Mapping the seafloor: the "uncharted" world
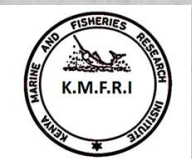
Oceans of Opportunities, River of Ideas (OORI)

5th -9th December 2018
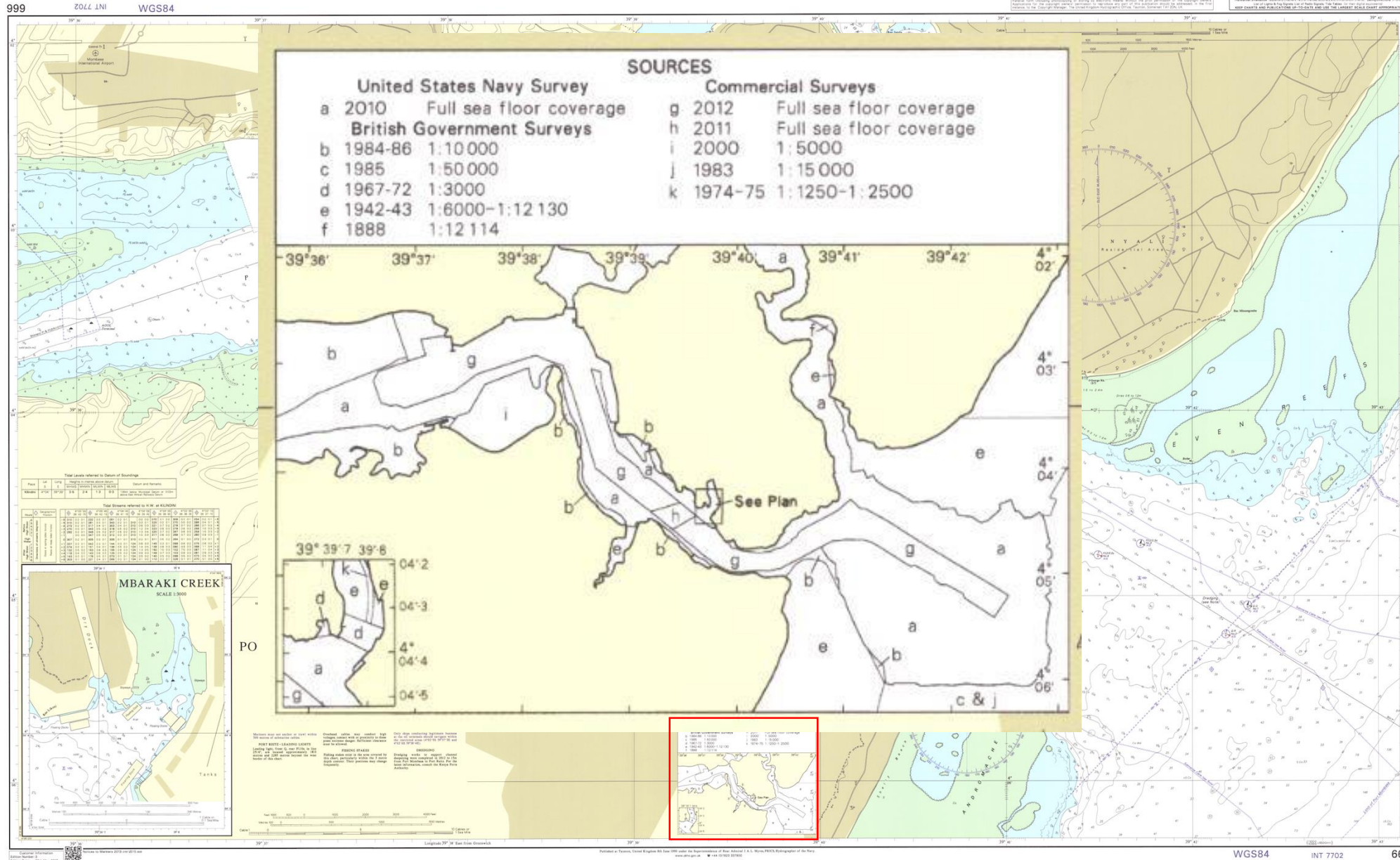
Gent, Belgium

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"*Trust in God and the* *Bathymetry*"

What is Bathymetry?

- Measure of depth of the water column relative to sea level.

- Several bathymetry measurements are used to visualize the topography of sea floor

- Bathymetry measurements can be obtained by:
    - Lead lines
    - Singlebeam echosounding
    - Multibeam echosounding (high resolution –full seafloor coverage)
    - LiDAR
    - Satellite altimetry

- Hydrography is the branch of science that deals with measuring bathymetry

Why do we need bathymetry?

One of the basemap required for all academic, commercial & exploration work at sea and has numerous applications:

- **Safety of Navigation:** maritime trade, military + coast guard

- **Scientific and academic research:** marine geology, global tectonics, ocean current models

- **Geohazard modelling and mitigation:** Tsunami-propagation and storm surge models

- **Sustainable resource management:** fisheries-resource management, mariculture, petroleum and mineral exploration, renewable energy resources (wind farms)

- **Environmental Stewardship:** Habitat monitoring, national heritage

- **Marine based engineering/construction:** Harbor & docks construction & maintenance

