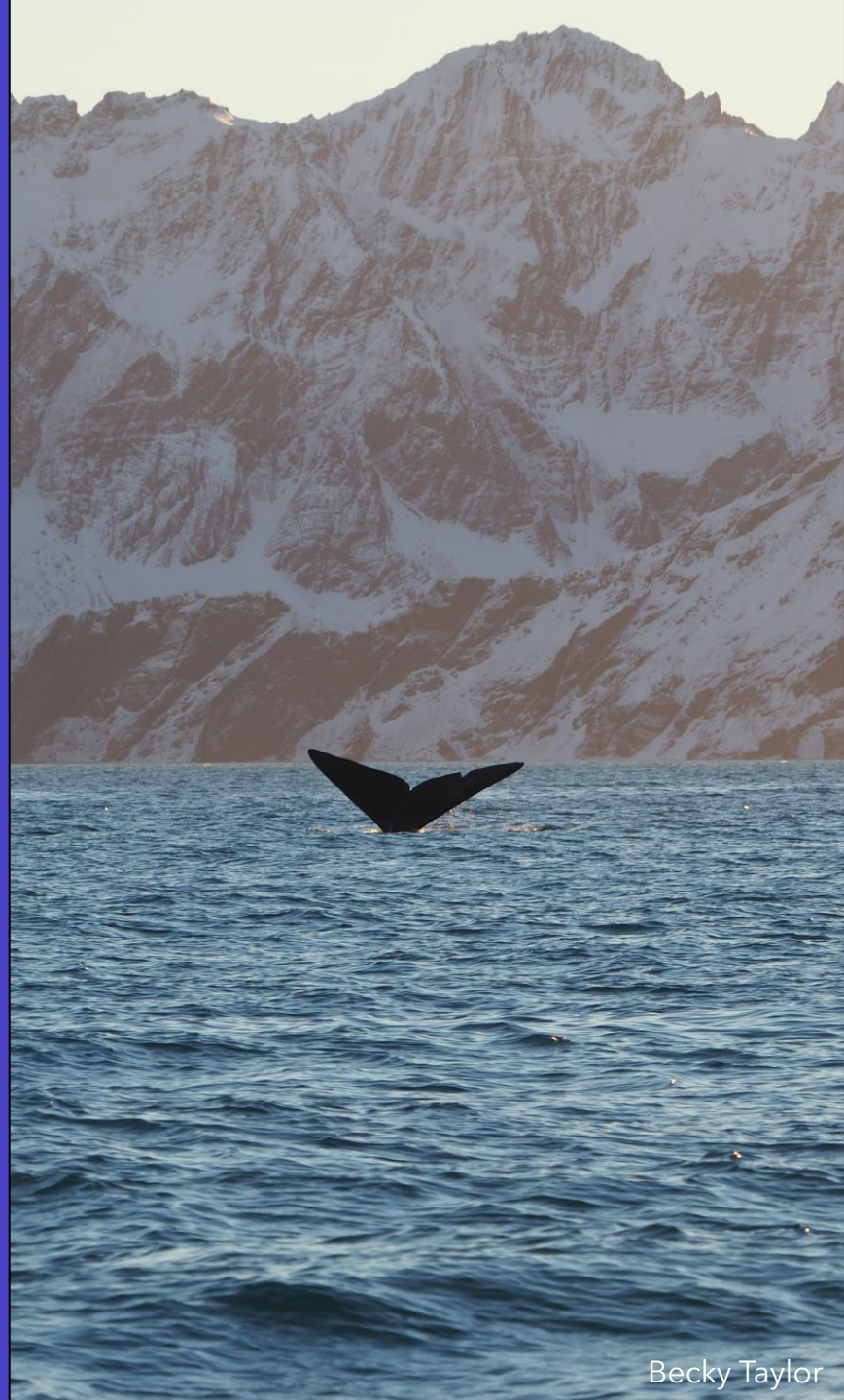
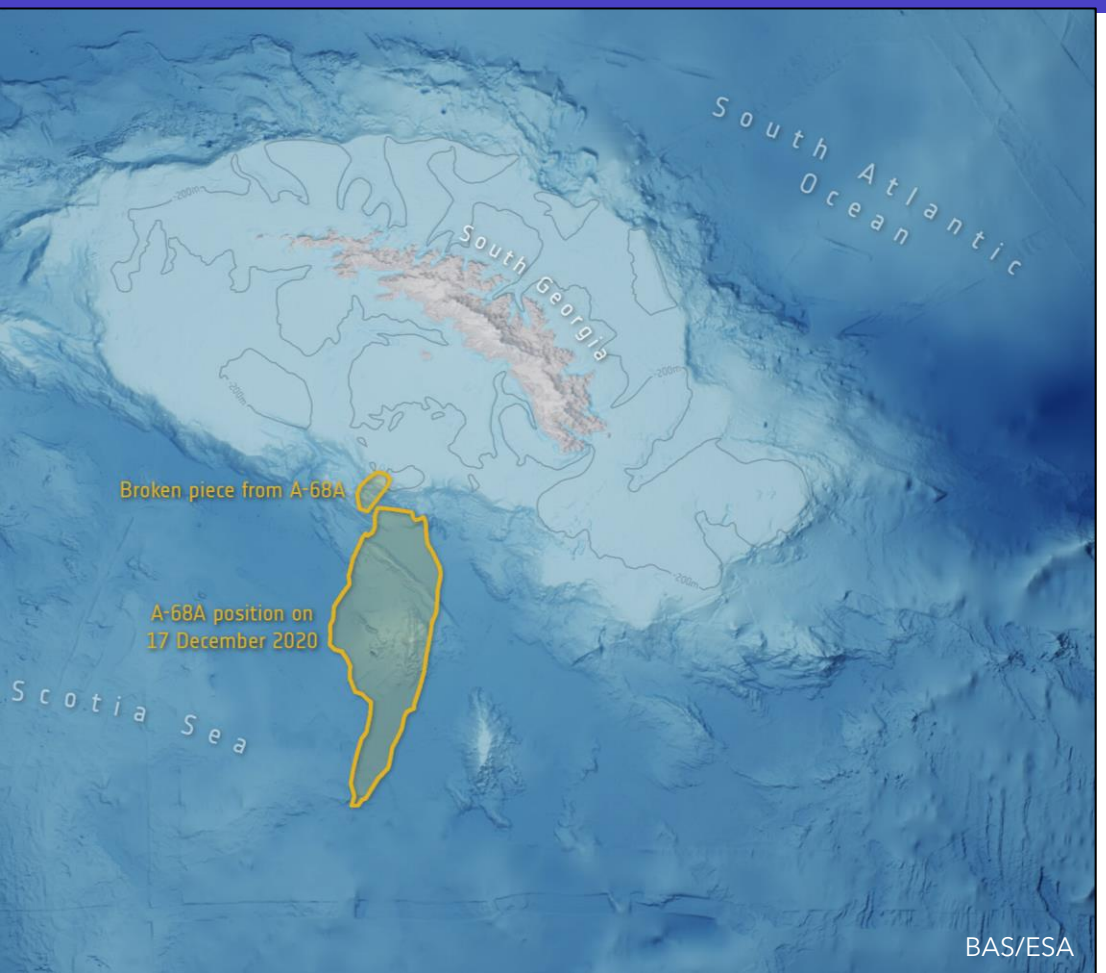
SGSSI MPA Review Science Symposium

13-14 June 2023
Aurora Conference Centre
Cambridge, UK

Hosted by the Government of South Georgia & the South Sandwich Islands



Climate Change



- **MCCIP: Key climate change effects on the coastal and marine environment around the Polar UK Overseas Territories.** *Oliver Hogg (Cefas)*
- **‘Megaberg’ impacts at South Georgia: the collapse of iceberg A68a in a sensitive marine ecosystem.** *Geraint Tarling (BAS)*
- **Five-years on: Assessing the Efficacy of the SGSSI MPA under Shifting Biological, Climatic & Geopolitical Conditions.** *Johnny Briggs (GBO / Pew Charitable Trusts)*

Oliver Hogg

Centre for Environment, Fisheries and Aquaculture Science


ESA


Sue G


Cefas

MCCIP: Climate change effects around the Polar UK Overseas Territories

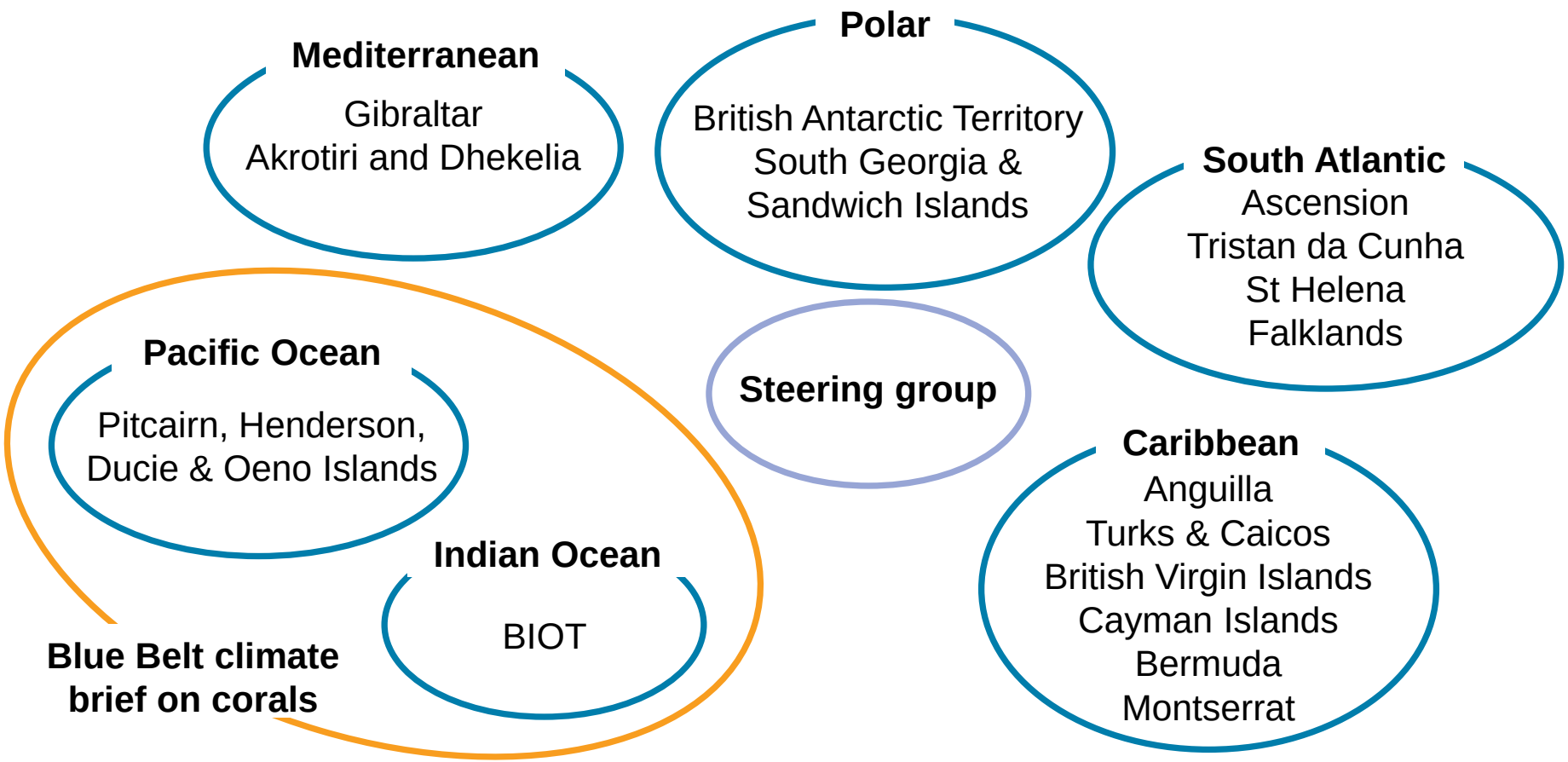
Oliver T. Hogg, Rachel Cavanagh, Susie Grant, Susan Gregory, Martin Collins

Cefas

MCCIP Marine Climate Change Impacts Partnership

The Marine Climate Change Impacts Partnership

'Providing a coordinating framework for the UK to enable the transfer of high quality, impartial evidence on marine climate change impacts and guidance on adaptation.'



- MCCIP is an independent provider of evidence for policy-makers, reporting information impartially and objectively to ensure scientific integrity and independence in its products.
- MCCIP uses a four-step process to aid in its reporting:

Frost et al. (2017). Reporting marine climate change impacts: Lessons from the science-policy interface. Env. Sci. Pol. 78: 114-120.




MCCIP Marine Climate Change Impacts Partnership

The 14 UK Overseas Territories (UKOTs) constitute a small land area with large ocean provinces, extending from the polar ocean to tropical seas. Collectively they represent the 5th largest marine estate in the world.

When considering priority climate change issues, many UKOTs are concerned about impacts on food security, both from local fisheries and food imports. Changes to the coastal zone caused by erosion and sea-level rise are a key issue for many UKOTs, including the natural coastal protection afforded by coastal and marine habitats. Impacts on large marine ecosystems and food webs in the seas and oceans around them were also highlighted by many UKOTs.

For this work, the UKOTs were grouped geographically into six regions. Experts from the regions identified the most pressing climate change issues for their UKOTs.

CARIBBEAN AND MID ATLANTIC

Key climate change drivers include changes in storms and waves, sea level rise, erosion, temperature rise, ocean acidification, changes in ocean circulation and decreasing dissolved oxygen, erosion.

Priority issues identified:

- **Food security, fish, and fishing communities,** affecting the future sustainability of fisheries and livelihoods in local communities.
- **Coral reefs**, and wider effects on ecosystem health and marine food webs, and the reefs appeal for tourism and recreation.
- **Natural coastal protection** from the growing threat of erosion and flooding, and the resulting impacts on coastal populations and economic activities at the coast. Climate change risks are being exacerbated by the degradation and loss of coastal ecosystems due to human activities.

MEDITERRANEAN

Key climate change drivers include increasing temperature, salinity, oxygen, ocean acidification, changes in ocean circulation, erosion and sea-level rise.

Priority issues identified:

- **Ecosystem function and food webs**, with critically endangered species and regionally important habitats under pressure, exacerbated by the spread of alien invasive species.
- **Human health, coastal communities and infrastructure** due to an increase in flood risk. Jellyfish and some algal species could become more abundant, presenting a risk to human health and industrial intakes.

COMMON CHALLENGES

There is strong evidence for climate change impacts in regional seas, but a lack of local baseline data makes it difficult to measure changes and identify trends in the UKOTs. Resources for implementing new long-term monitoring programmes are highly constrained.

Many projections of future conditions are based on global models which do not realistically represent regional and local land and sea areas in the UKOTs, creating uncertainty when planning adaptation and resilience building actions.

