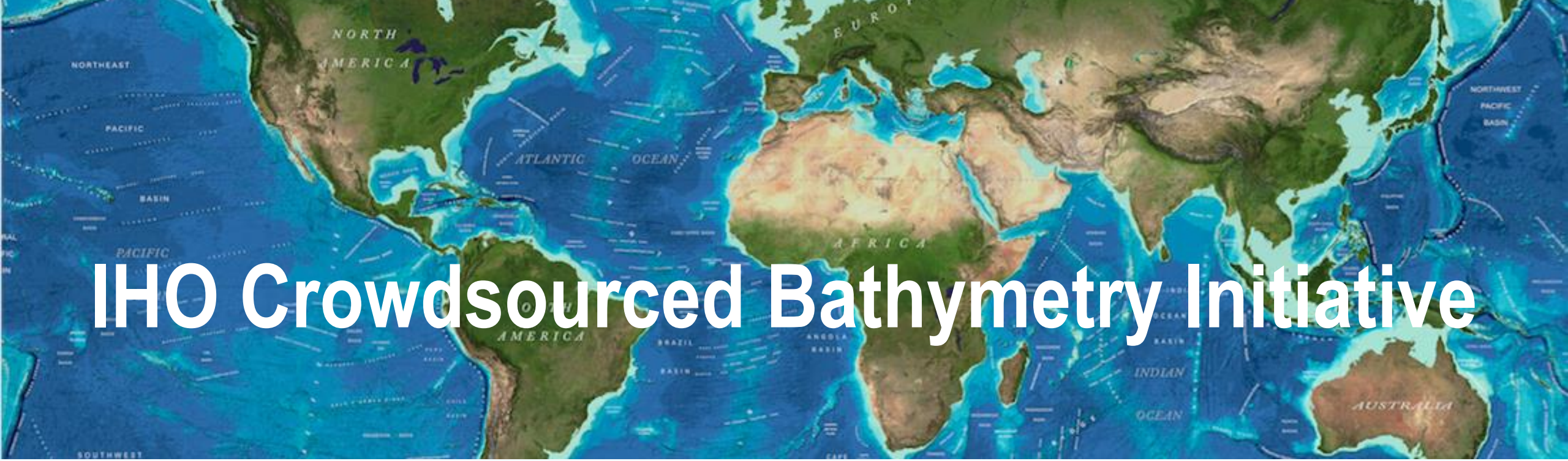
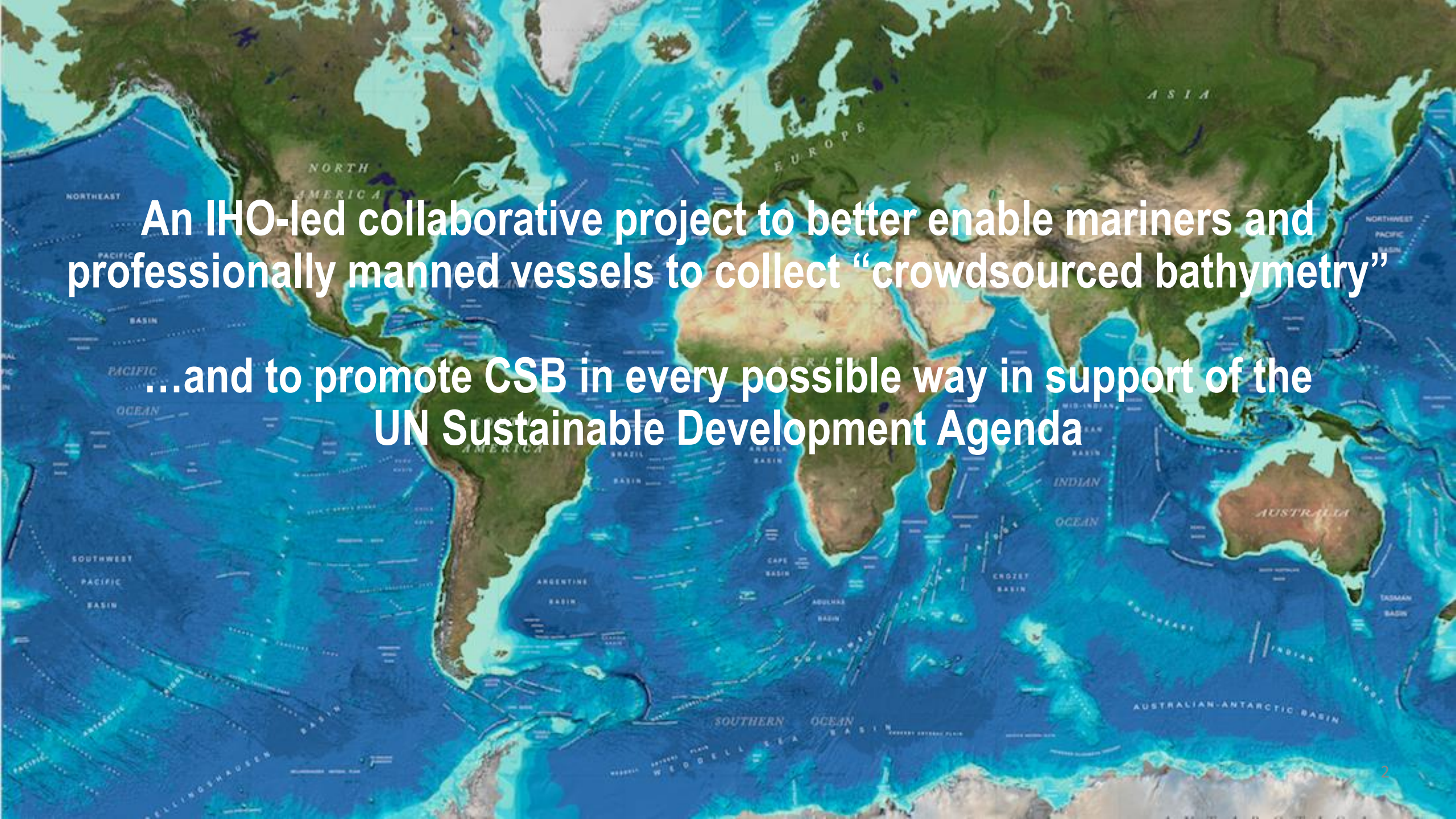
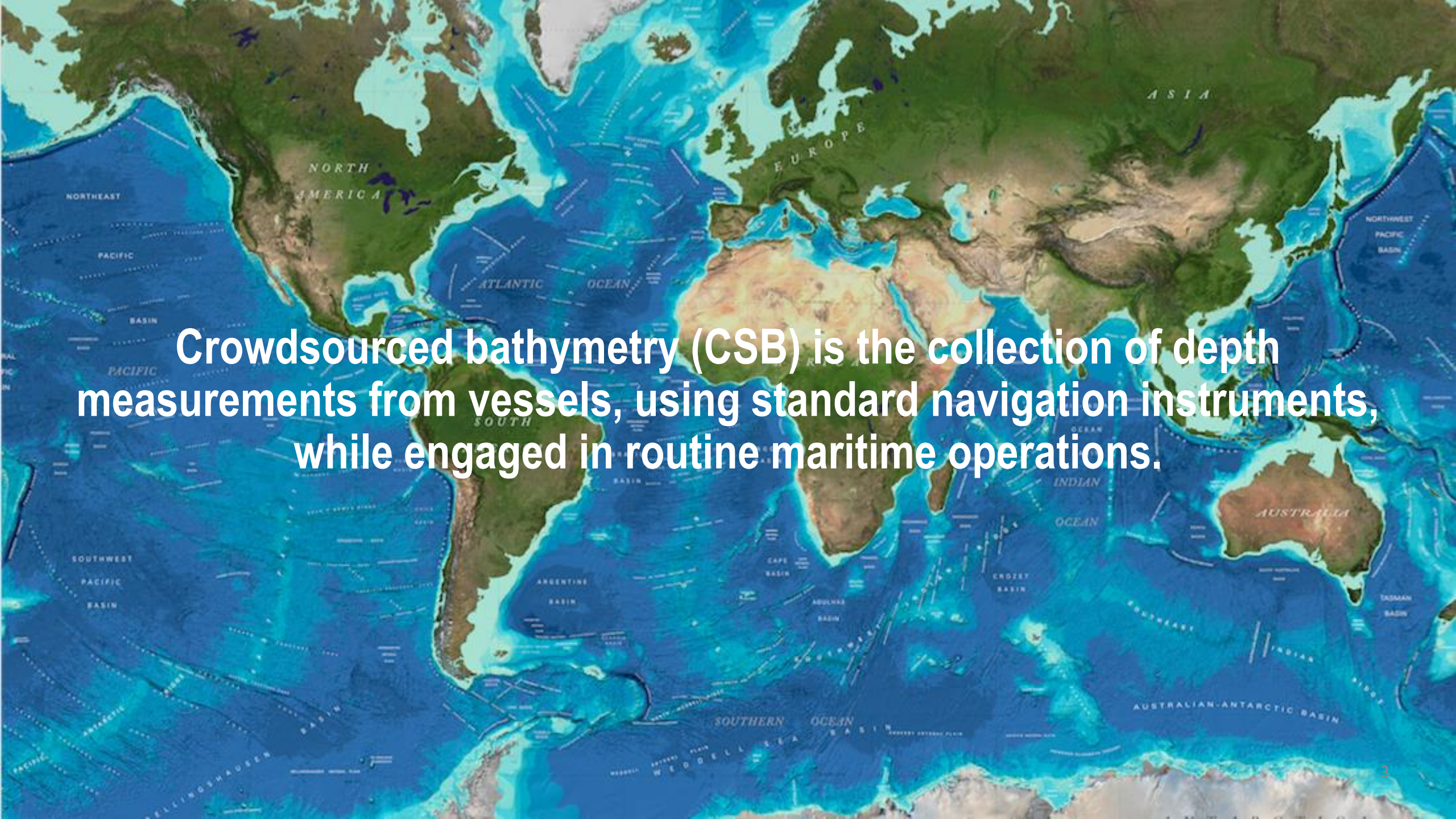