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BLUE ECONOMY!
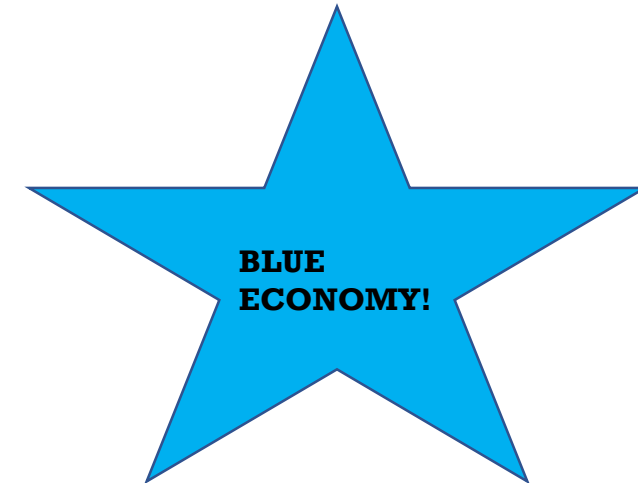
# Status: How much of the World Ocean floor is mapped?
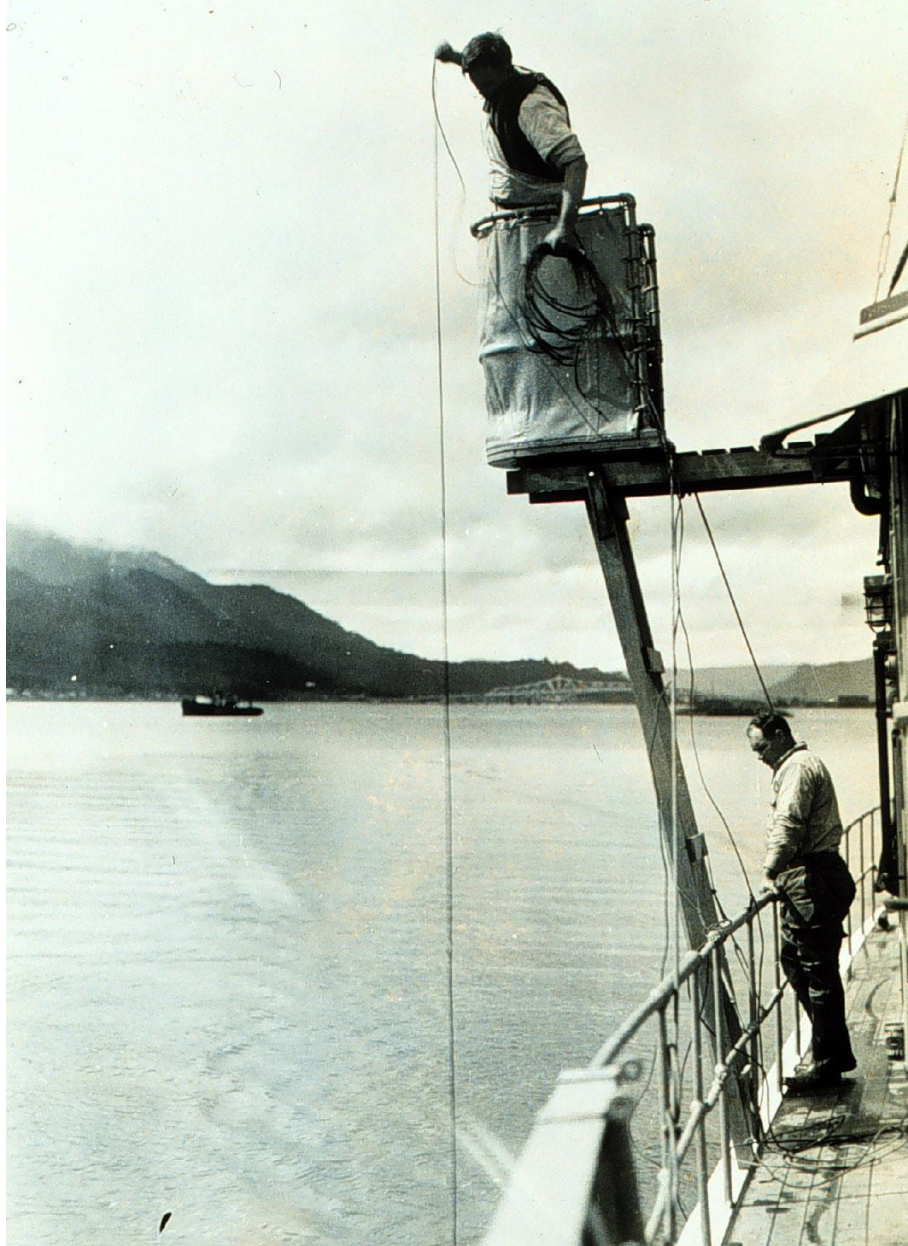
Quick FACTS

- ~70% of the Earth is covered by the World Ocean.

- Systematic acquisition of deep ocean (>200m) bathymetric data began in (1872–1876)
  - →British HMS Challenger expedition generating 492 deep-sea soundings

- Sea bottom topography
  - →far less known than the surfaces of Mercury, Venus, Mars, and the moon.

Photo source: Seabed 2030 Roadmap; originally in C&GS Season's Report Karo 1936–88. Provided from NOAA's Historic Coast & Geodetic Survey

Status: How much of the World Ocean floor is mapped?