Despite strong environmental protection measures in the UKOTs, adapting to the effects of large-scale ocean and atmosphere changes is a major challenge. Globally, concerted action to move to net zero emissions is critical to limit the consequences for these unique and sometimes isolated environments and communities.

PACIFIC OCEAN

Key climate change drivers include increasing temperature, ocean acidification, extreme events, sea-level rise and decreasing dissolved oxygen concentration.

Priority issues identified:

- **Coral reefs and associated communities**, which are at risk from the combined effects of warming and ocean acidification.
- **Coastal and deep-water fisheries resources** as reef fish are impacted from changes in their habitats and reduced oxygen levels could make Pitcairn's waters less suitable for some tuna species.
- **Imports to the island and the safe movement of goods at sea**. Pitcairn Island relies heavily on imports for food, fuel, clothing, medicines and most other goods and materials, which could be disrupted by extreme events and an increased risk of flooding.

SOUTH ATLANTIC

Key climate change drivers include increasing temperatures, sea-level rise, extreme events, and changes in ocean circulation.

Priority issues identified:

- **Fish and invertebrates**, such as tuna, squid and lobster, that are harvested for human consumption, affecting **food security**.
- The **growth and productivity of marine plants**, including plankton, which form the basis of the food web and kelp which provides important habitat.
- **Coastal communities**, as sea level rise and storms potential threaten the 'islander' way of life and **cultural identity**, including declines in iconic marine and seabird species.

POLAR

Key climate change drivers include increasing temperatures, ocean acidification, decreasing dissolved oxygen and changes in ocean circulation.

Priority issues identified:

- How **food webs and ecosystems function**, impacting on charismatic species and important ecosystem services such as fisheries and carbon storage.
- **Sea ice** which helps regulate global climate and provides critical habitat for wildlife, including species of penguins and seals, and krill.
- How **carbon is used and stored** by the ocean and marine organisms, which helps to remove excess CO_2 from the atmosphere.

INDIAN OCEAN

Key climate change drivers include increasing temperatures, ocean acidification, decreasing dissolved oxygen, changes in ocean circulation, erosion, sea-level rise and extreme events.

Priority issues identified:

- **Corals**, with an increase in bleaching, caused by heat stress, as well as physical damage from storms. Several coral species are already becoming rare or significantly reduced in abundance.
- A reduction in **reef habitat quality** and structural complexity because of rising temperature, physical damage and ocean acidification with, impacts on other organisms, such as fish.
- **Reef islands and sandy beaches** could be affected by changes in sea level, storms and waves and large-scale ocean processes, especially on eroding coasts exposed to the prevailing winds. These changes could affect important terrestrial habitat, natural coastal protection, and island maintenance.

Frost, M., Bamford, K., Clarke, C., Dark, J., Dorrington, T., Hardman, E., Hall, J., Herbon, C., Lincoln, S., Petit, L., Whomersley, P. and Worboys, K., eds. Howes, E., and Buckley P. (2021) Key climate change challenges facing the UK Overseas Territories. Marine Climate Change Impacts Partnership (MCCIP), 1 pp. DOI: 10.14465/2021.orc00.all

This work was funded by the Department for Environment, Food and Rural Affairs (Defra) in preparation for the UNFCCC Conference of the Parties (COP) 26.

MCCIP

POLAR

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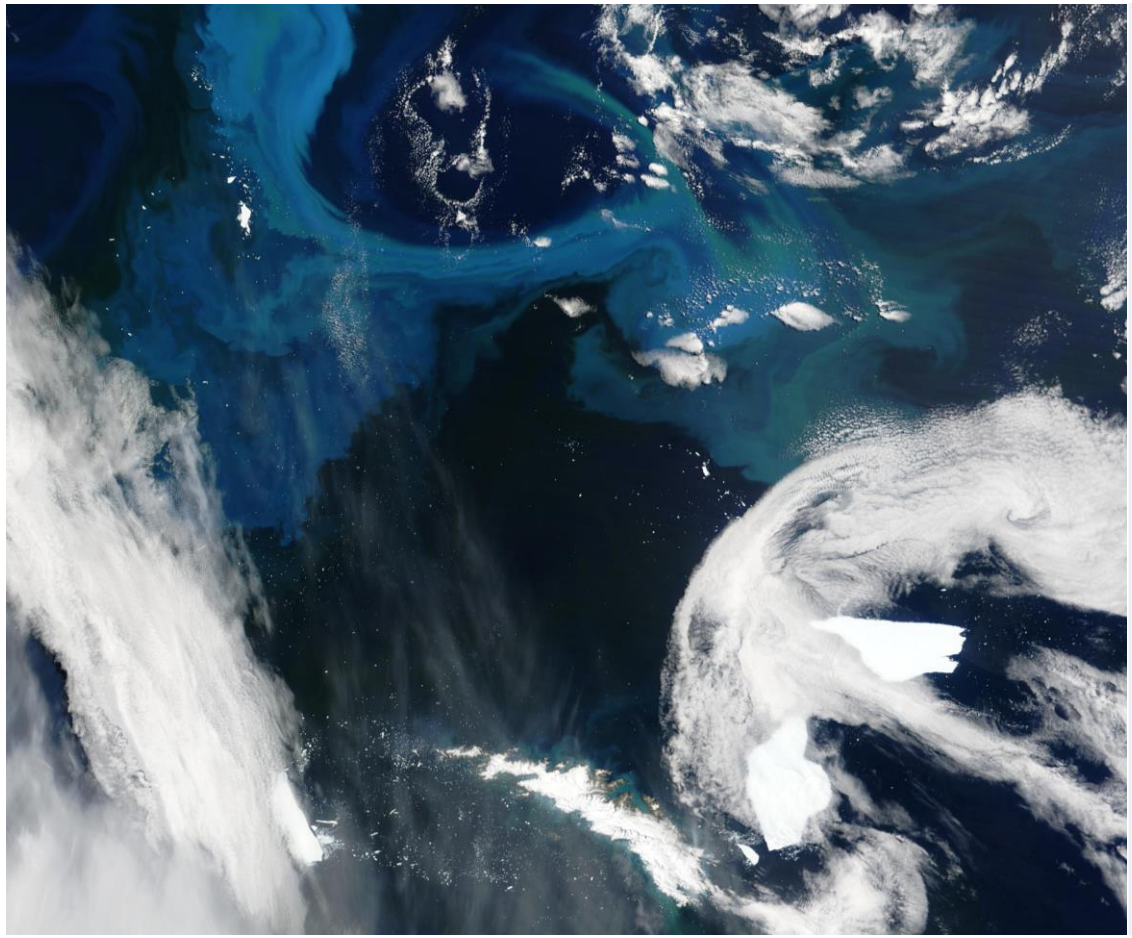
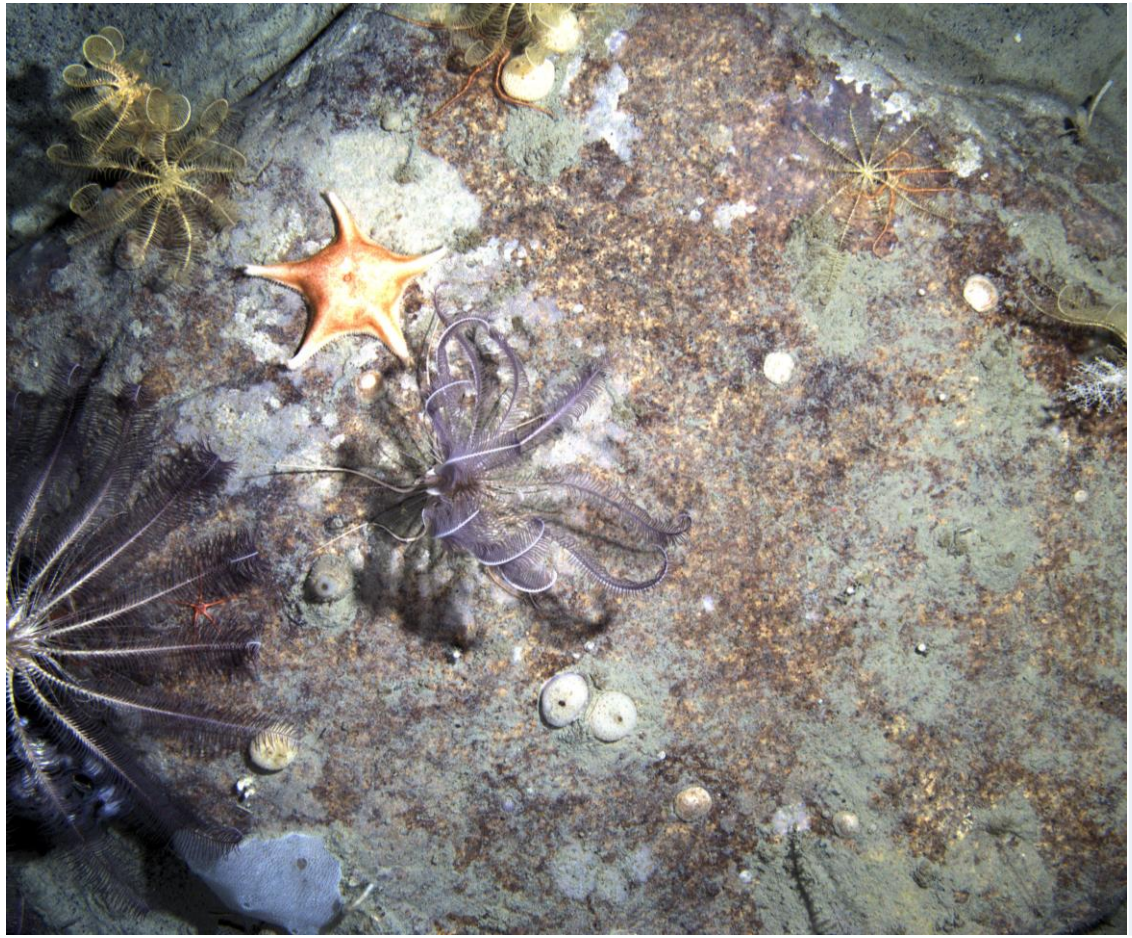


POLAR

PRIORITY 1: CHANGES IN FOOD WEBS AND ECOSYSTEM FUNCTION.

Southern Ocean food webs support ecosystems with significant global value through the existence of charismatic wildlife, and through ecosystem services such as fisheries and carbon storage.



POLAR

PRIORITY 2: CHANGES IN CARBON UPTAKE, EXPORT AND SEQUESTRATION BY BIOLOGICAL PROCESSES

The ‘blue carbon’ pathway is the process by which inorganic carbon in the form of dissolved CO_2 is captured in the world’s oceans and coastal ecosystems through capture and fixation by marine organisms.

POLAR

PRIORITY 3: CHANGES IN THE DISTRIBUTION OF SEA ICE HABITAT

During the Austal winter, sea ice extends across the BAT to encompass the South Shetland Islands, South Orkney islands and much of the South Sandwich Islands. It has a major modifying influence on the global climate system and provides a key habitat for breeding, resting and feeding for many ice-dependent species

Next Steps

- To understand change in polar ecosystems, sampling programs need to be maintained as well as a better understanding of the links between physical change and ecological processes.
- To achieve this will require an international coordination of effort to obtain standardized datasets and provide improved data coverage.
- Innovations in technology will increase our ability to sample inaccessible regions and provide long term time series data.
- Conservation of mature undamaged habitats and ecosystems is more effective than restoration and remediation.
- Important that new and existing MPAs are future proofed to ensure a connected, representative network of MPAs.

https://www.mccip.org.uk/uk-overseas-territories

INDIAN OCEAN

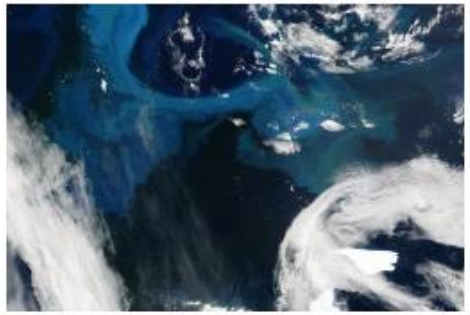
INDIAN OCEAN REPORT CARD

The British Indian Ocean Territory (BIOT) is the only UK Overseas Territory in the Indian Ocean and includes the Chagos Archipelago.

PACIFIC

PACIFIC REPORT CARD

The UK Overseas Territory of the Pitcairn Islands is a chain of four small islands (Pitcairn, Oeno, Henderson and Ducie).



POLAR

POLAR REPORT CARD

The UK Polar Overseas Territories comprise two geographically and environmentally distinct territories: (1) South Georgia and the South Sandwich Islands (SGSSI), and (2) the British Antarctic Territory (BAT).

SOUTH ATLANTIC

SOUTH ATLANTIC REPORT CARD

The areas referred to as the South Atlantic UK Overseas Territories (SAOT's) are comprised of Ascension Island, Falkland Islands, Tristan da Cunha and St Helena Island.

CARIBBEAN AND MID-ATLANTIC

CARIBBEAN AND MID-ATLANTIC REPORT CARD

There are six UK Overseas Territories in the Caribbean and Mid-Atlantic comprised of the islands of Anguilla, Bermuda, the British Virgin Islands, the Cayman Islands, Montserrat, and the Turks and Caicos.

MEDITERRANEAN

MEDITERRANEAN REPORT CARD

There are two UK Overseas Territories (UKOTs) in the Mediterranean comprised of Gibraltar and the Sovereign Base Areas of Akrotiri and Dhekelia in Cyprus.