IHO Crowdsourced Bathymetry Initiative



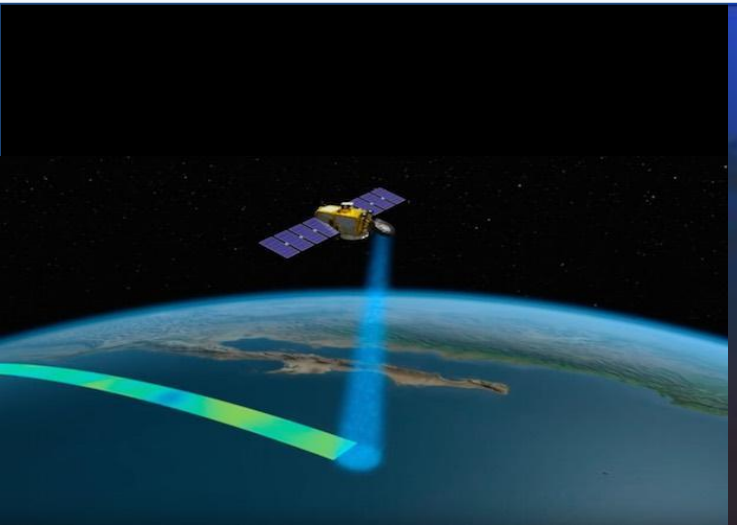
An IHO-led collaborative project to better enable mariners and professionally manned vessels to collect "crowdsourced bathymetry"

…and to promote CSB in every possible way in support of the UN Sustainable Development Agenda


Crowdsourced bathymetry (CSB) is the collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations.

How is depth information used?

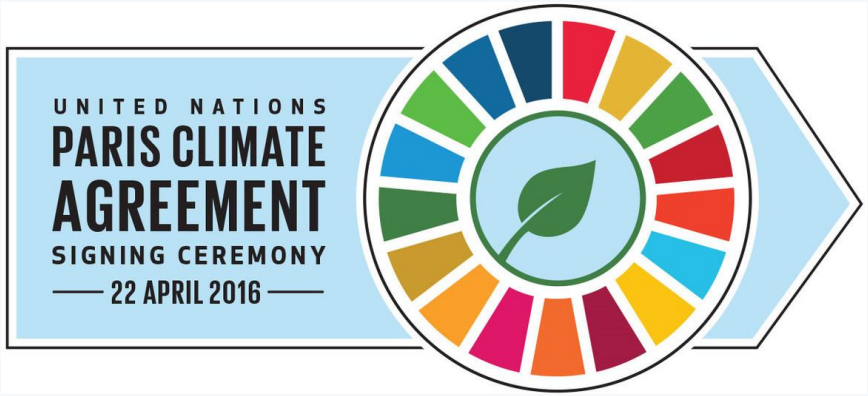
- Nautical charts
- Oil, gas, & mineral exploration
- Safety and storm surge/tsunami inundation models
- Ecosystem identification and management
- Emergency response
- Satellite verification models
- Ocean circulation/pollution models
- Coastal and Marine Spatial Planning
- Coastal Hazard Assessment
- Ocean Exploration
- Coastal Change Analysis
- Sea Level Rise Mitigation
- New Energy Siting
- Marine heritage
- Climate modeling