A shaded relief of the GEBCO_2014 grid [Source: Weatherall et al. (2015)]
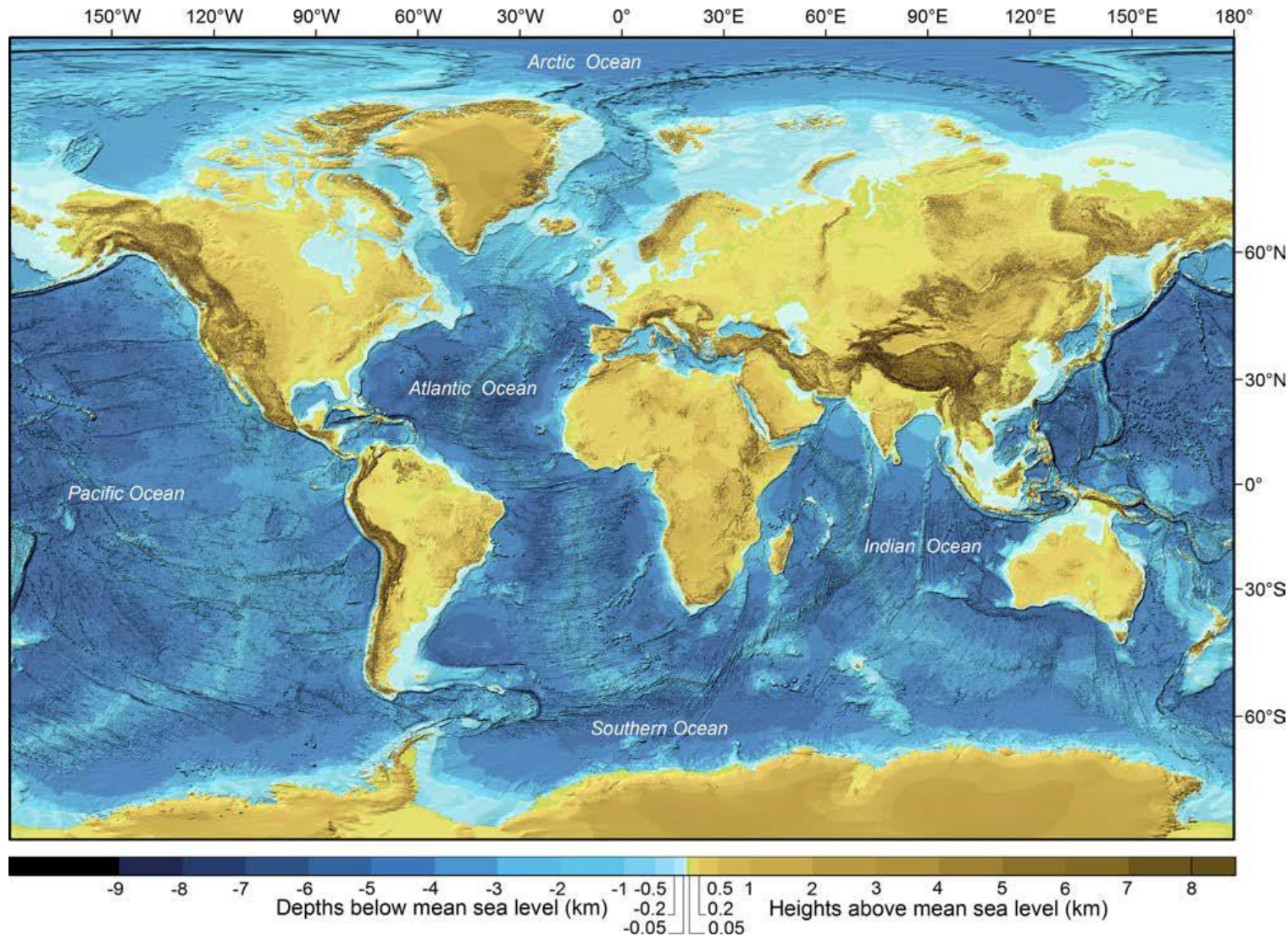
- Very low resolution → single beam and ship track data used.

- Satellite altimetry (Sandwell et al., 2014; Smith and Sandwell, 1997)