Geraint Tarling

British Antarctic Survey


ESA


Sue G


BFSAI

Megaberg impacts at South Georgia: the collapse of iceberg A68a in a sensitive marine ecosystem

Geraint Tarling

- on behalf of the A68a team

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF LEEDS

Iceberg A68 grabbed the world's media attention – Nov 2020

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NEWS

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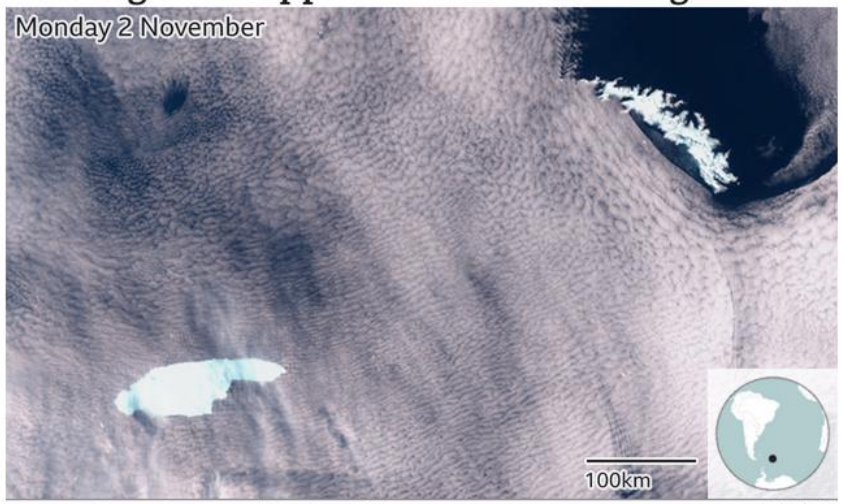
Science & Environment

A68 iceberg on collision path with South Georgia

By Jonathan Amos
BBC Science Correspondent

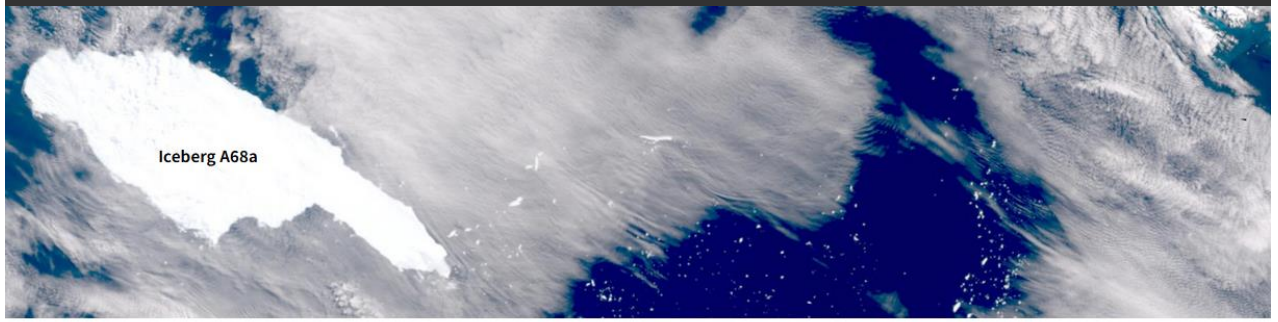
4 November 2020

Iceberg A68a approaches South Georgia



Source: Copernicus Data / Sentinel Hub BBC

REUTERS GRAPHICS



World's biggest iceberg heads for disaster

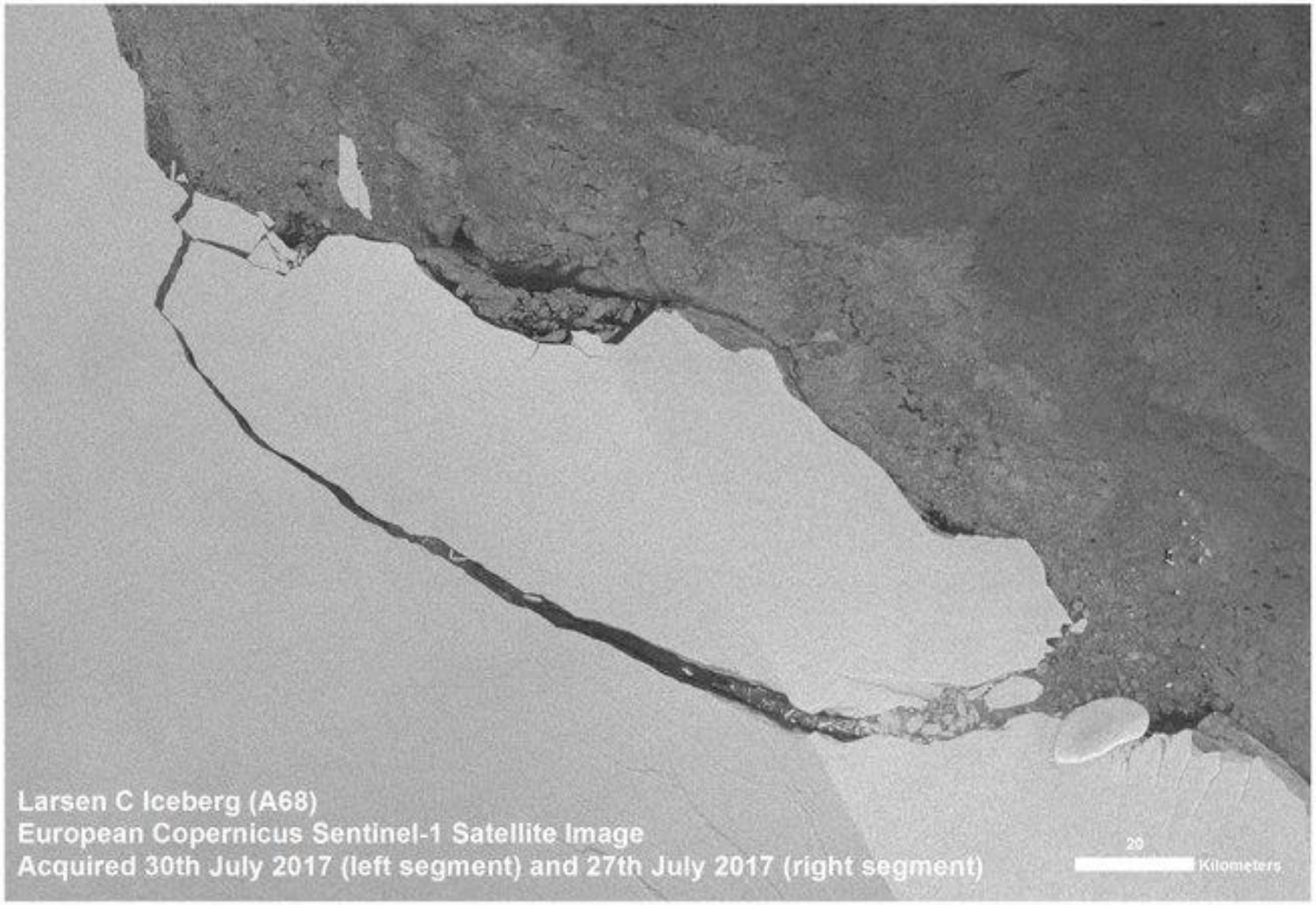
The mass is now moving straight toward a remote south Atlantic island populated by penguins and seals. Scientists say a collision could cause a local, environmental catastrophe.

By **Marco Hernandez** and **Cassandra Garrison**

PUBLISHED DEC. 11, 2020
UPDATED MAY 10, 2021

Iceberg A68a has been on a slow journey toward cataclysm.

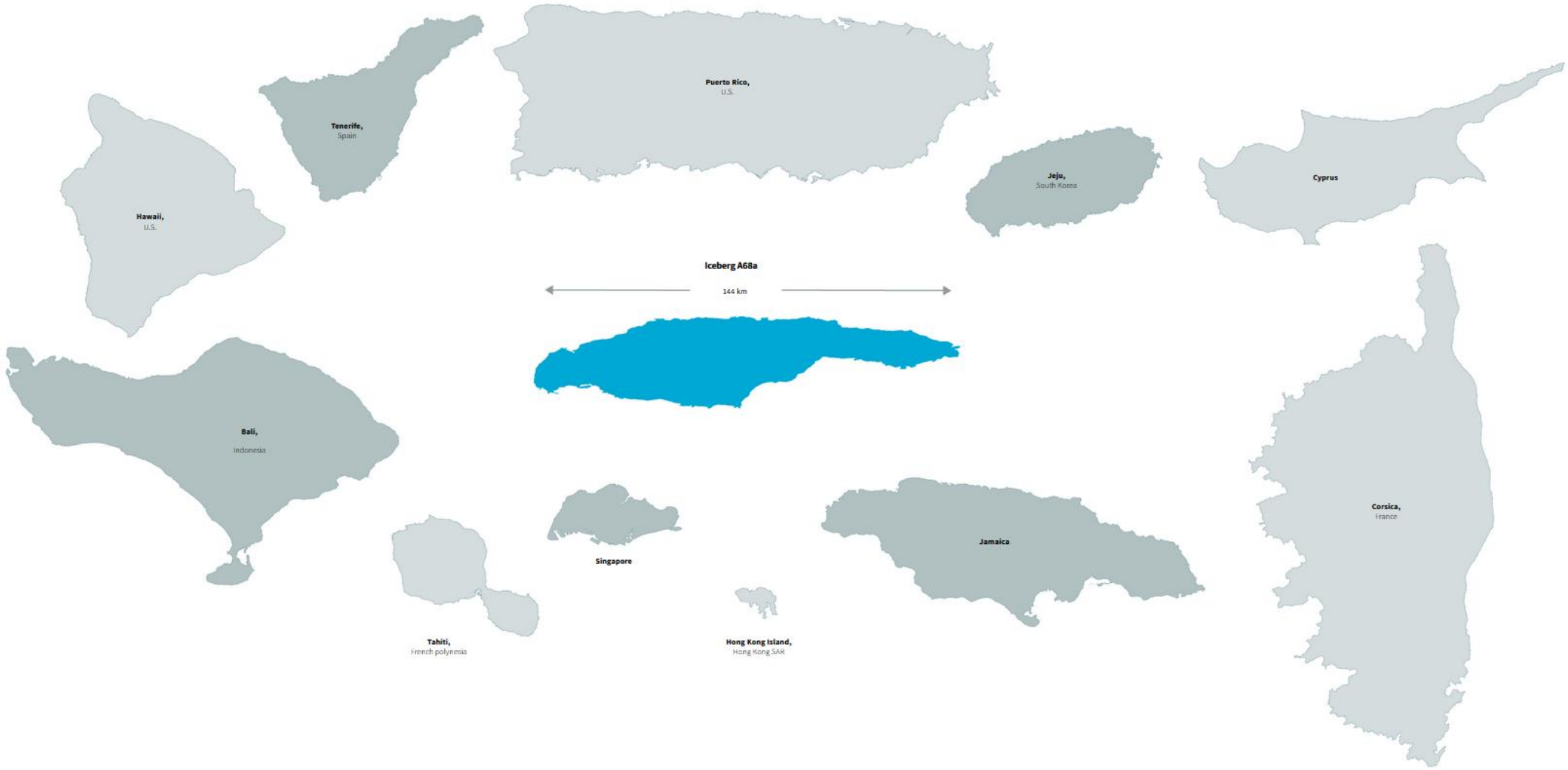
Birth of A68: detached from Larsen C ice-shelf July 2017



- 175 km long
- 50 km wide
- 5800 km^2
- 200 m thick
- 10^{12} tonnes

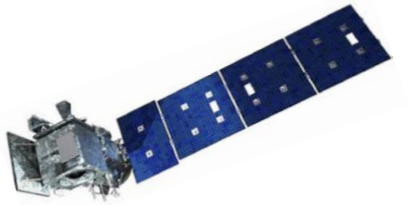
Reduced overall size of Larsen C by 12%

Scale of A68

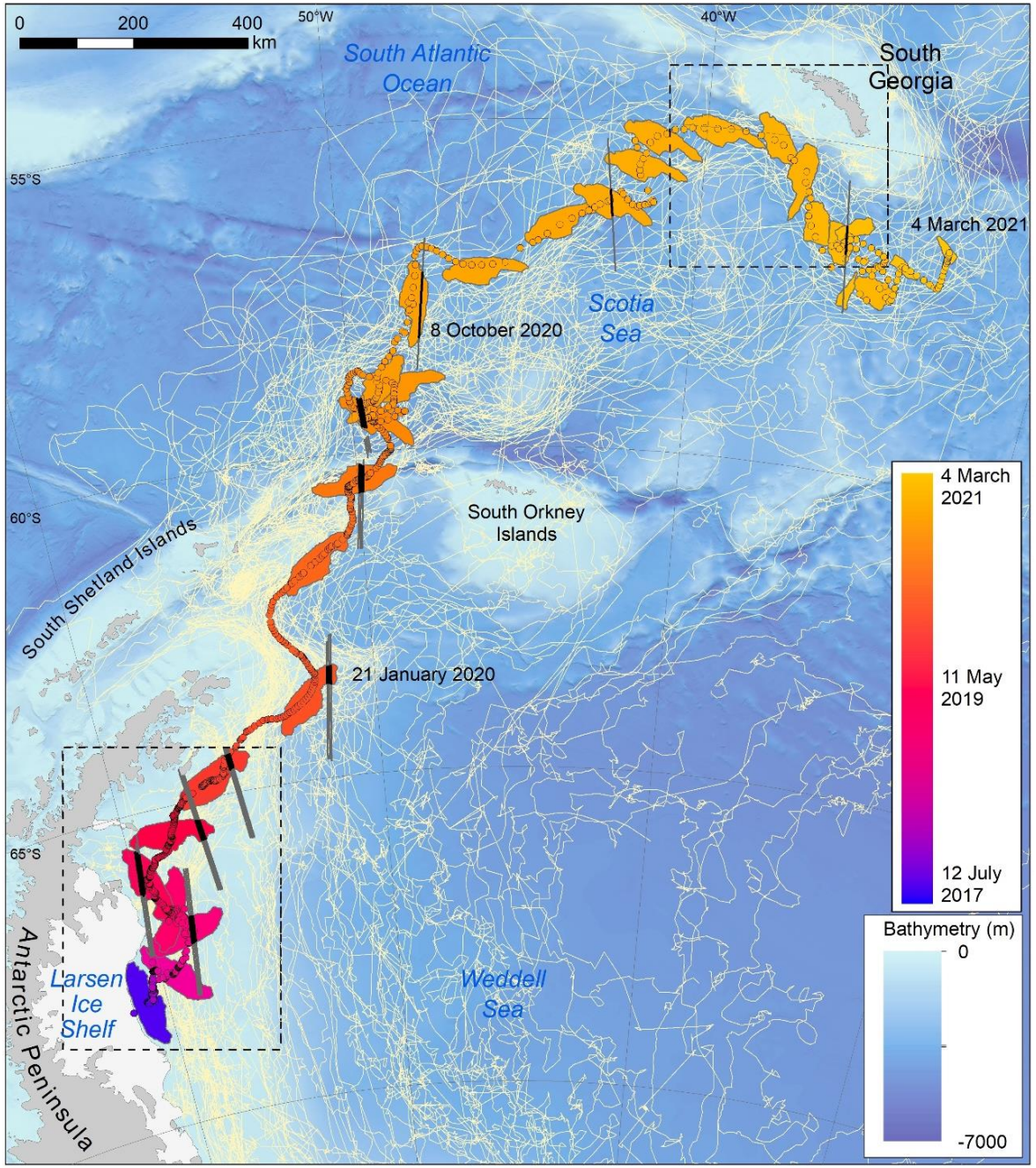

Tenerife,
Spain
Puerto Rico,
U.S.
Hawaii,
U.S.
Jeju,
South Korea
Cyprus
Iceberg A68a
144 km
Bali,
Indonesia
Singapore
Jamaica
Corsica,
France
Tahiti,
French polynesia
Hong Kong Island,
Hong Kong SAR

