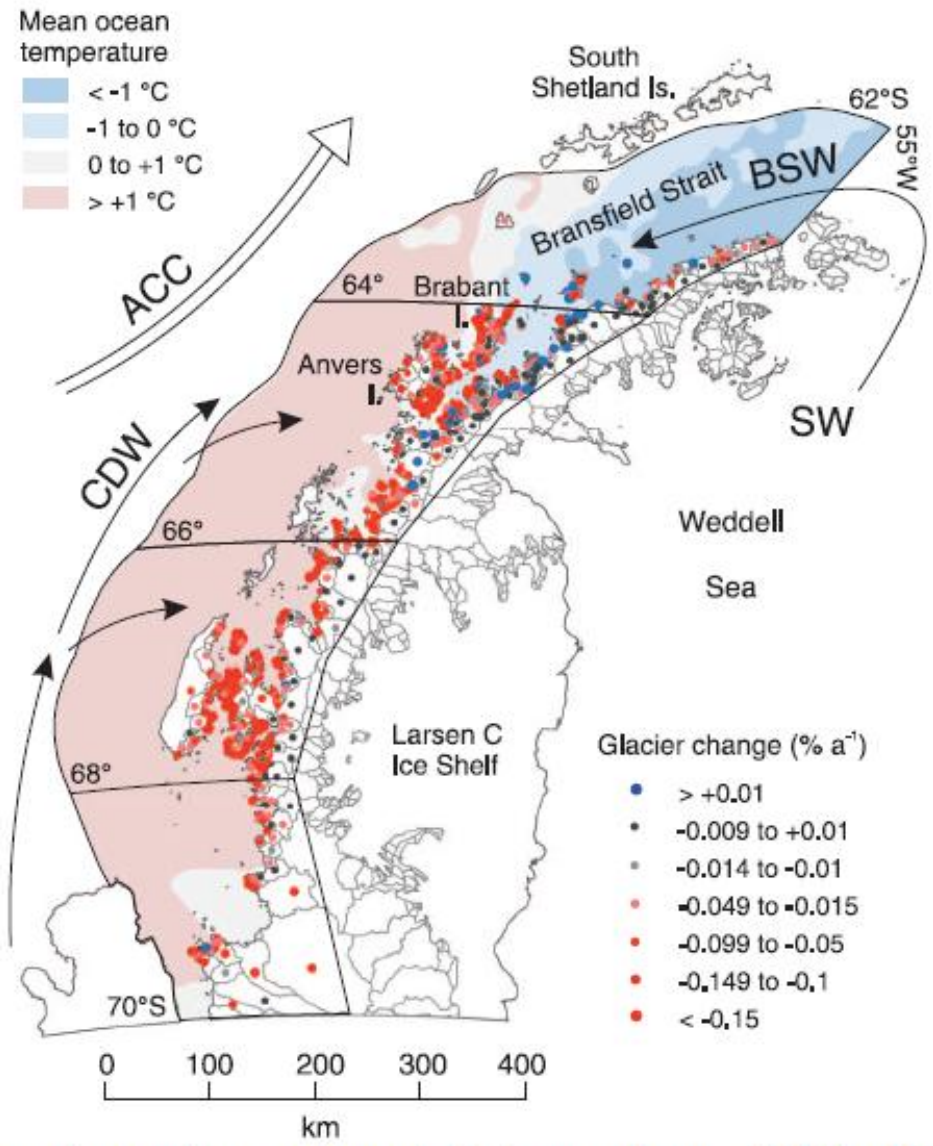


Fig. 1. Mean ocean temperatures and overall glacier area changes, 1945 to 2009. Mean in situ ocean temperature at 150-m depth (shaded) and glacier change (points). For each of the 674 glaciers along the west coast, the point shows overall change between its earliest and latest recorded ice-front position, relative to basin size (% a^{-1}). A similar spatial pattern is found for changes in absolute area loss per glacier. The point symbols are layered in the same order as in the legend (i.e., blue above red). Ocean circulation and water masses are also shown schematically: CDW, Shelf Water (SW), BSW, and ACC.