  - Global ocean 5km⨉ 5km grid

- Only ~15% of worlds deep ocean is mapped to required standards (MBES=full sea floor coverage)
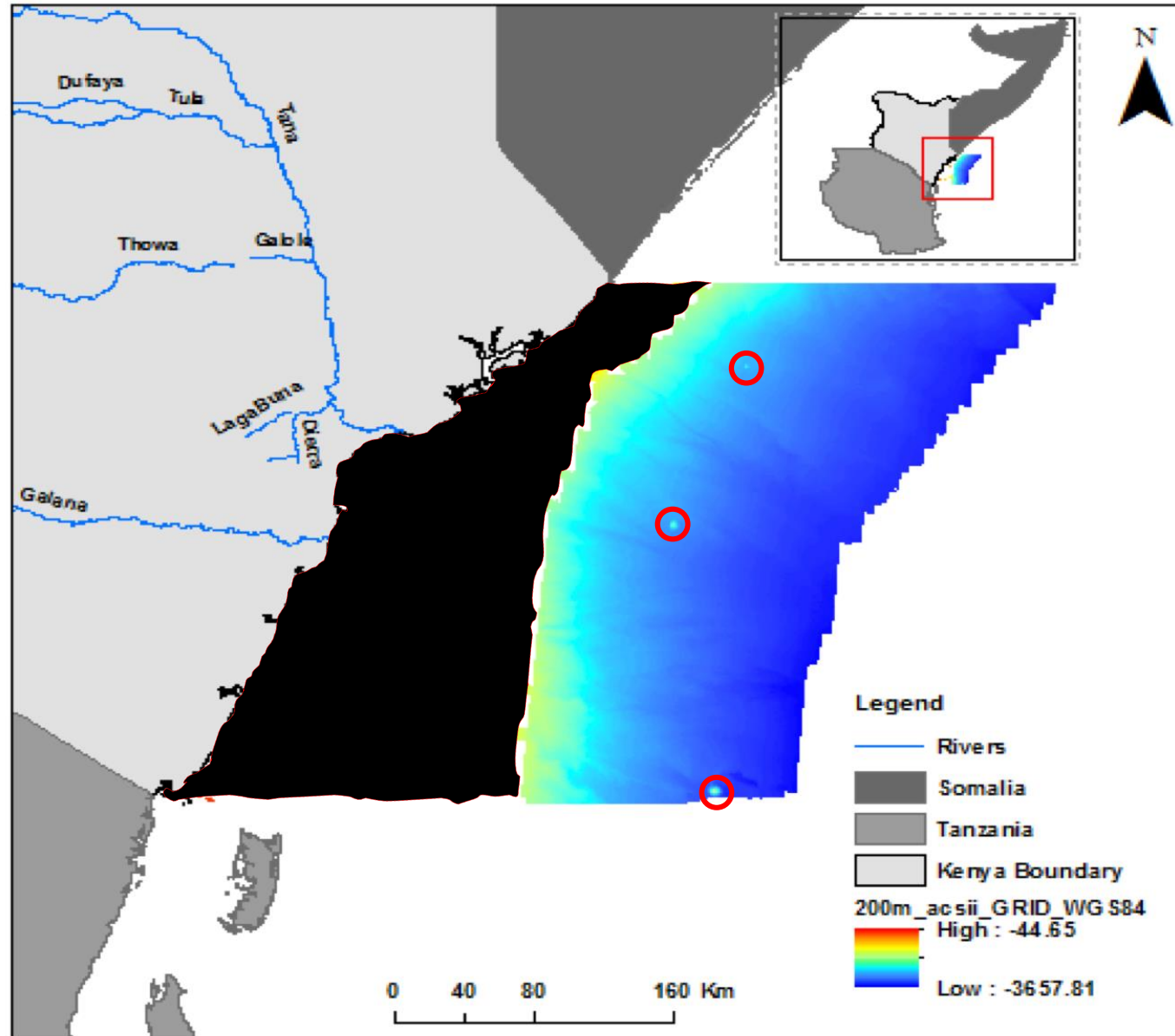
Closer home: Indian Ocean
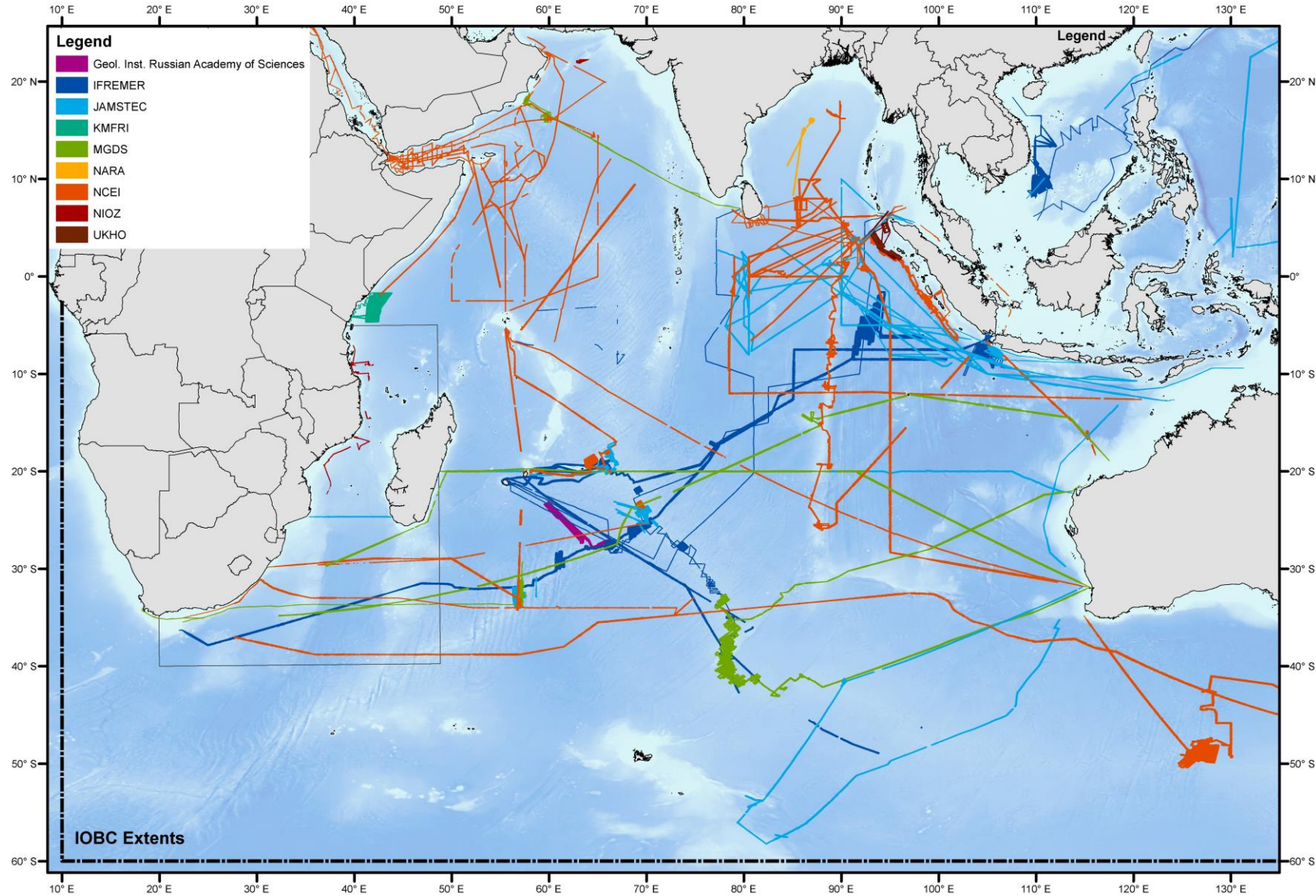
- Only **2%** of Indian Ocean covered by publically-available MBES data.