Passage of A68 to South Georgia

CryoSat-2, ESA:
Radar altimeter



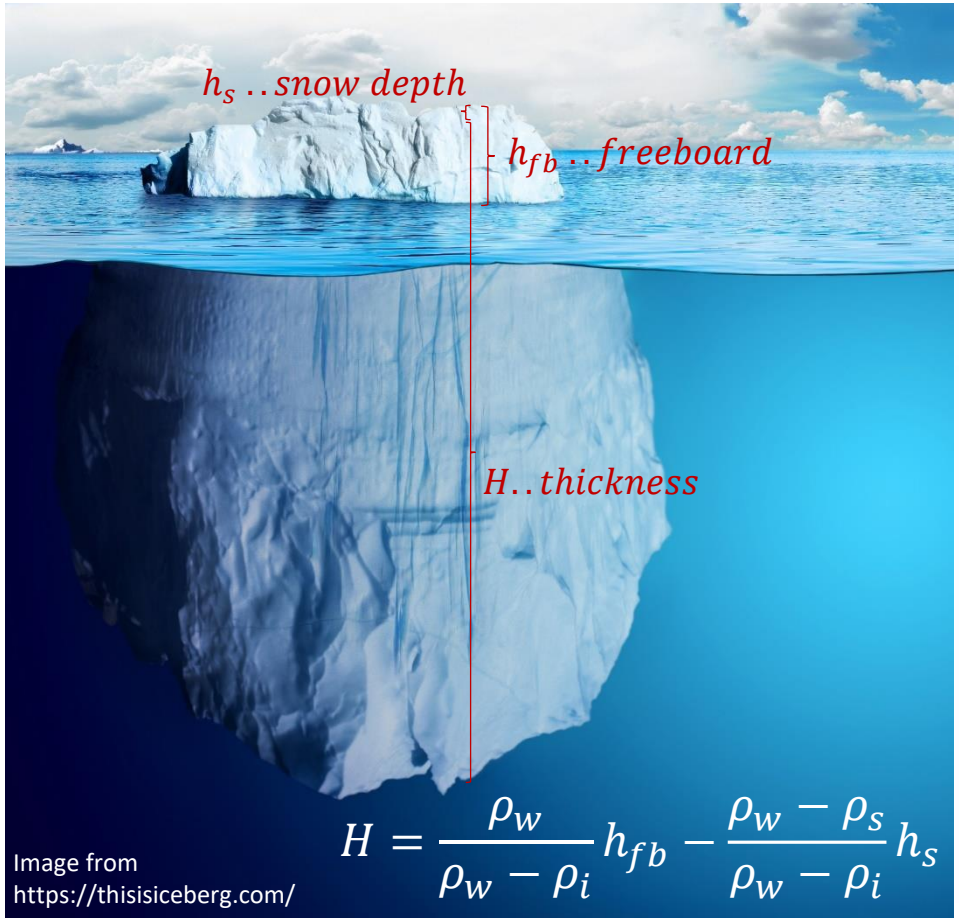
ICESat-2, NASA:
Laser altimeter

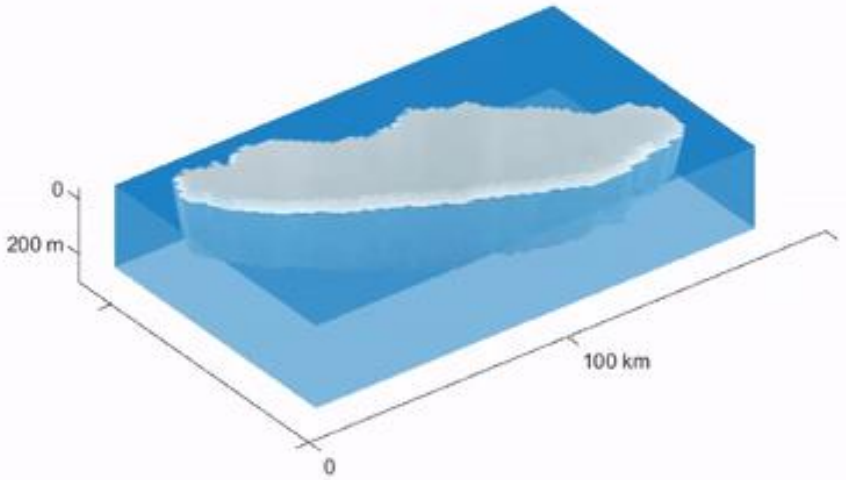


Passage approximated the path of the Antarctic Circumpolar Current (ACC)

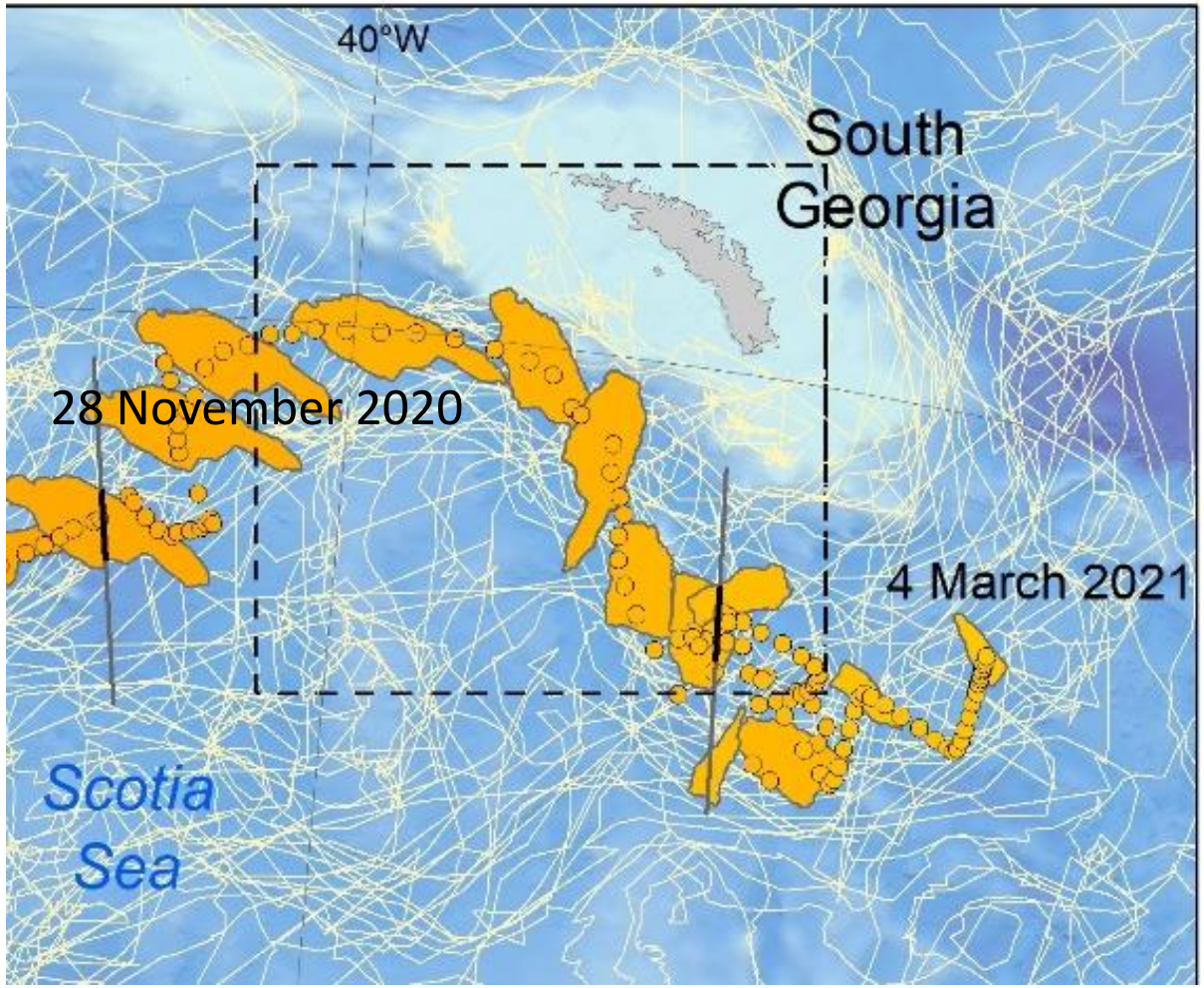
Anne Braakmann-Folgmann

Satellites measured iceberg freeboard and area from which volume loss was calculated





Fresh water flux near South Georgia



- **At least 96 days were spent within 300 km off the coast**

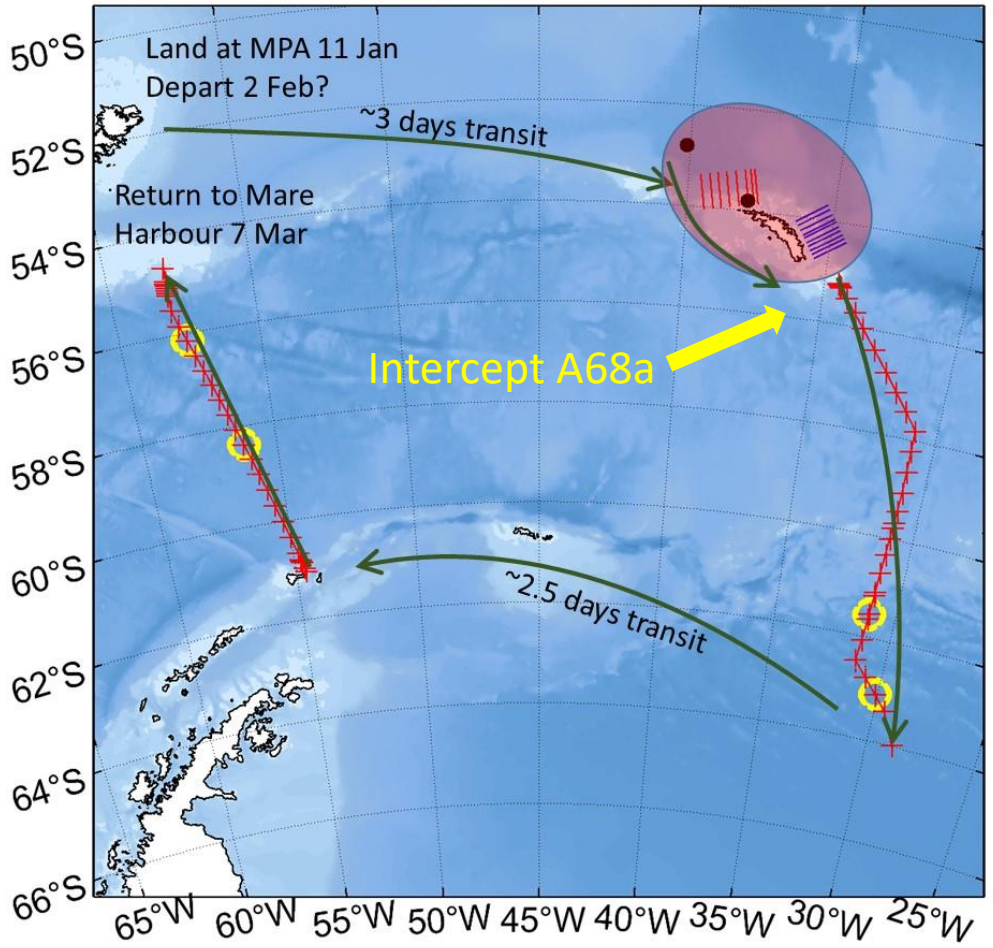
→ **152 ± 61 G tons of fresh water released close to South Georgia**