Global Initiatives

UN's 2030 Agenda for Sustainable Development Goals

Seabed 2030

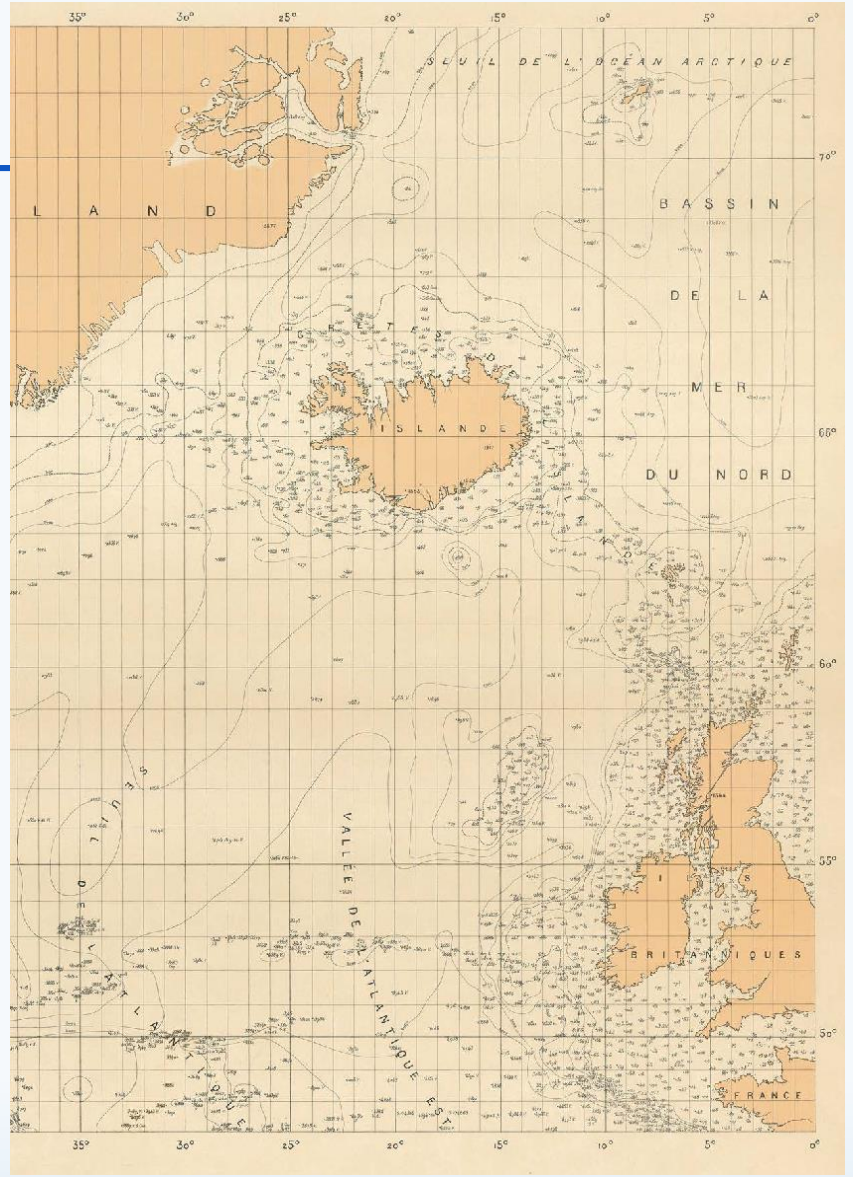


The Paris Agreement under the UN Framework Convention on Climate Change

The Sendai Framework for Disaster Risk Reduction 2015-2030

The IHO & GEBCO

- The IHO has a long history of encouraging the collection of CSB to help improve mankind's understanding of the shape and depth of the seafloor.
- The General Bathymetric Chart of the Ocean (GEBCO) project was initiated in 1903 by Prince Albert I of Monaco to provide the most authoritative, publicly-available bathymetry of the world's oceans.
- The GEBCO Project, now jointly overseen by the IHO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, has produced maps of the ocean floor from depth measurements collected by vessels as they journeyed across the oceans.



Part of GEBCO Sheet B1, from 1st Edition 1903. Source: IHO archive

The IHO & GEBCO

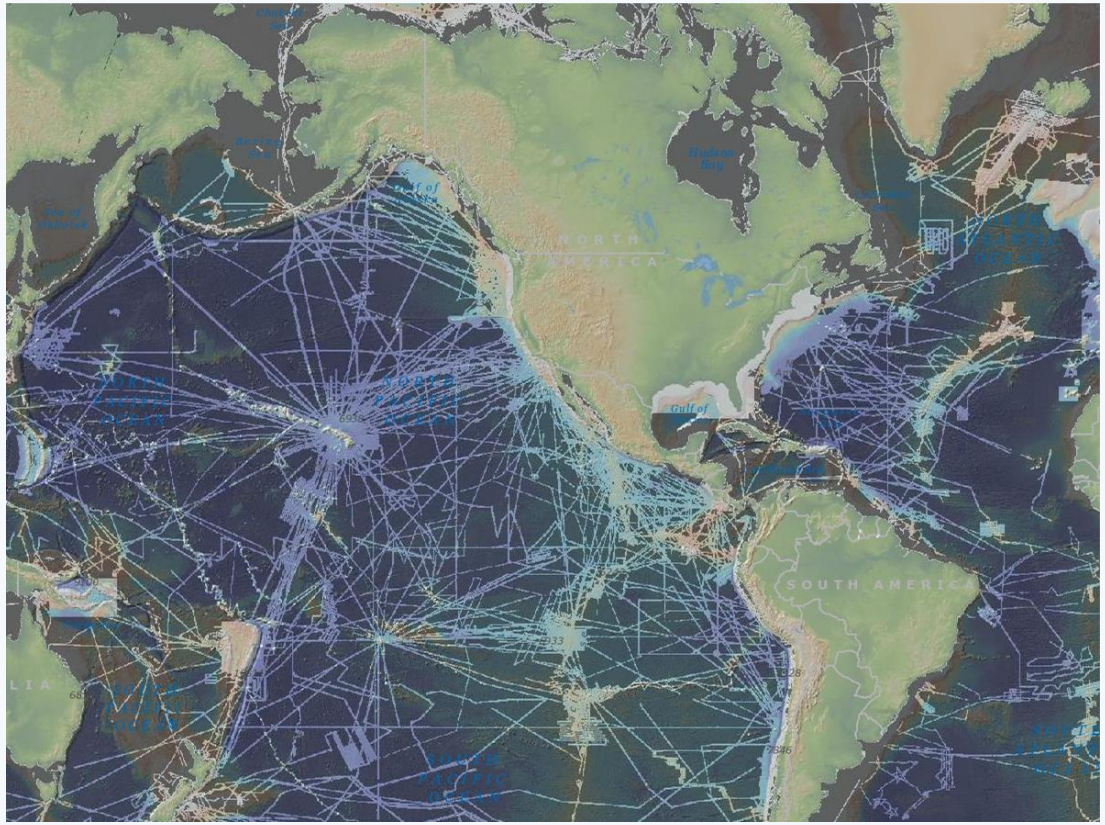
Systematic surveys are now routinely used to improve the maps and grids.