- It could change if all available bathymetry data was shared.
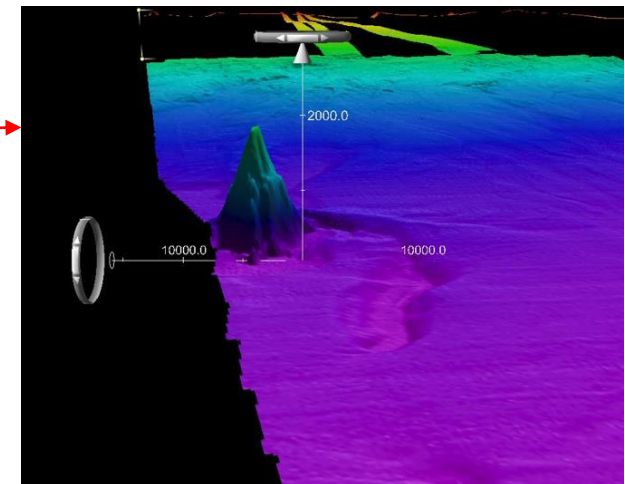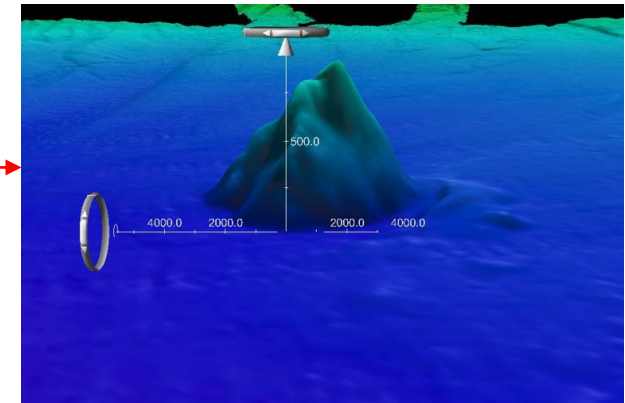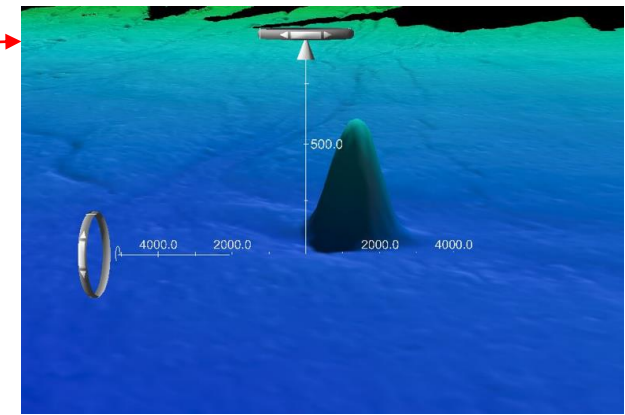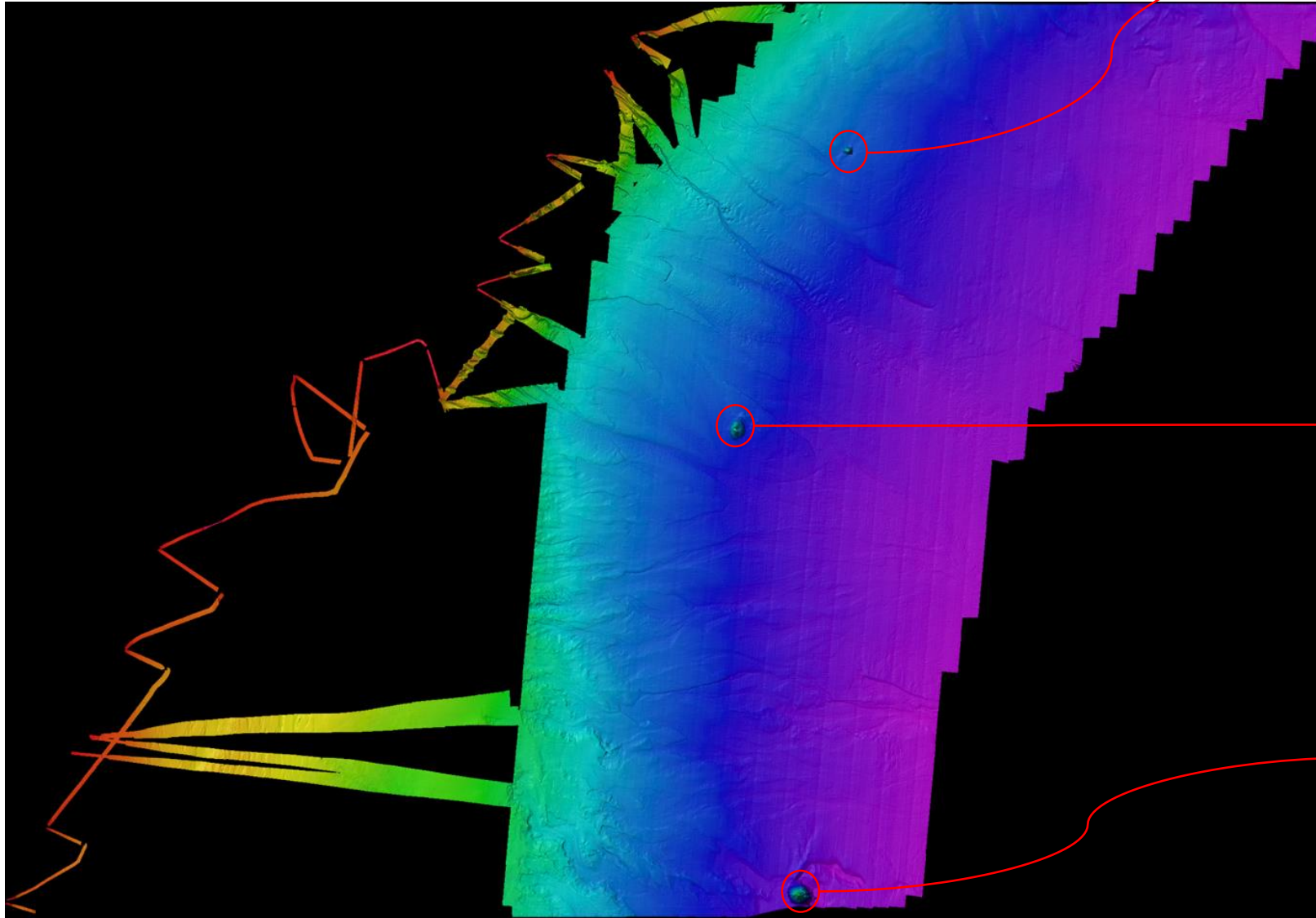
Source: Wigley, 2018

Much closer home: Kenya

- MBES survey was done in 2007 under Kenya's UNCLOS project to delineate its outer continental shelf.

- Support Kenya's submission to UNCLOS for extension of it's EEZ.

  HOWEVER, most of our Kenyan territorial "shallow" waters remains unsurveyed.

Seamounts/Guyots in Kenya waters

Images: Kimeli, 2015

Nippon Foundation – GEBCO Seabed 2030 Project

Seabed 2030 is a global initiative to cooperatively work toward creating a high resolution complete map of the world's ocean floor by 2030.

-The **Nippon Foundation** is a private Japanese-based, non-profit grant-making organization with a mission based around philanthropic activities to pursue global maritime development and assistance for humanitarian work.

-The **General Bathymetric Chart of the Oceans (GEBCO)** organization operates under the joint auspices of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO

Seabed 2030 Mission

*"Empower the world to **make policy decisions, use the ocean sustainably**, and **undertake scientific research** that is informed by a detailed understanding of the global ocean floor"*.