→ **2/3 from fragmentation, 1/3 from basal melting**

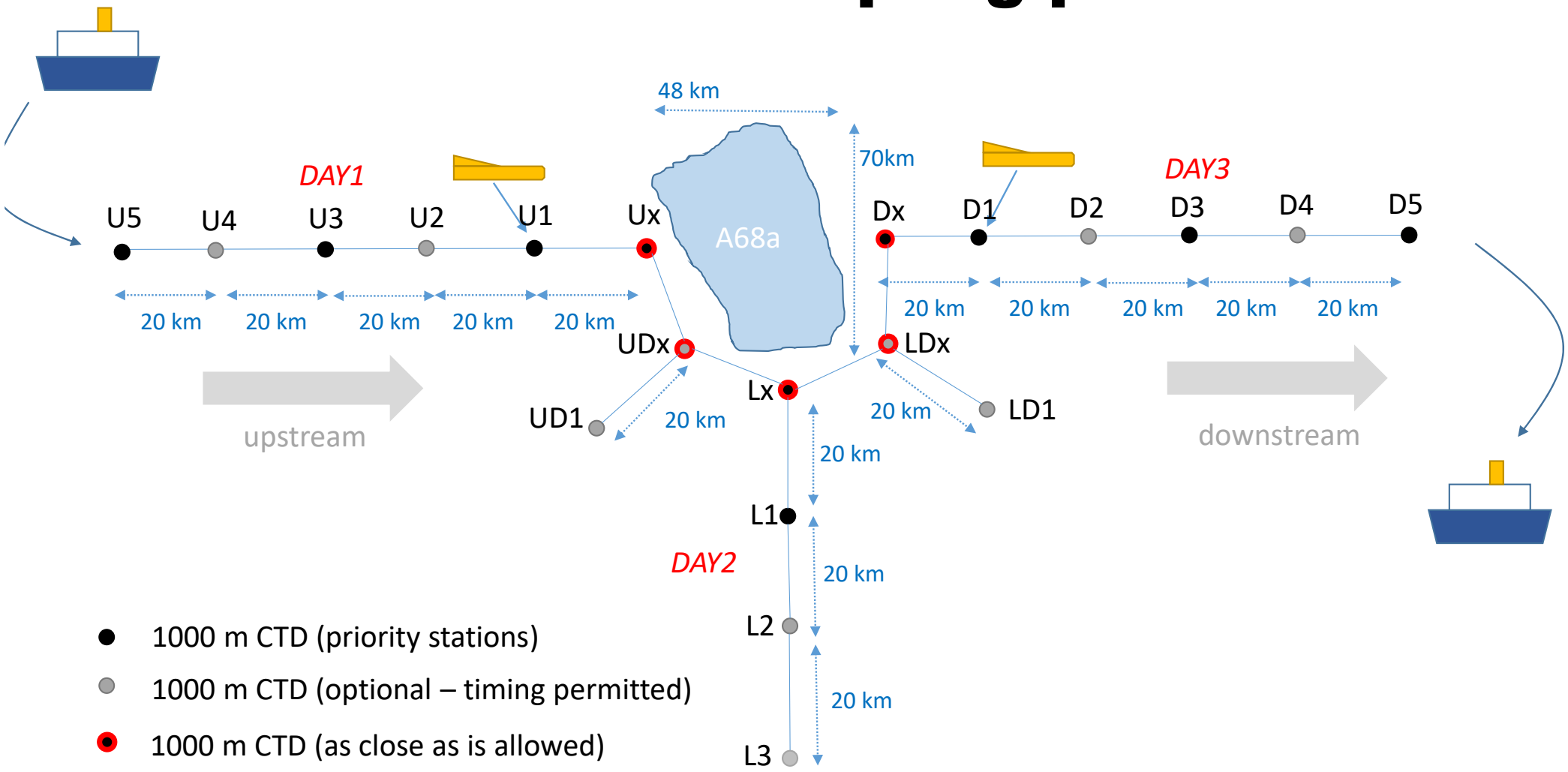
Photo: Goway.com

Field observations – *RRS James Cook*

Expedition leader:
Povl Abrahamsen



Ideal sampling plan



Realised sampling plan

CTD deployments

..with biogeochem. sampling

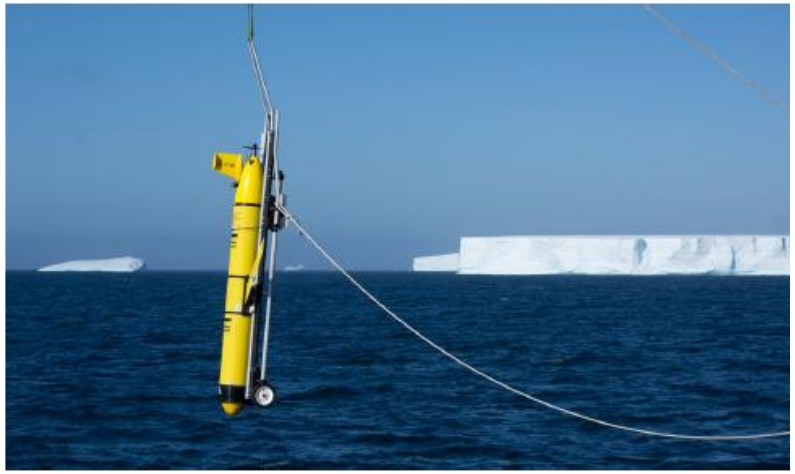
Glider launch

NASA WORLDVIEW

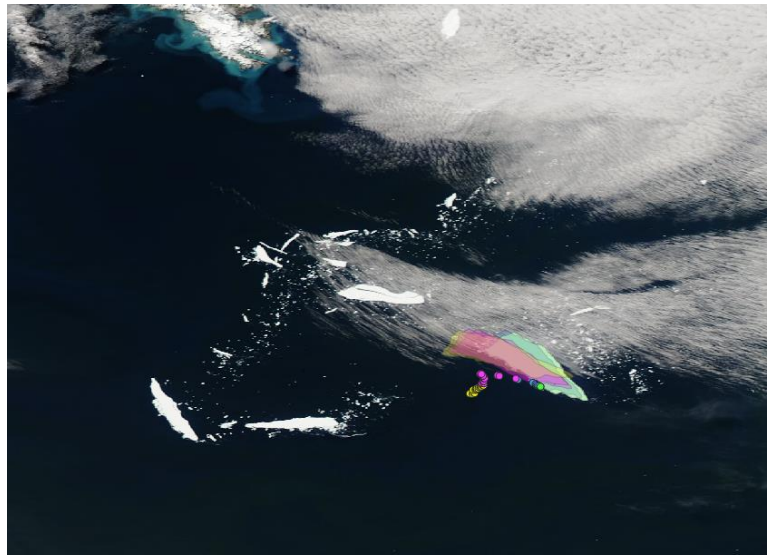
2021 FEB 16

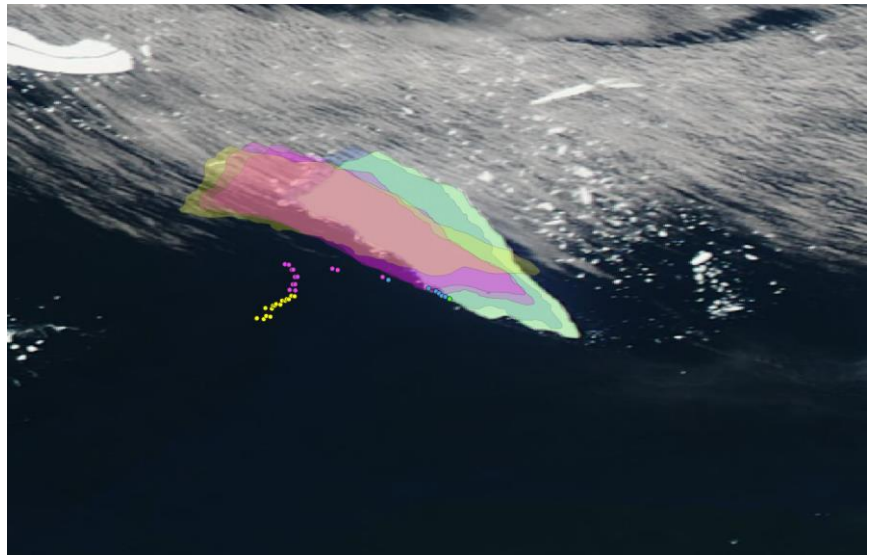
Glider deployment

Natasha Lucas



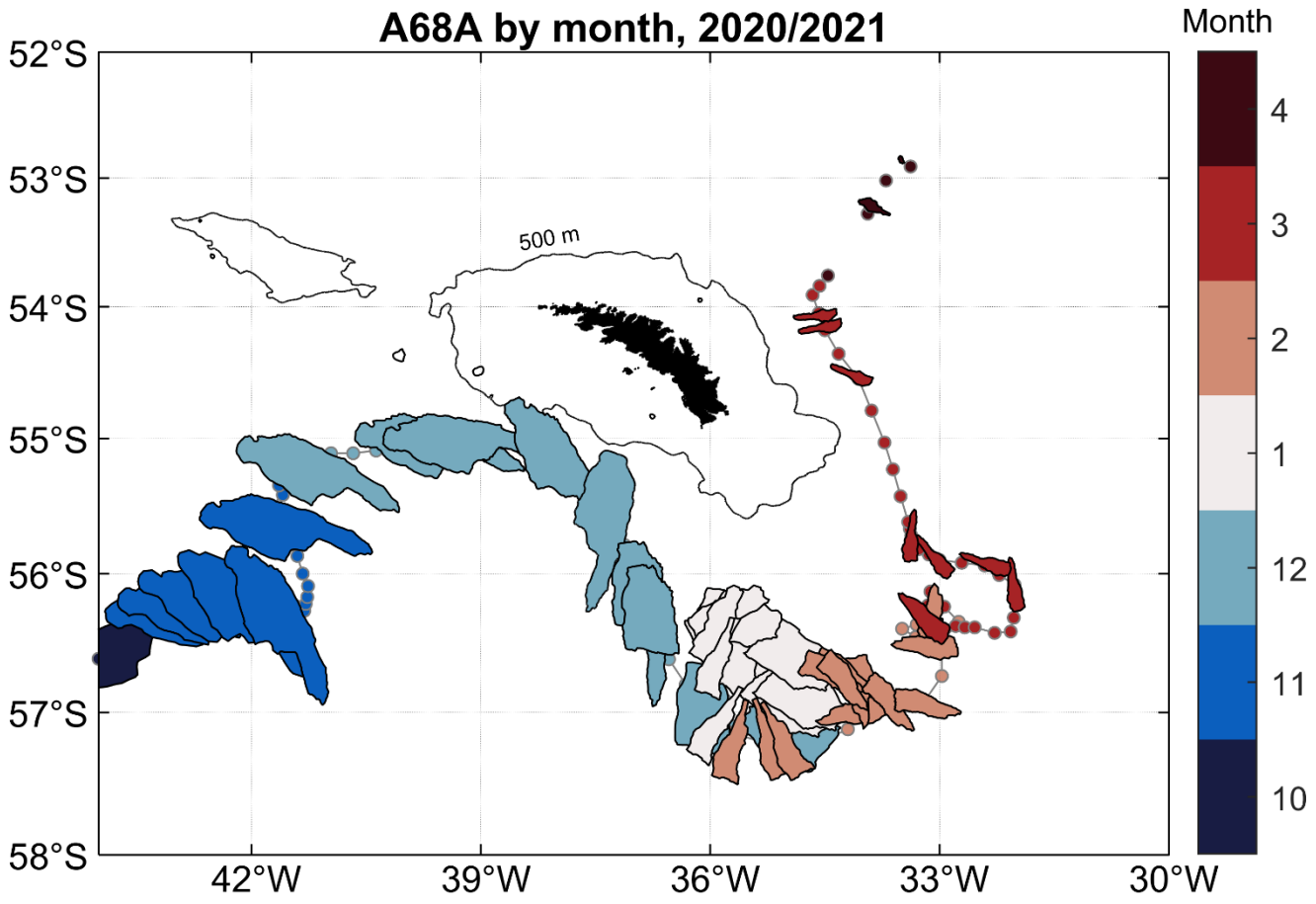
Alex Brearley





Analysis focussed on first 19 days of deployment

Onward track of A68a until extinction



Circles mark centre locations of A68A (Smith & Bigg, 2023)
A68A outlines generated by P. Abrahamsen and L. Gerrish

Satellite analysis – Sally Thorpe

A68a collapse at South Georgia - summary

- Released ~150 G tons of freshwater around South Georgia
- Large perturbations in biogeochemistry in vicinity of bergs
- Evidence of seeding waters with ice-berg association phytoplankton
- Glider data provides unprecedented insights into melting and mixing
- Widespread impacts on salinity and primary productivity lasting a number of months