However, “passage soundings” continue to play an important role in enabling the creation of progressively more-detailed seafloor maps and digital data grids.

GEBCO_2014 World Map

The IHO & GEBCO

- < 15% of the world's ocean depths have been measured
- ~50% of the world's coastal waters shallower than 200 metres remain unsurveyed.
- The rest of the data used to compile seafloor maps are inferred depths from satellite observations.



Global Multi-Resolution Topography (GMRT) Synthesis, doi:10.1029/2008GC002332

5th Extraordinary International Hydro Conf

In 2014, the IHO, at its EIHC5, initiated a collaborative project to better enable mariners and professionally manned vessels to collect “crowdsourced bathymetry” (CSB)

The Inter-Regional Coordination Committee (IRCC) was tasked to establish a working group to prepare a new IHO publication on policy for CSB.

The IHO Crowdsourced Bathymetry Working Group has since developed IHO publication B-*12 IHO Guidance on Crowdsourced Bathymetry* to state its policy towards, and provide best practices for collecting CSB.

IHO CSB Working Group

- Representatives from 12 Member States
  Canada, Italy, Nigeria, Norway, Philippines, Denmark, Finland, France, Germany, India, Portugal, and USA
- Observers and expert contributors from TeamSurv, Olex, Sea-ID, GMATEK, Inc./World Maritime University, and SevenC's
- Former IHO Secretary General Robert Ward, IHO Secretary General Mathias Jonas and Assistant Director David Wyatt

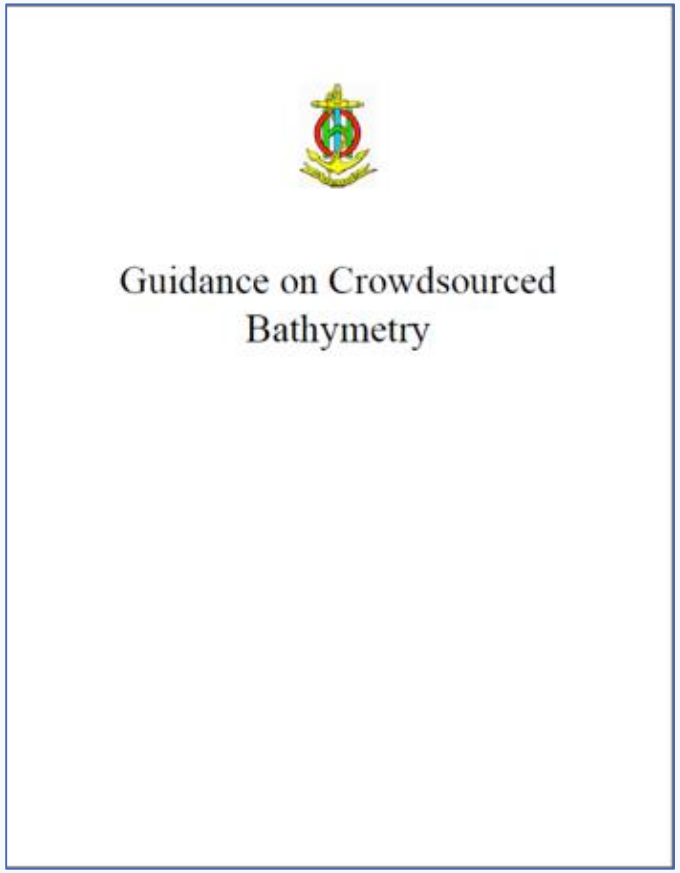
CSBWG2: 10-11 Jan 2016 - Boulder, CO

CSBWG5: 5-6 Dec 2017 - IHO, Monaco

IHO CSB Working Group

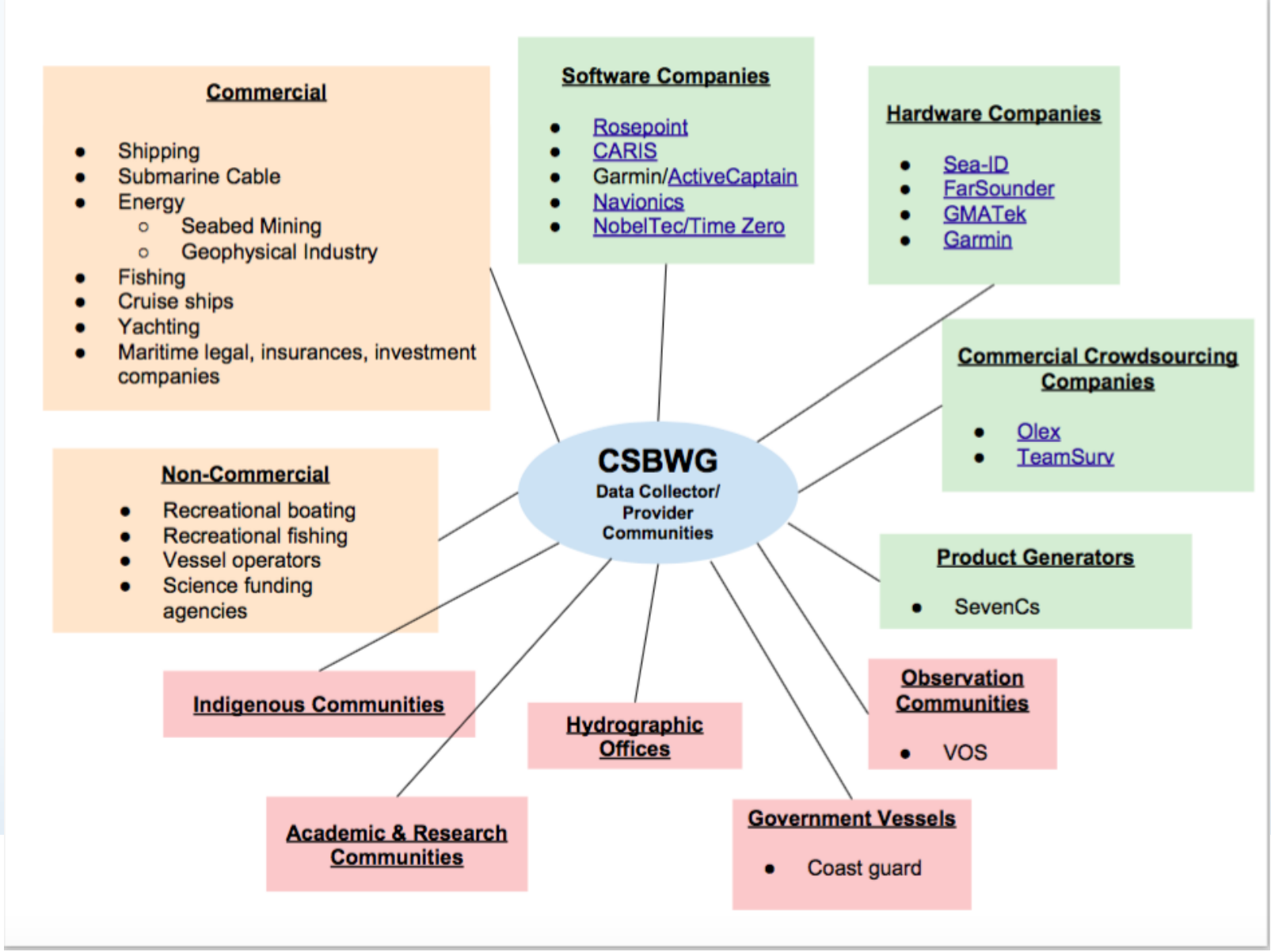
The working group has developed ***B-12 IHO Guidance on Crowdsourced Bathymetry*** to state the IHO's policy towards, and provide best practices for collecting, crowdsourced bathymetry.