Supports SDG 14 and coincides with UN Decade of Ocean Science for Sustainable Development

# Seabed 2030 Project (https://seabed2030.gebco.net/)

- Initiated in 2016 during the Forum for Future Ocean Floor Mapping (FFOFM) in Monaco.

- Clearly set long-term AMBITIOUS goal:

  " To see 100% of the World Ocean floor topography mapped by 2030 so that: No features of the accessible parts of the World Ocean floor larger than 100m remains to be portrayed ".

- Target is to map world ocean at 100m resolution.

- Seabed 2030 will compile all available and newly collected bathymetric data into a high resolution, high-quality digital model of the World Ocean floor.

Seabed 2030 structure
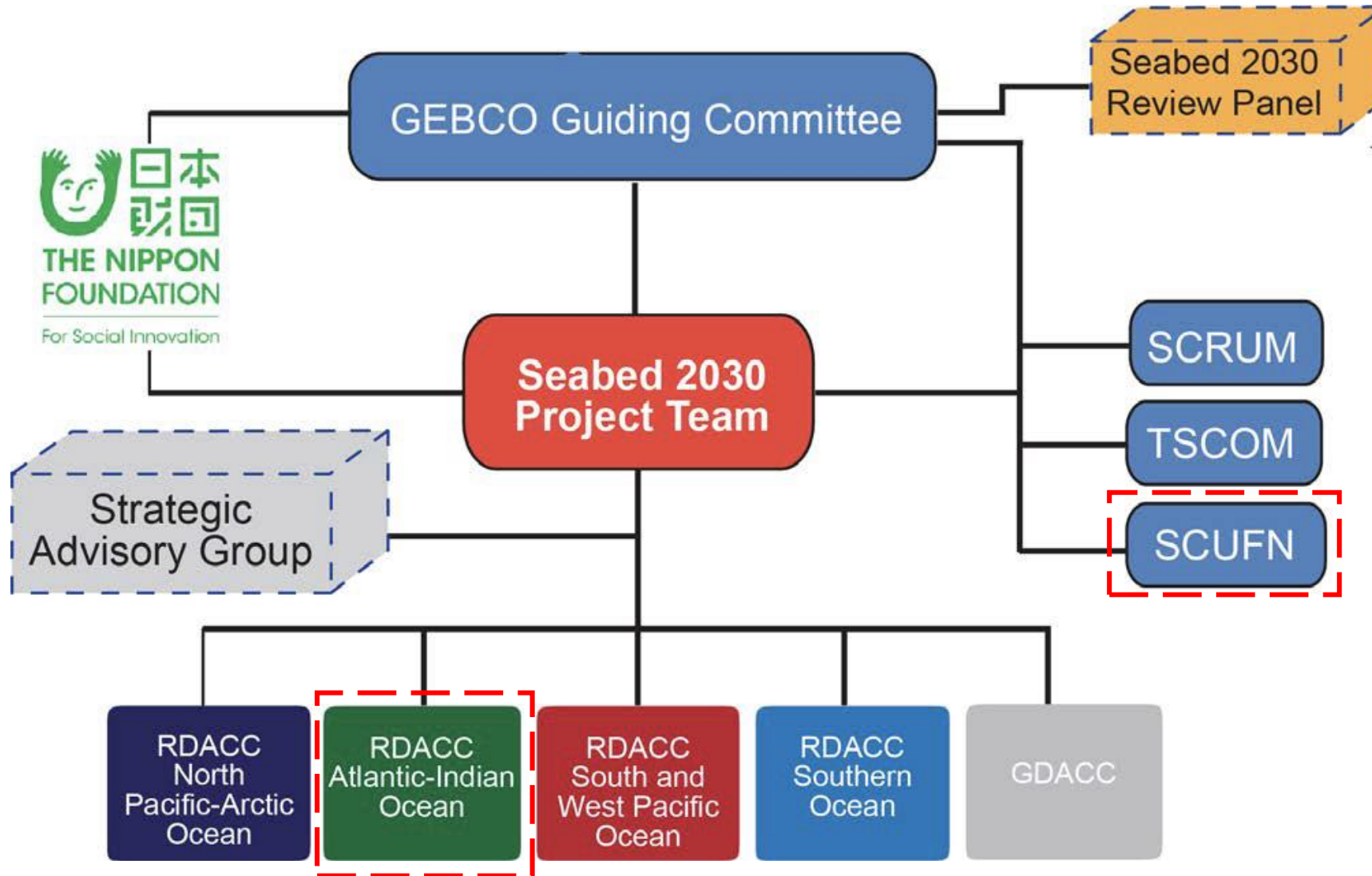
Survey efforts needed to map the world's ocean floor