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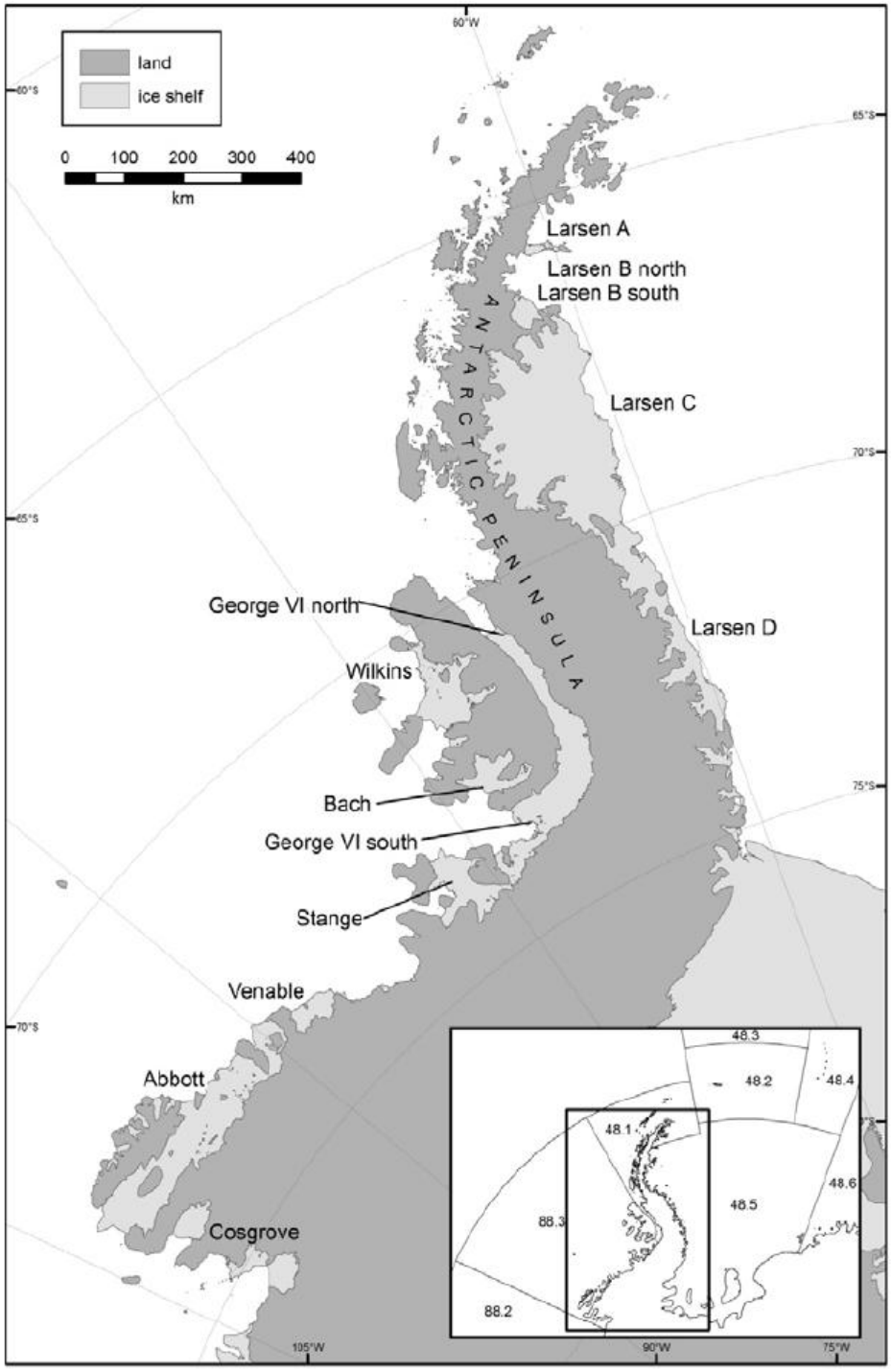
Ecosystem changes following ice shelf collapse/retreat