This document provides guidance on the collection and assessment of CSB data for inclusion in the global bathymetric data set which is maintained in the IHO Data Centre for Digital Bathymetry (DCDB).



To access the document:
https://www.iho.int/iho_pubs/IHO_Download.htm

CSB Stakeholders



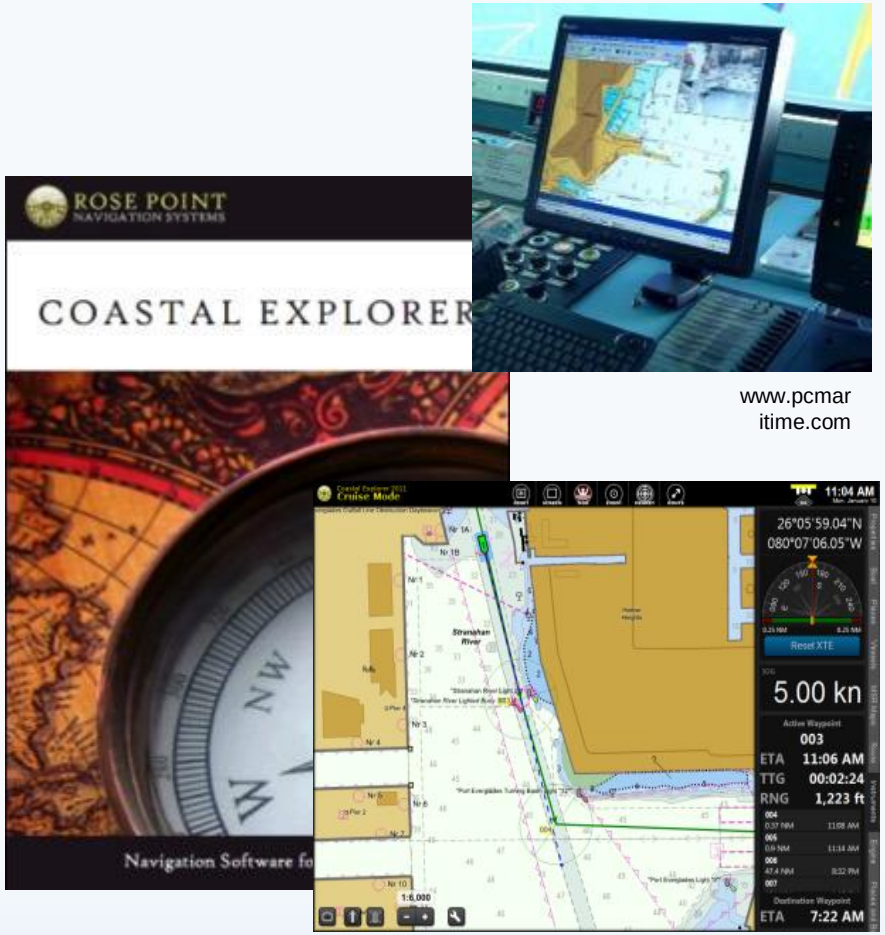
IHO DCDB Enhancements & Pilot Project

For the last several years, the IHO Data Centre for Digital Bathymetry (DCDB), working in collaboration with the CSB Working Group, has worked on enhancing its infrastructure to allow the public to upload, discover, display and download CSB data via a web-based interface.