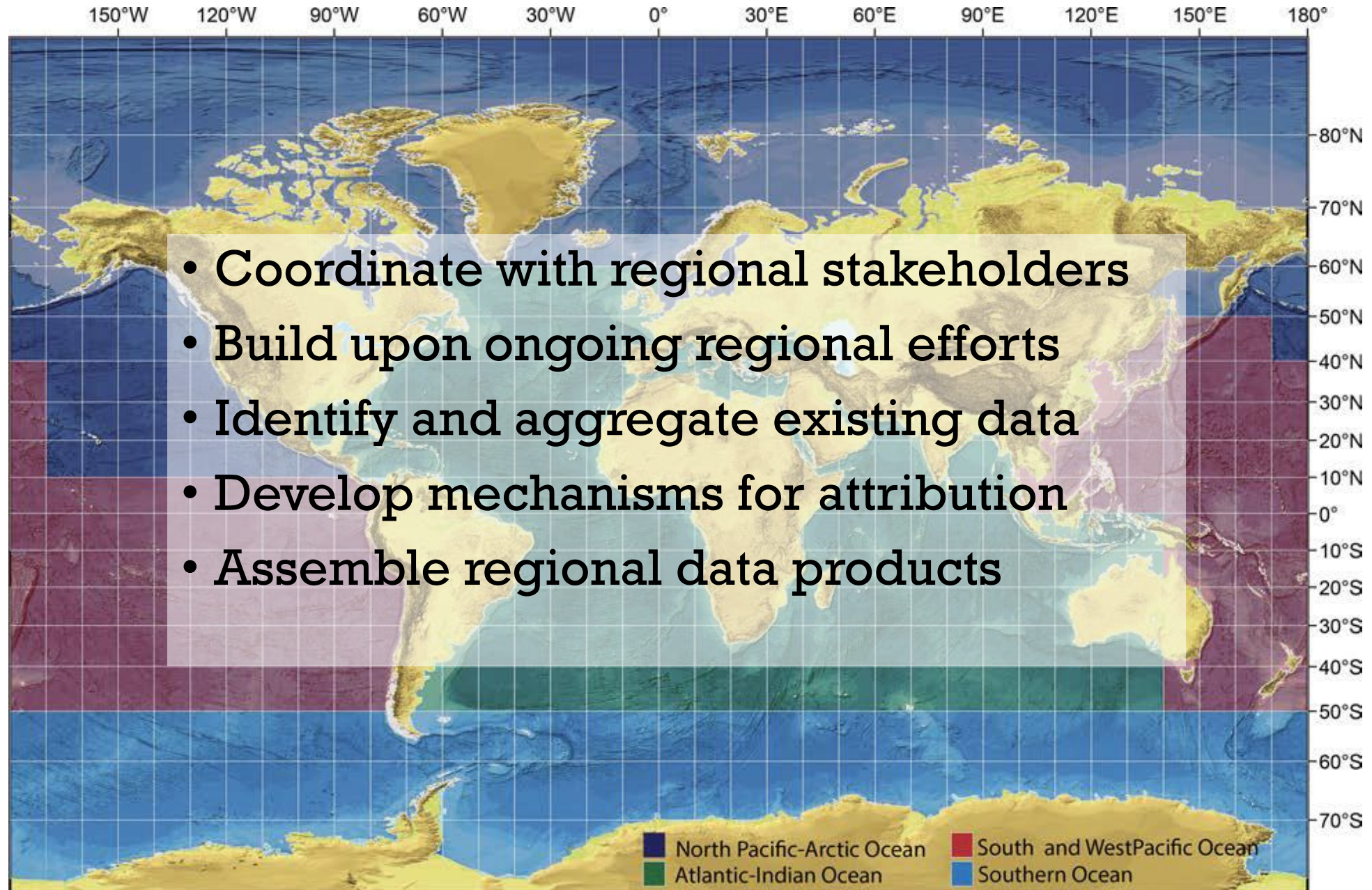| Water depth interval (modal water depth)	Average water depth (km)	Proportion of water depth (%)	Proportion of uncharted surface – this interval	Proportion of uncharted surface (overall ocean)	Cumulated surface of the GEBCO 2014 grid nodes originating from interpolated driven by altimetry (km2)	Remaining effort (years) (for one survey boat)
>3000	4	75.3	85	69	230,910,385	188
3000–1000	1.5	13.0	72	15	34,143,193	74
1000–200	0.4	4.4	66	7	10,654,693	86
0–200	0.1	7.3	71	9	18,995,603	619

- ~970 years would be required to survey the area of the *GEBCO_2014* grid today unconstrained by any sounding.

- Of these ~620 years consist of the shallow areas between 0–200m water depths.

[Source: Seabed 2030 Roadmap]

Seabed 2030 Regional Data Centers
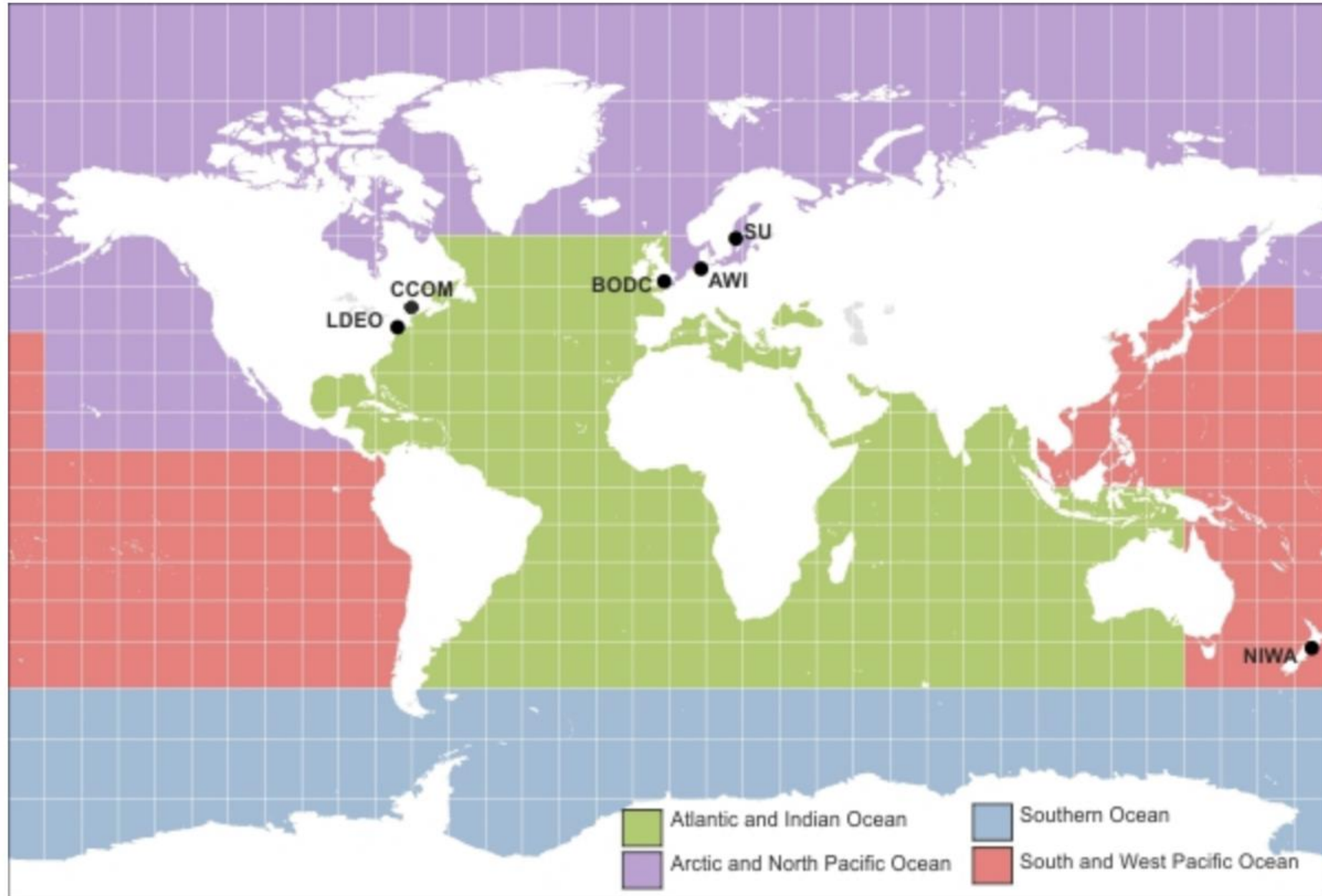
The World Ocean divided into four regions, each falling under the responsibility of a RDACC. This division is based on ongoing activities within GEBCO and to keep the number of RDACCs on a fundable level. Source: Seabed 2030 Roadmap