- Loss of ice shelves and retreat of coastal glaciers around the Antarctic Peninsula in the last 50 years has exposed at least 2.4×10^4 km^2 of new open water.
- Phytoplankton blooms, increased productivity, rapid change from low-nutrient conditions.
- Colonisation by species from adjacent areas.
- Change in community structure, species turnover.
- Scientific value of newly exposed habitats, and need to facilitate research.

Image: Julian Gutt, Alfred Wegener Institute

Protection for areas exposed after ice shelf collapse

- 2010 - Antarctic Treaty Meeting of Experts on Climate Change recommendation on interim protection for areas exposed following retreat or collapse of ice shelves
- 2011 - UK proposal to CCAMLR on implementation of ATME recommendation
- 2016 – CCAMLR agreement on ice shelves Conservation Measure, for the Antarctic Peninsula region



- Automatic protection for 2 years following retreat or collapse.
- Extended to further 10 years, after consideration of available data.
- Members encouraged to undertake research in Special Areas for Scientific Study, particularly in order to understand ecosystem processes in relation to climate change.
- Research fishing activities are only permitted under certain conditions, with the agreement of the Scientific Committee.

Conservation Measure 24-04 (2016)

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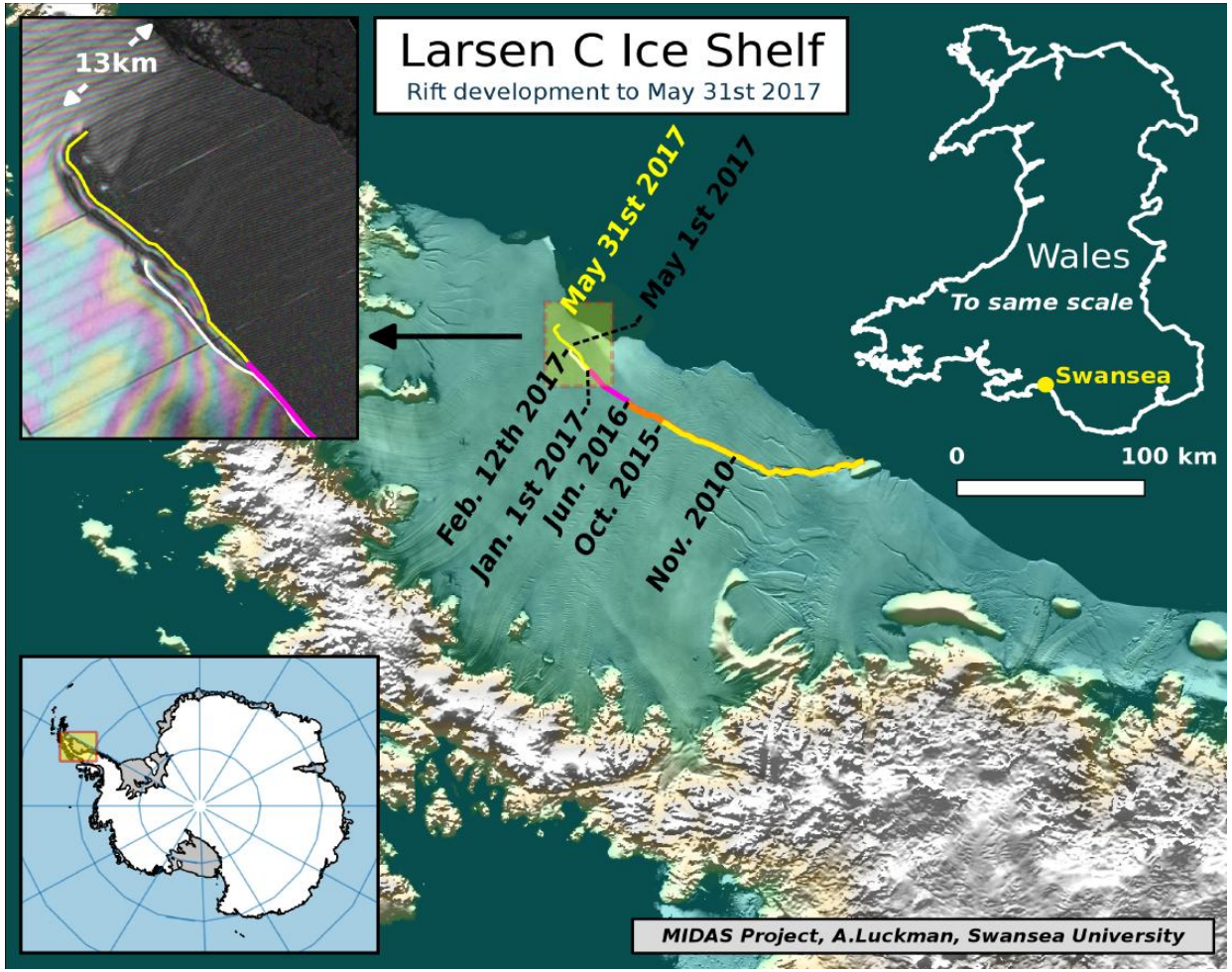
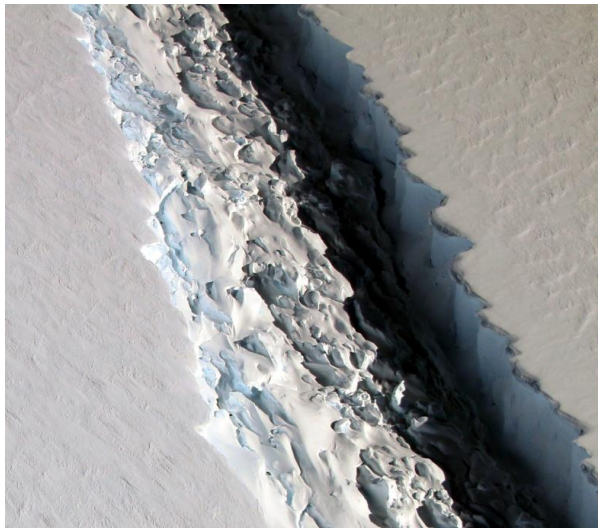
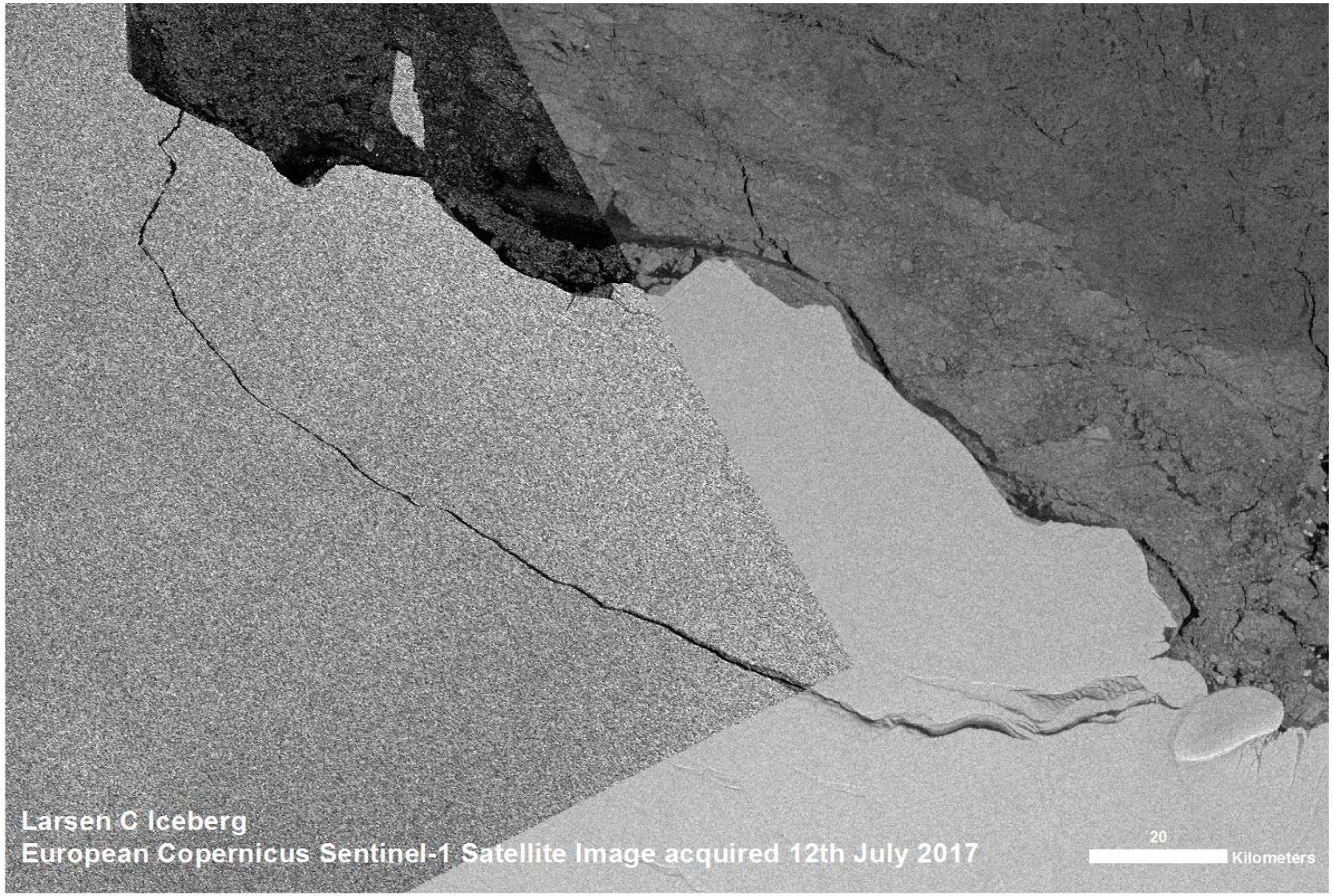
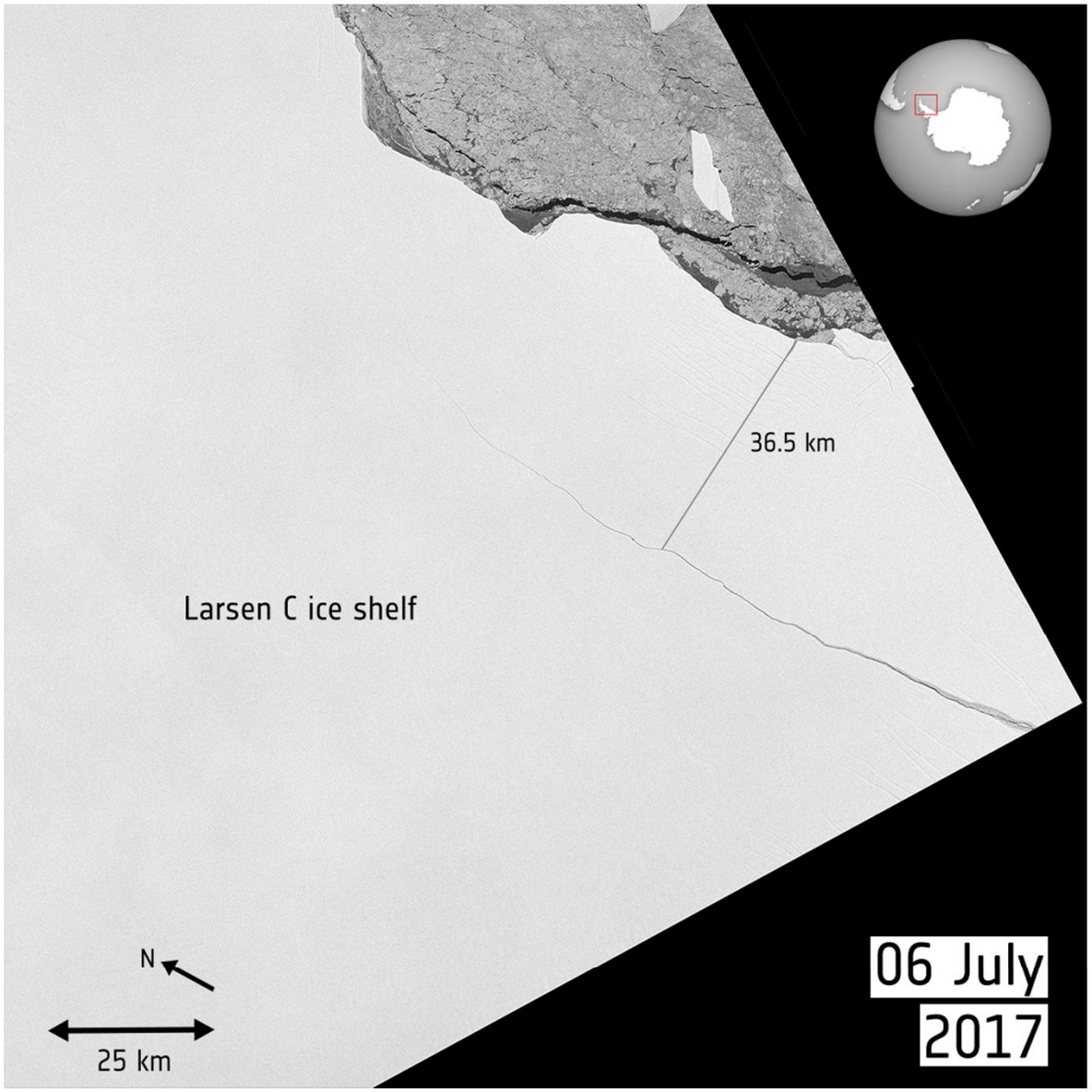
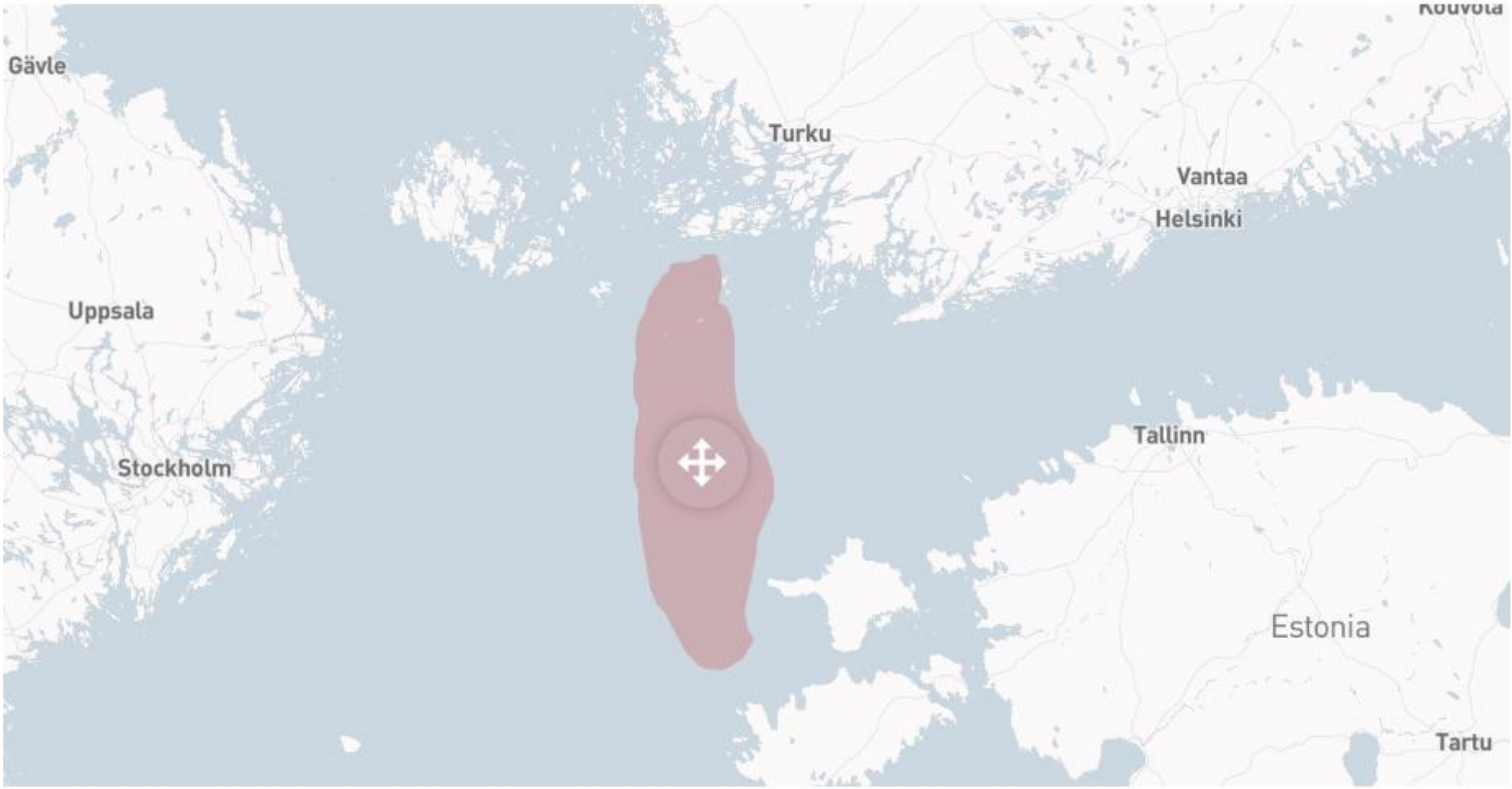