https://maps.ngdc.noaa.gov/viewers/iho_dcdb/

IHO DCDB Enhancements & Pilot Project

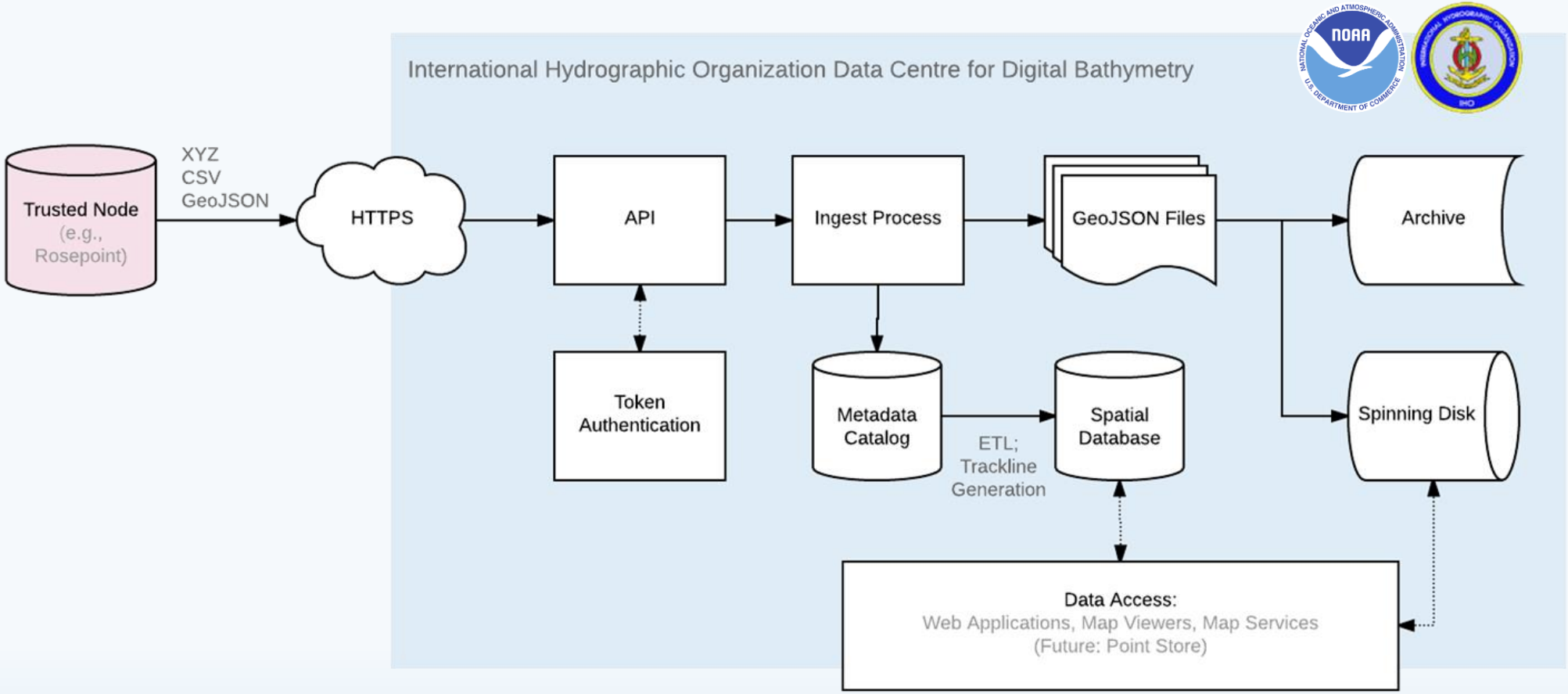
- IHO DCDB and NOAA teamed up with Rose Point Navigation Systems
- Mariners given an option to enable CSB logging, allowing a modified ECS log file to record position, depth and time.
- Mariners can choose to be anonymous or to submit metadata about vessel and equipment
- Whenever the mariner updates the software or chart catalog, the data is sent to Rosepoint who then transmits the data to the DCDB via HTTPS post.