Johnny Briggs

Great Blue Oceans / Pew Charitable Trusts


ESA

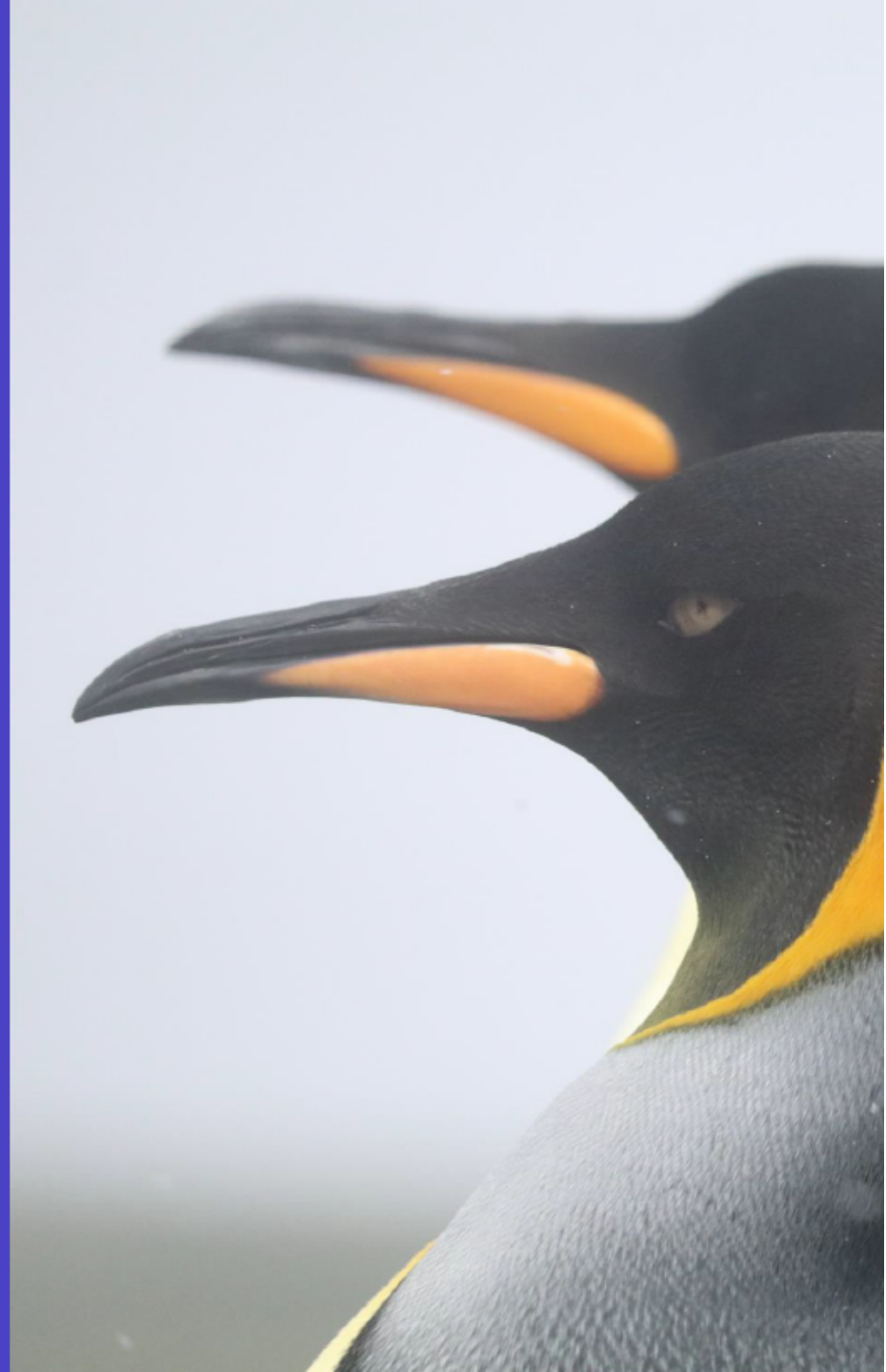

Sue G

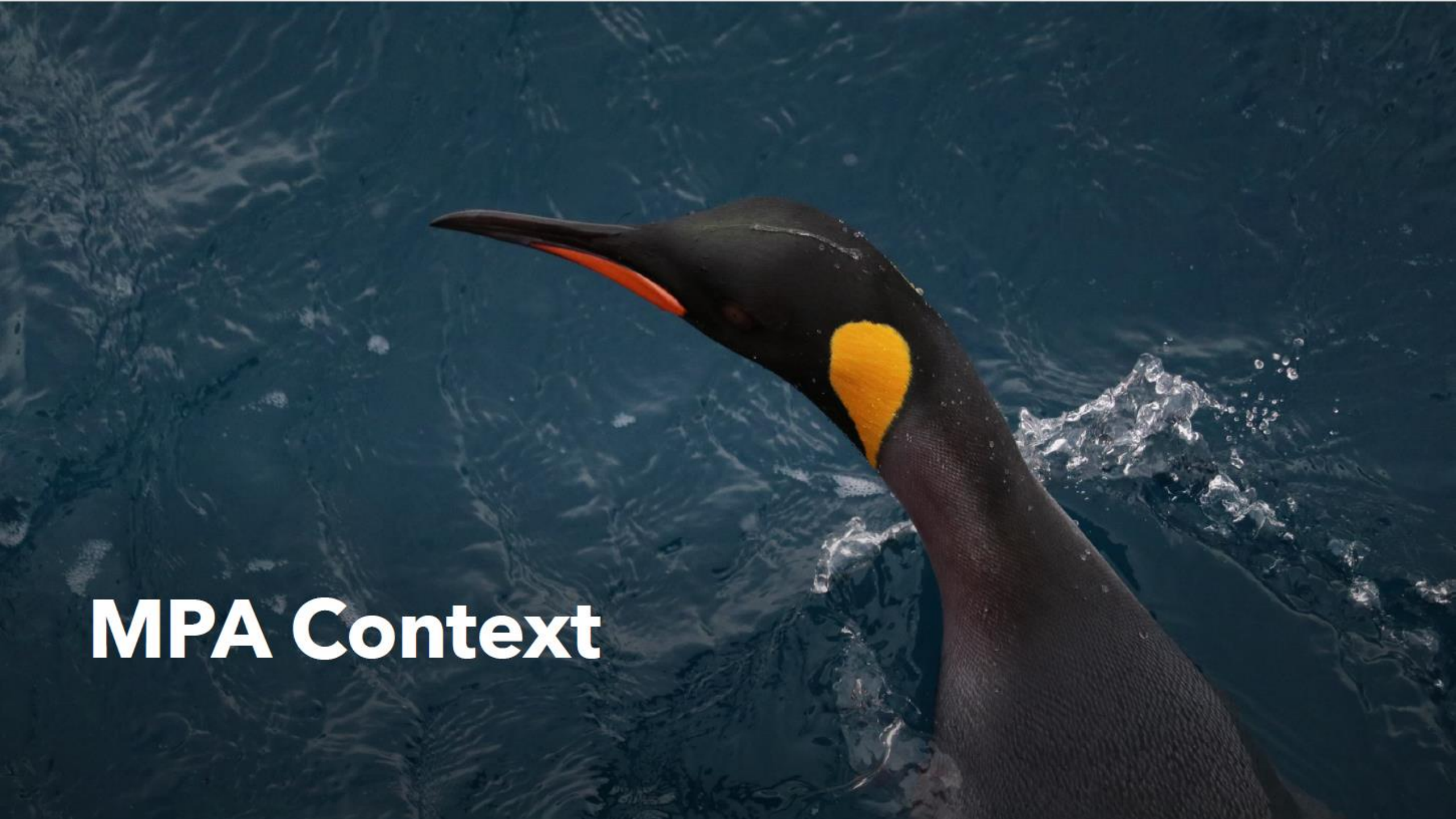

Wolfgang Kaehler

5-years on: Assessing the Efficacy of the SGSSI MPA under Shifting Biological, Climatic & Geopolitical Conditions

Johnny Briggs

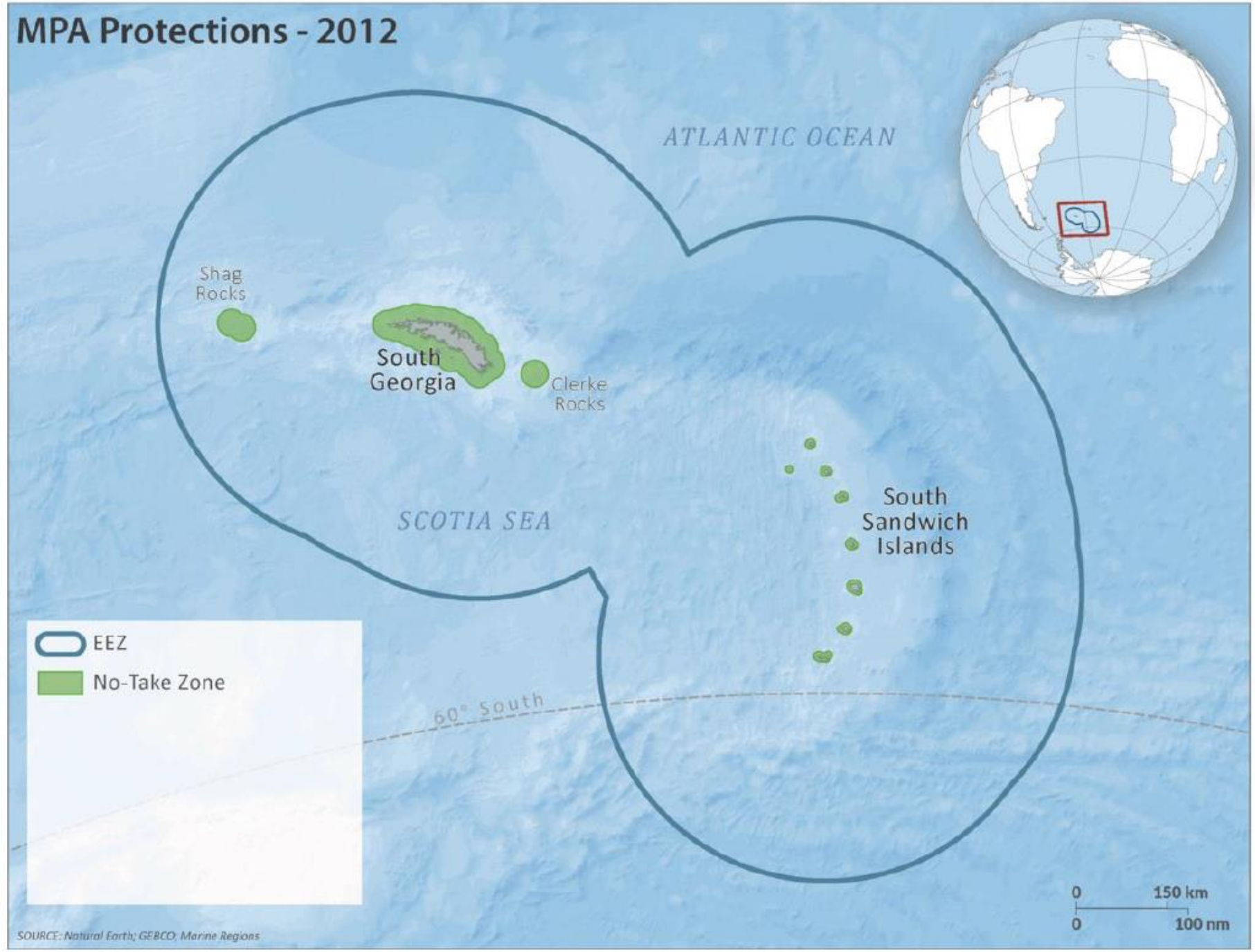
GREAT BLUE OCEAN





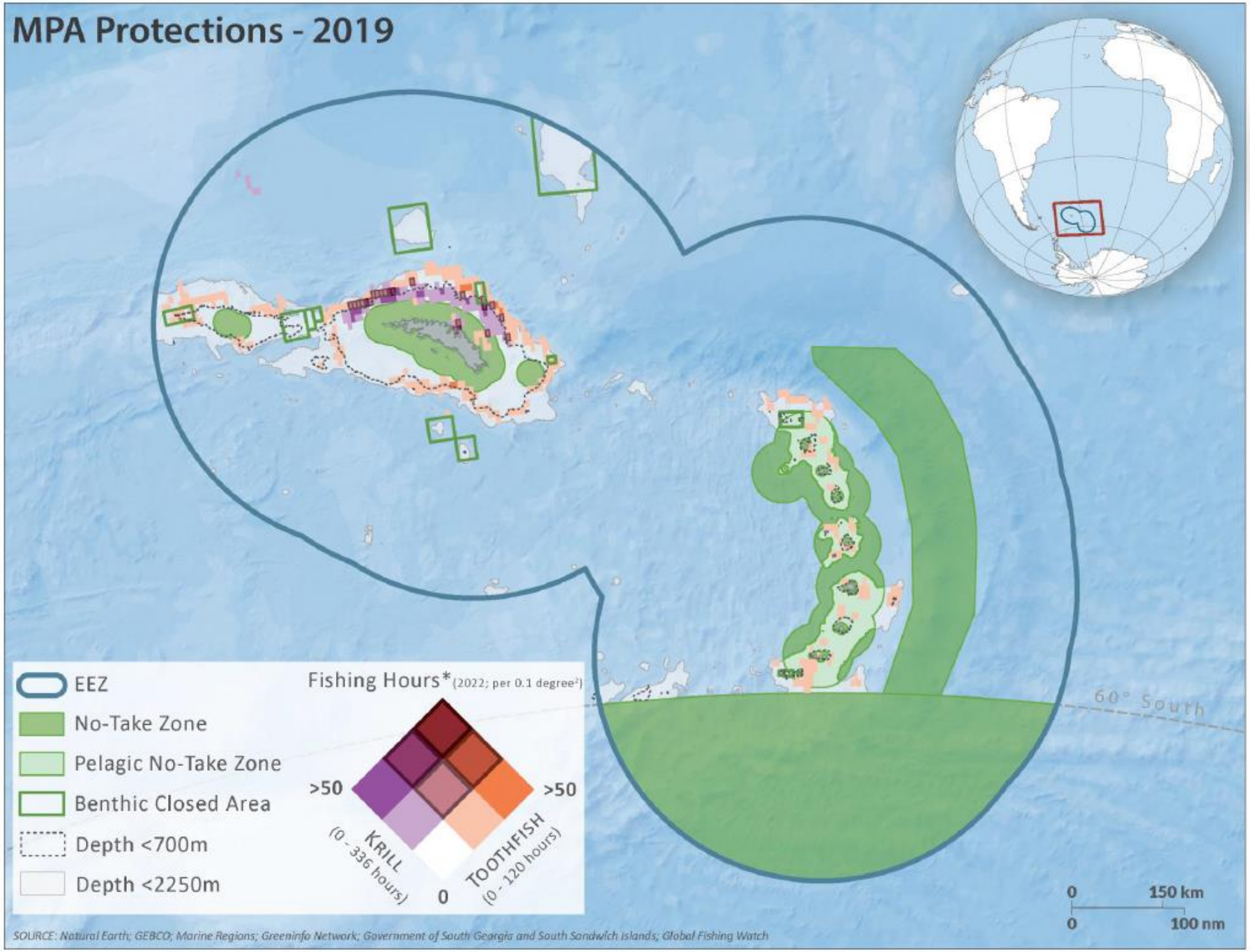
MPA Context

MPA Over Time



GREAT BLUE OCEAN

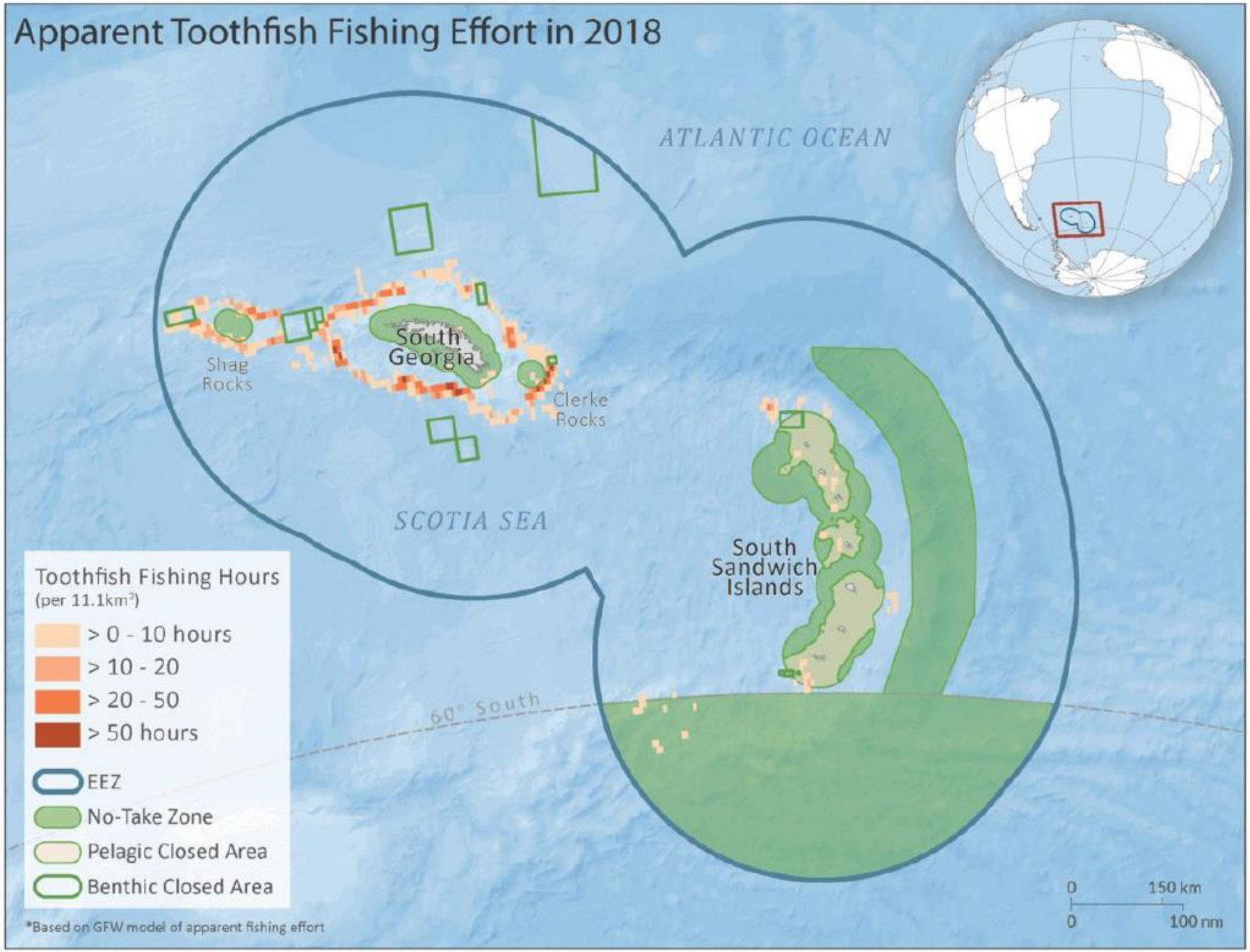
Apparent Fishing Effort (vessel presence)