Seabed 2030 Regional Data Centers

- Coordinate with regional stakeholders
- Build upon ongoing regional efforts
- Identify and aggregate existing data
- Develop mechanisms for attribution
- Assemble regional data products

North Pacific-Arctic Ocean   South and West Pacific Ocean
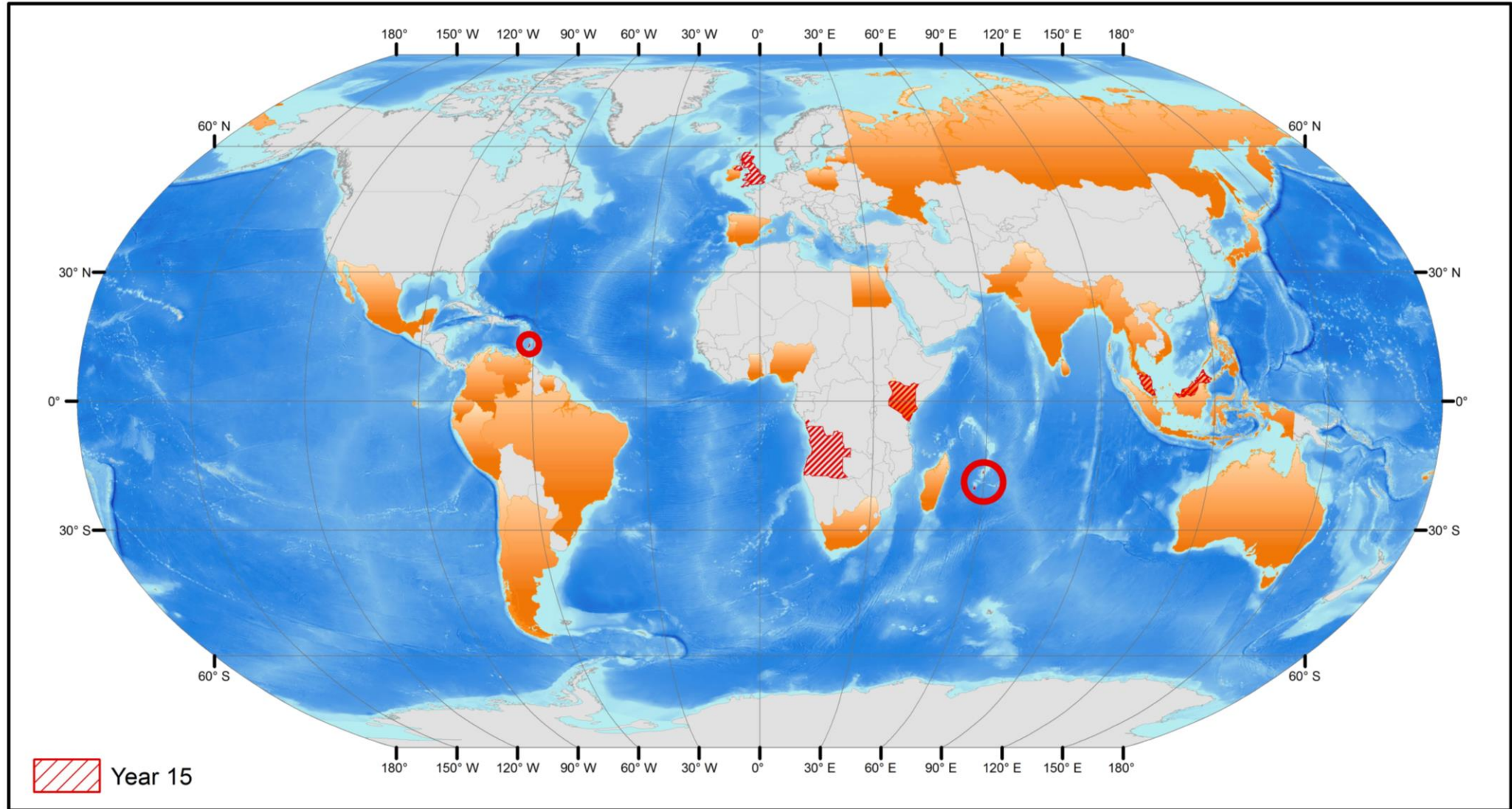Atlantic-Indian Ocean   Southern Ocean

The Seabed 2030 Project builds on the more than century-long legacy of GEBCO and the investment in human capacity built by the GEBCO–Nippon Foundation training program over the past decade.

THE NIPPON FOUNDATION

GEBCO

Human Capacity-building: Nippon Foundation / GEBCO training program: 2004 -

>90 students and alumni from 40 coastal states over last 15 years (current class in red)

Take home message: Seabed 2030 is a global call to action

- Share existing data

- Work together to coordinate acquisition of new data

- Make use of crowd-sourcing

- Develop new technical and human capacity to confront this global challenge

https://seabed2030.gebco.net

Questions?

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