www.pcmaritime.com

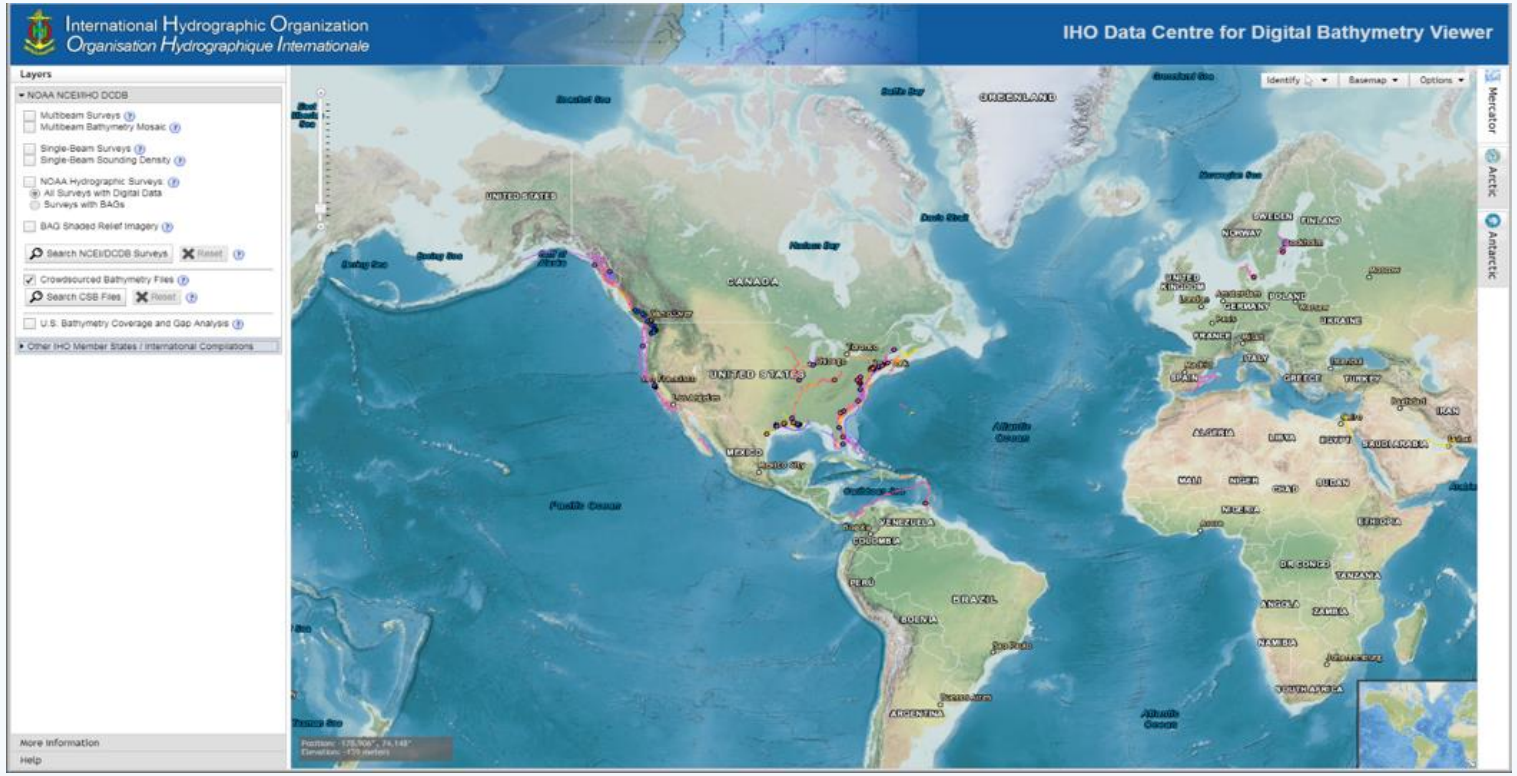
www.rosepointnav.com

CSB ~~Pilot~~ Project – NOW OPERATIONAL



IHO DCDB CSB Data Holdings

- 117 million soundings
- 110 contributing vessels
- 3435 data deliveries

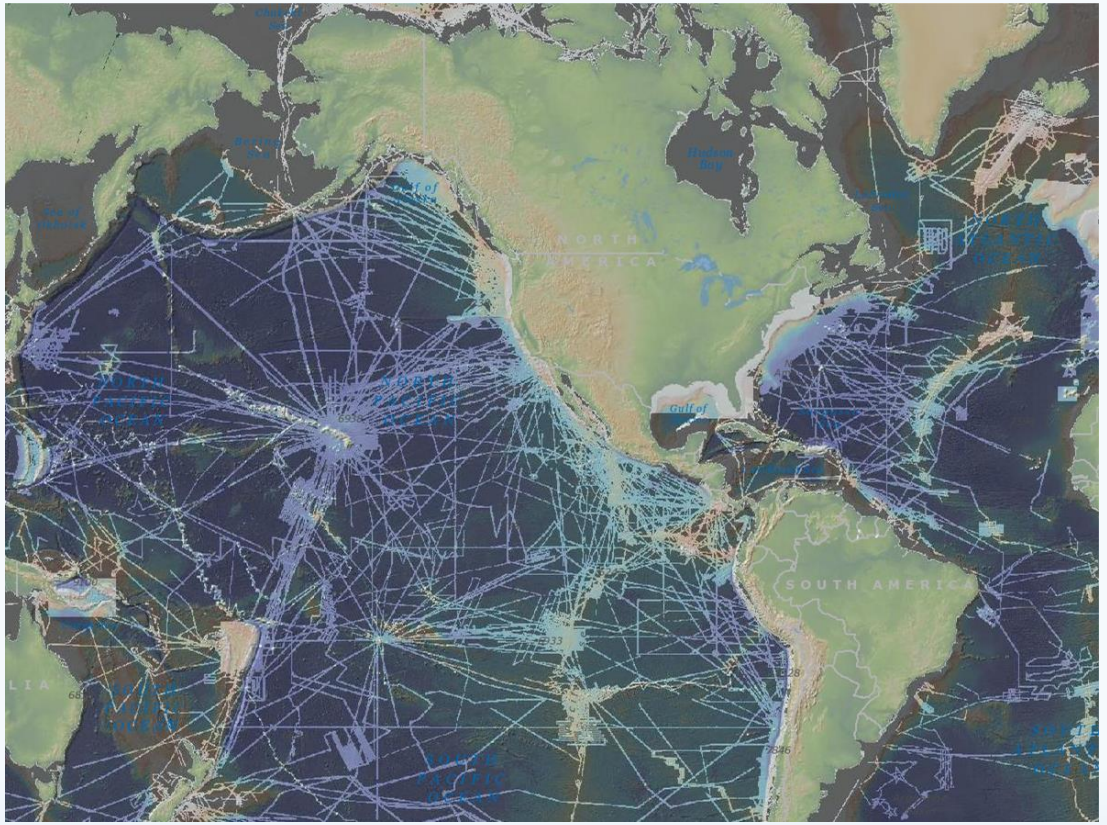


https://maps.ngdc.noaa.gov/viewers/iho_dcdb/

The Role of CSB Data

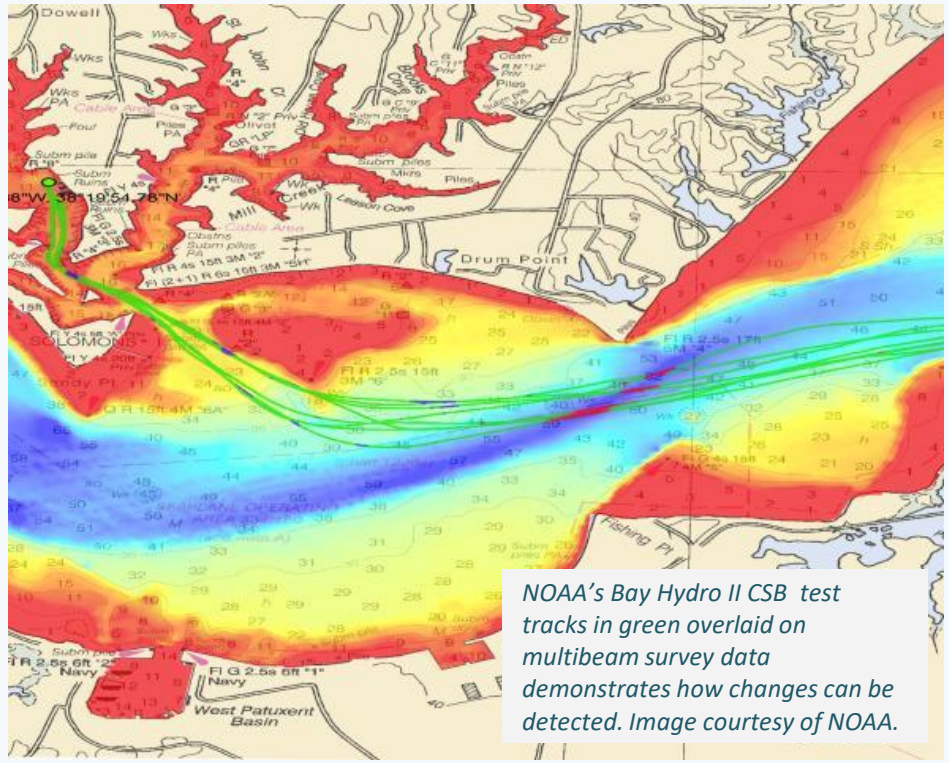
While CSB data may not meet accuracy requirements for charting areas of critical under-keel clearance, it holds limitless potential for myriad other uses.

CSB is a powerful source of information to supplement the more rigorous and scientific bathymetric coverage done by hydrographic offices, industry, and researchers around the world.



The Role of CSB Data

- Support national and regional development activities
- Fill gaps where data is scarce (eg: Arctic, SIDS, open ocean)
- Useful along shallow, complex coastlines that are difficult for traditional survey vessels to access (areas that may be more frequently visited by recreational boaters)
- Identify uncharted features
- Assist in verifying charted information
- Confirm whether charts are appropriate for the latest traffic patterns.