*Based on GFW model of apparent fishing effort

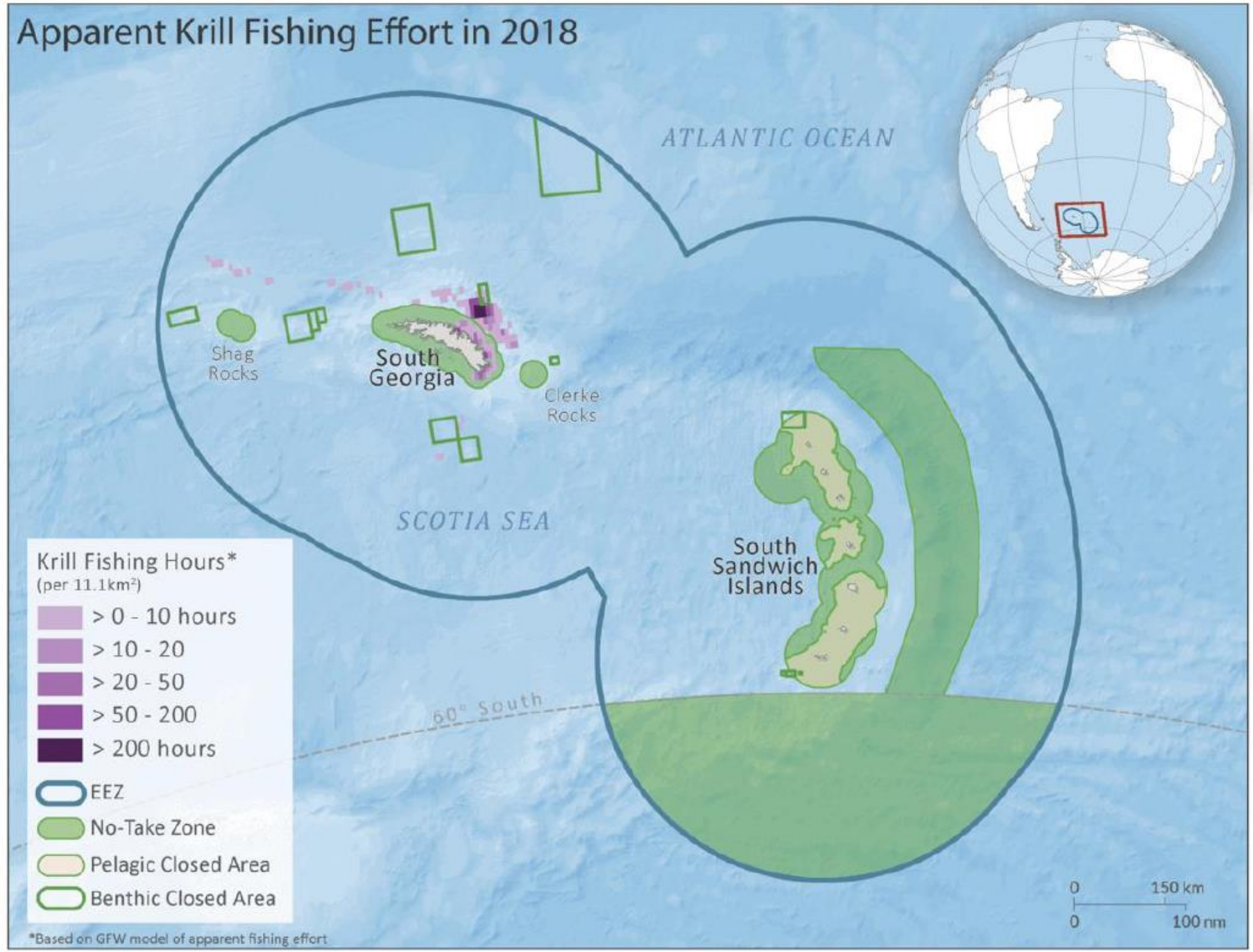
GREAT BLUE OCEAN

Apparent Fishing Effort – Toothfish (vessel presence)



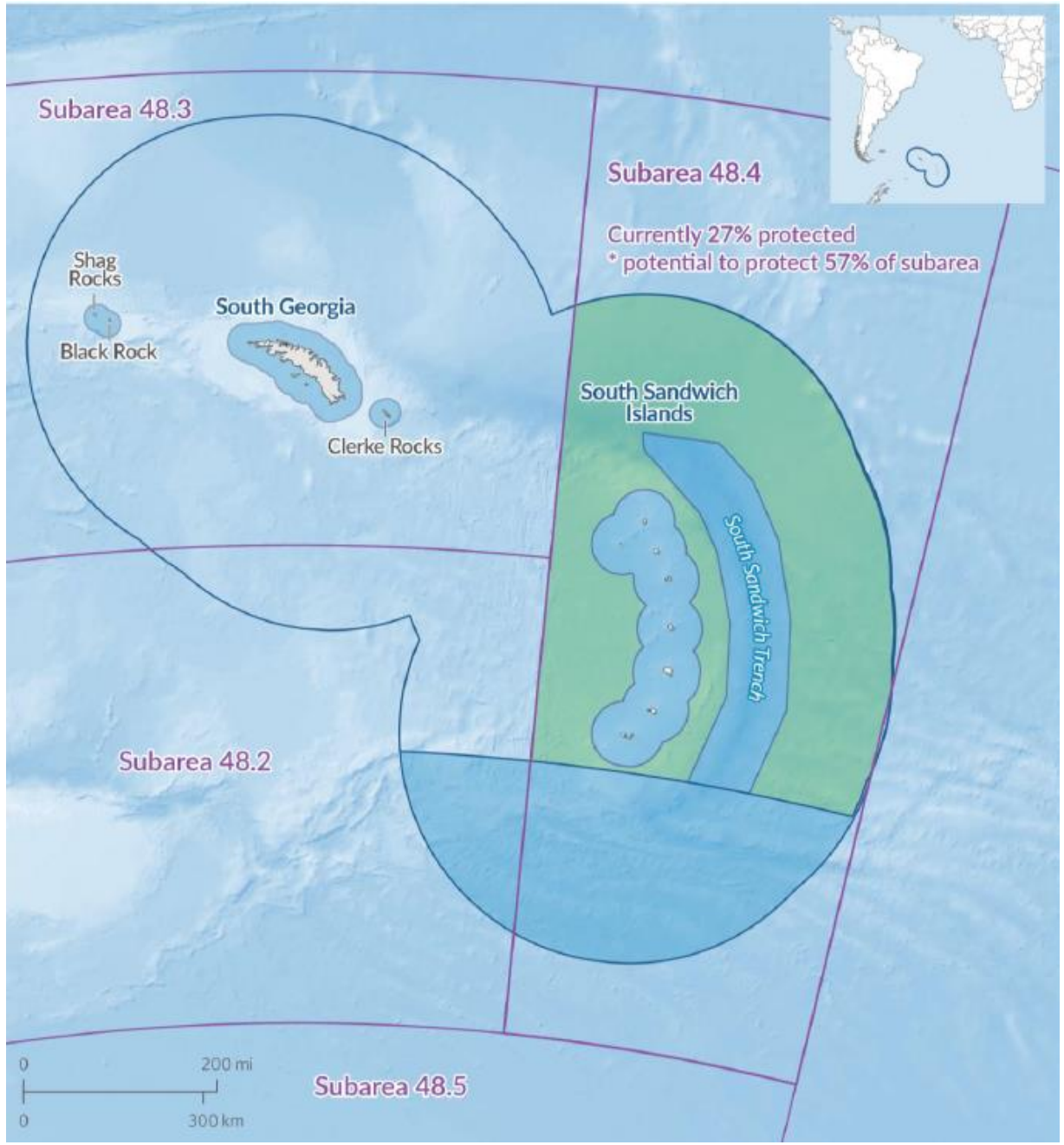
GREAT BLUE OCEAN

Apparent Fishing Effort - Krill (vessel presence)

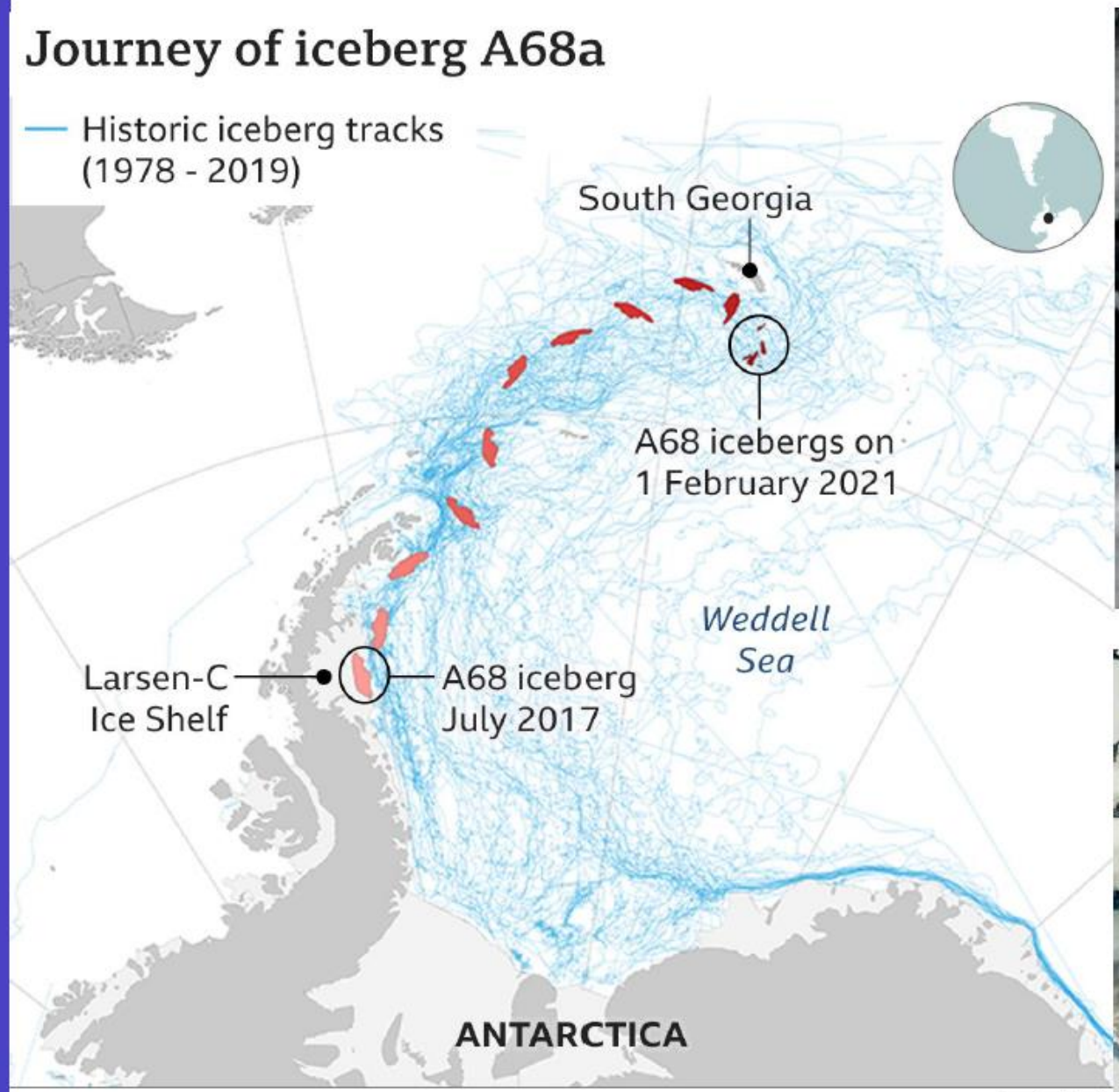


SOURCE: Global Fishing Watch; Natural Earth; GEBCO

GREAT BLUE OCEAN


Subarea 48.3
Subarea 48.4
Currently 27% protected
* potential to protect 57% of subarea
Shag Rocks
Black Rock
South Georgia
Clerke Rocks
South Sandwich Islands
South Sandwich Trench
Subarea 48.2
Subarea 48.5
0
200 mi
0
300 km