Larsen C Ice Shelf
Rift development to May 31st 2017
13km
May 31st 2017
May 1st 2017
Feb. 12th 2017
Jan. 1st 2017
Jun. 2016
Oct. 2015
Nov. 2010
Wales
To same scale
Swansea
0
100 km
MIDAS Project, A.Luckman, Swansea University




Larsen C Iceberg
European Copernicus Sentinel-1 Satellite Image acquired 12th July 2017
20
Kilometers




Larsen C Iceberg (A68)
European Copernicus Sentinel-1 Satellite Image
Acquired 16th September 2017 (left segment) and 13th September 2017 (right segment)
20
Kilometers

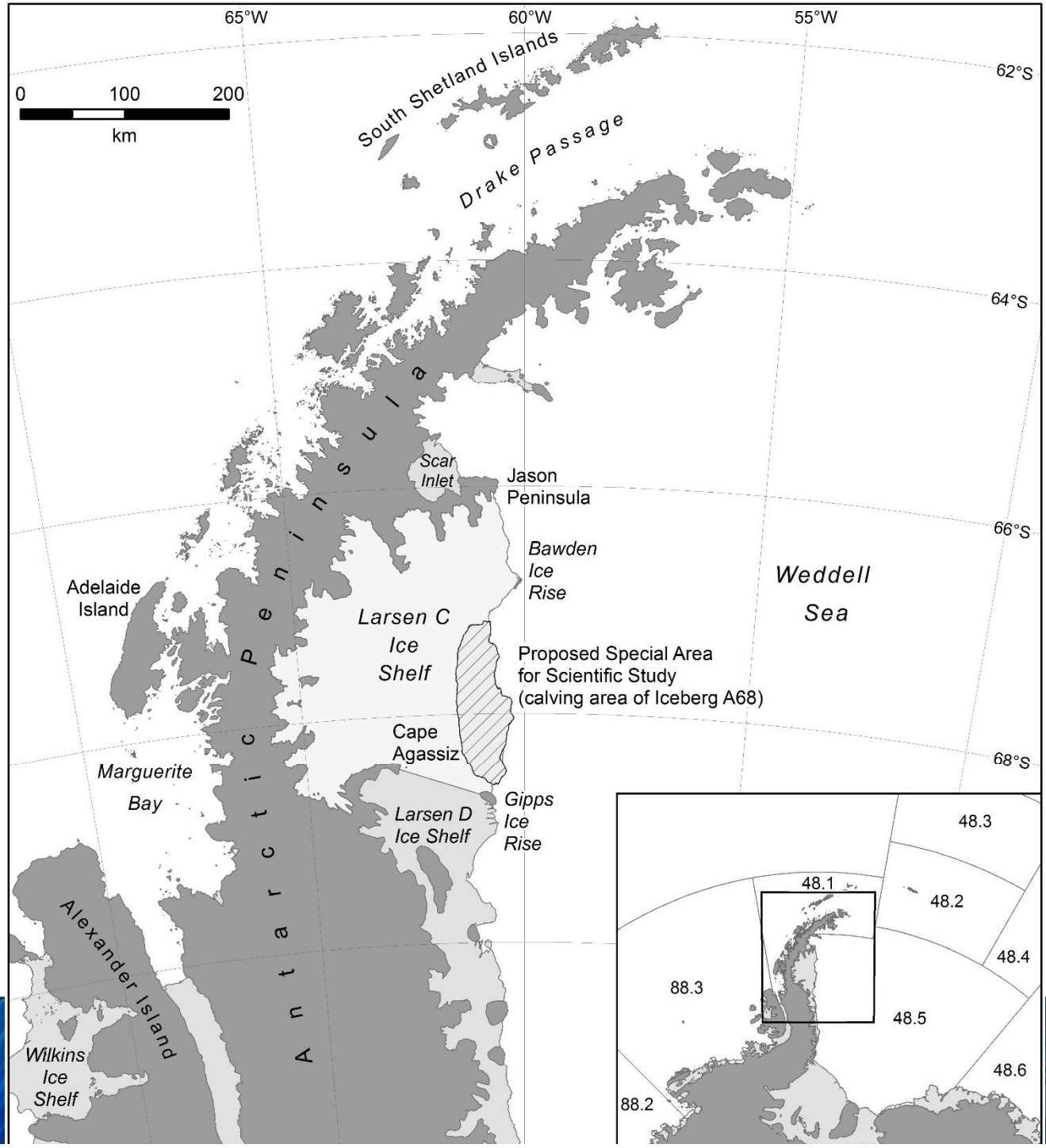


A68 iceberg calved from Larsen C ice shelf – comparative size!
https://interaktiv.morgenpost.de/eisberg-groessenvergleich/

CCAMLR's first Special Area for Scientific Study (5,818 km^2) established on 9th Sept 2017.

Larsen C iceberg calving may be part of natural growth/decay cycles...

...but opportunity to study response to such events.



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Contribution to Antarctic conservation

- SASSs are a short-term measure to facilitate research – *not MPAs*.
- Research will inform decisions on future protection or management, by improving scientific understanding of possible ecosystem responses to impacts of climate change, and helping develop measures to improve ecological resilience.
- Important addition to the suite of area-based conservation and management measures for the Southern Ocean.

- CCAMLR and CEP are both developing Climate Change Response Work Programmes – actions & research required to address impacts.
- Integrating consideration of climate change into decision-making.

With thanks to:
Phil Trathan, Andrew Fleming, Huw Griffiths, Eugene Murphy,
and the UK CCAMLR Delegation

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