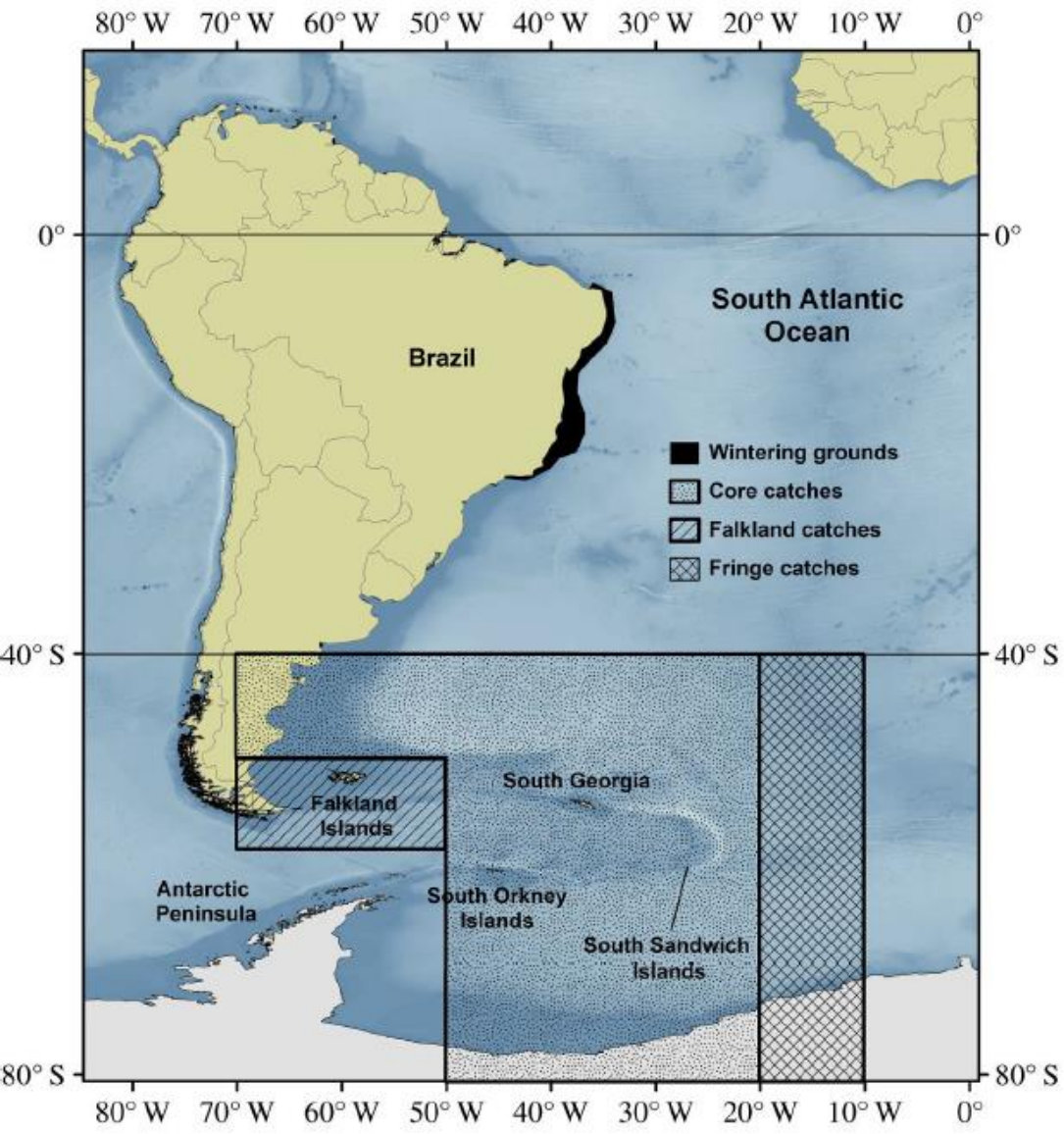
Climate

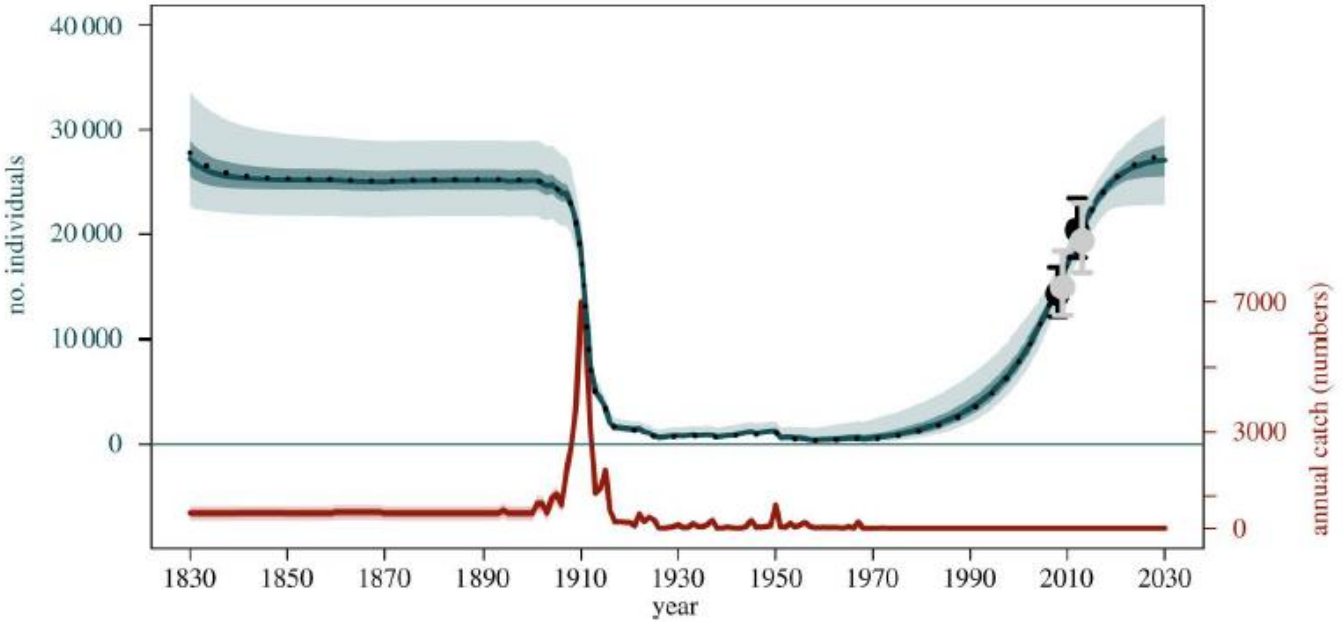


GREAT BLUE OCEAN

Science

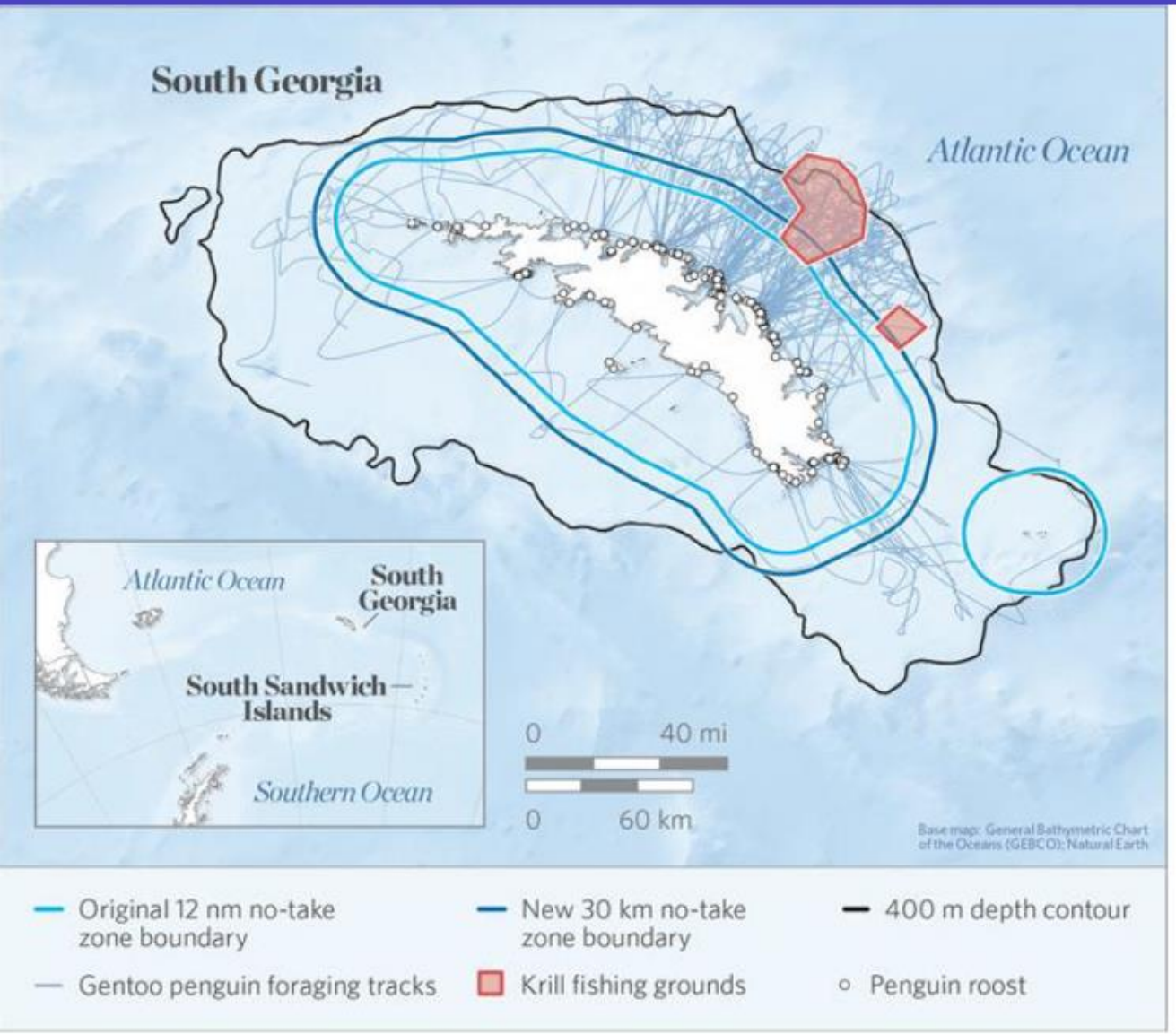
Assessing the recovery of an Antarctic predator from historical exploitation (Zerbini et al 2019)



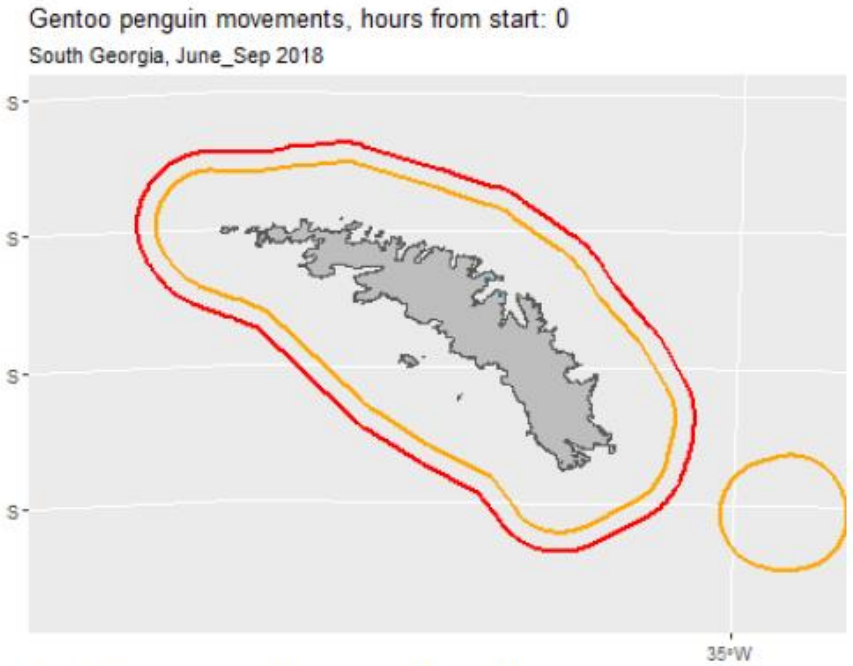


"The recovery of humpback whales in the western South Atlantic has the potential to modify the structure of the ecosystem in their feeding habitats around SGSSI. For this reason, it is important to continue monitoring abundance and potential shifts in distribution to understand how krill and their predators, including whales, will respond to effects from climate change and whether these effects will impact their populations,"

Changes in prey fields increase the potential for spatial overlap between gentoo penguins and a krill fishery within a marine protected area (Ratcliffe et al 2021)

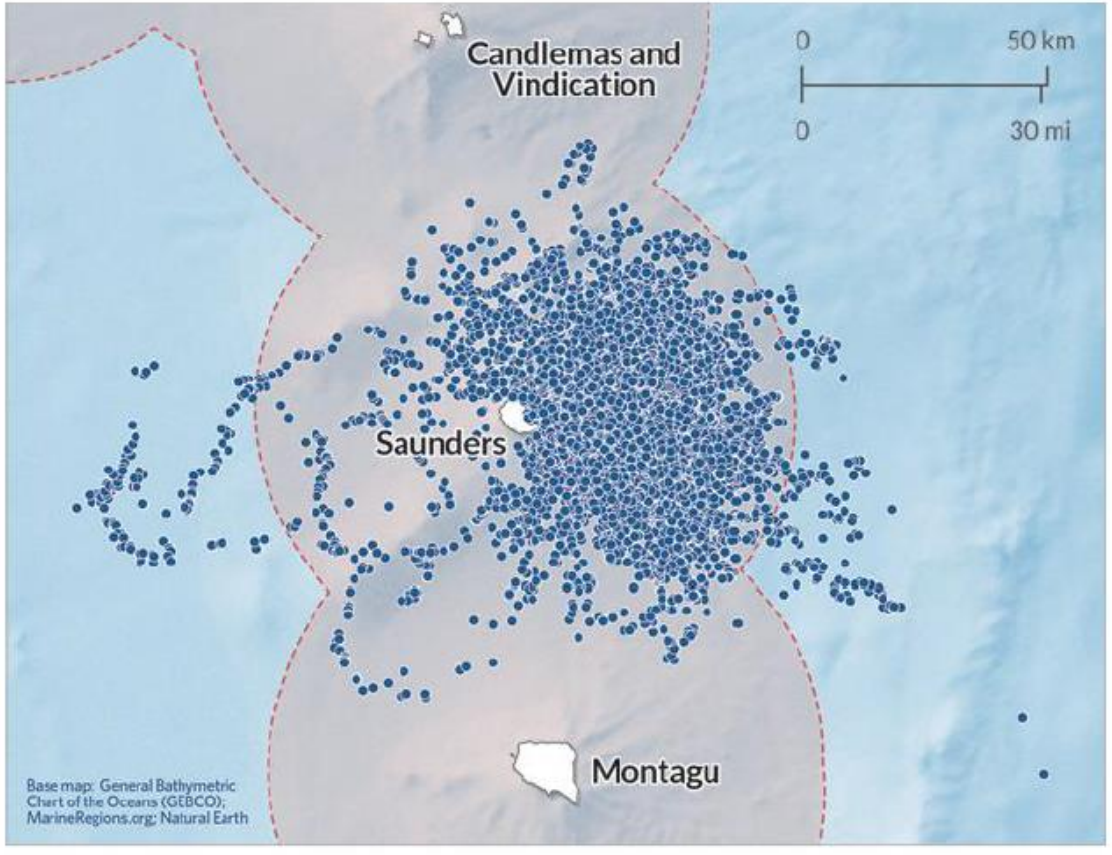


Source: British Antarctic Survey



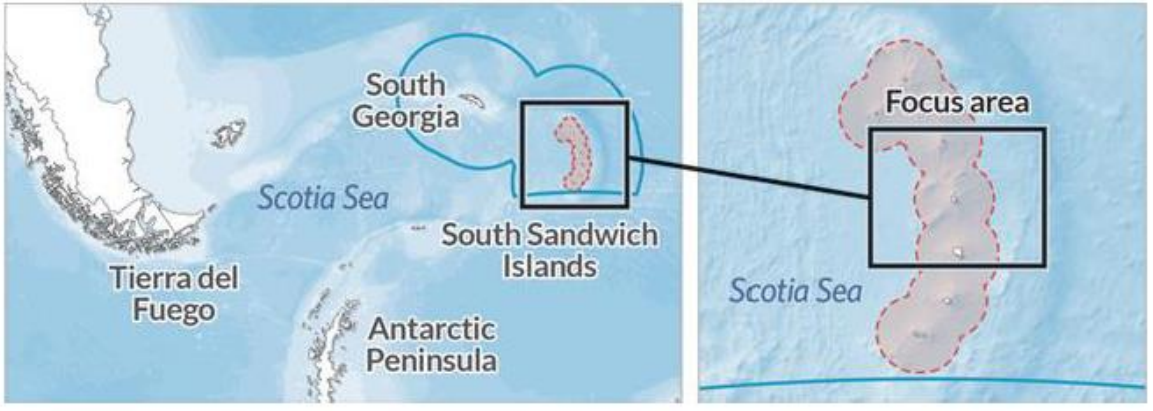
"The NTZ would need to be extended to the 400m depth contour (~55 km from shore) to fully encompass the gentoo penguin distribution observed in 2018……Closing the shelf to the krill fishery would have a major impact on its performance owing to low and unpredictable krill densities in off-shelf waters"

Using habitat models for chinstrap penguins, *Pygoscelis antarctica,* to inform marine spatial management around the South Sandwich Islands during the penguin breeding season (Clucas et al 2022)



- Periodic location transmissions from tags attached to 20 chinstrap penguins
- 50-km no-take zone
- Exclusive economic zone

Source: British Antarctic Survey



"During winter, when the area outside the South Sandwich Islands 50 km pelagic no-take zone is open to the krill fishery, the fishery is unlikely to operate because of seasonal sea ice forming a physical barrier to fishing operations [for the time being]. However, to the north of the sea ice, krill predators may still be vulnerable to competition if the fishery were to operate in these open water areas".

Five Penguin Species on One Beach

As rare as we said??

Science driven enhancements to protections since 2012

Precautionary Principle applied

Recovering baleen whales

Regional context is key

30 by 30 leadership

GREAT BLUE OCEAN

Thank you

Pew Bertarelli Ocean Legacy

Marine Conservation Society

Greenpeace

Great Blue Ocean

Pew

Blue Marine Foundation

Blue Nature Alliance

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Rod Strachan