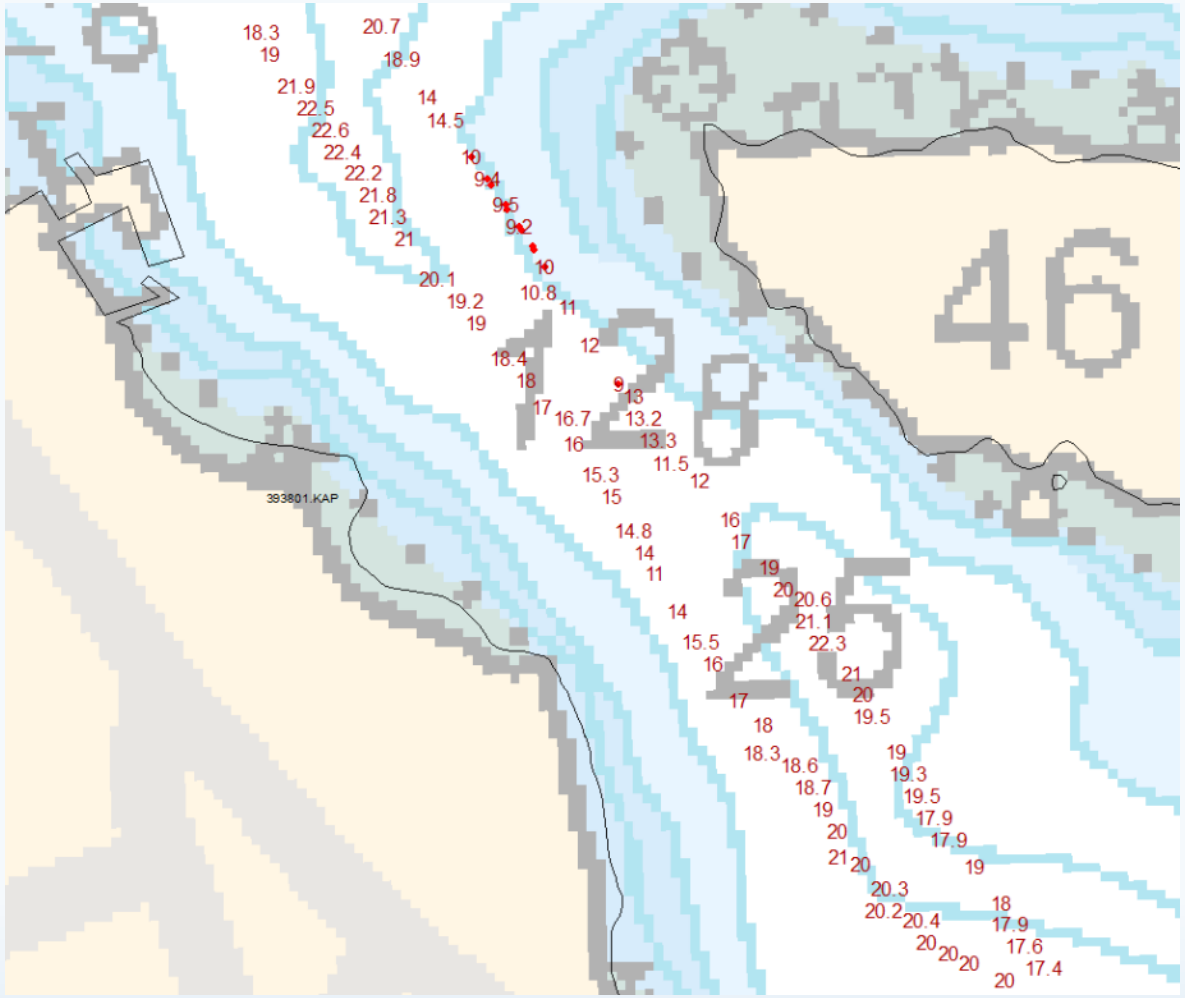


NOAA's Bay Hydro II CSB test tracks in green overlaid on multibeam survey data demonstrates how changes can be detected. Image courtesy of NOAA.

...but only if vessels collect and donate depth information while on passage...

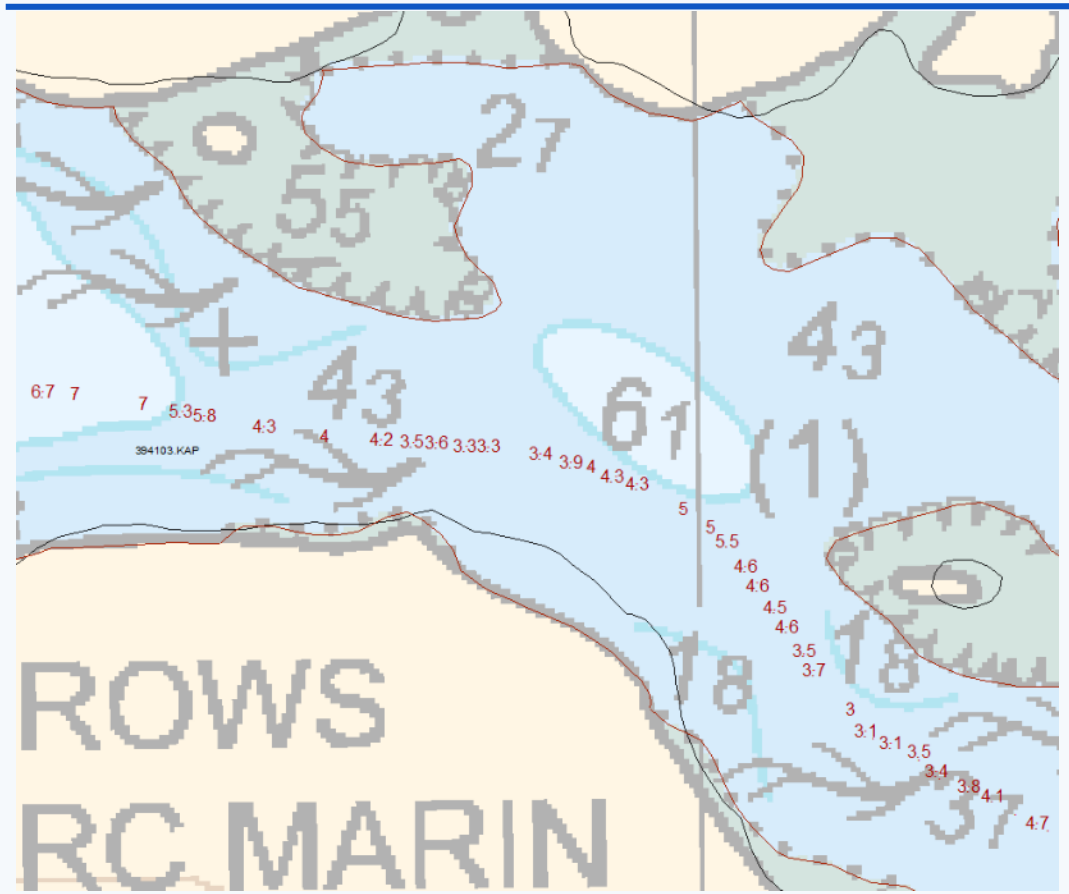
Use Case – CHS Pacific

- CSB data was treated by the Canadian Hydrographic Service Pacific as just another Mariner Report; ISO processes were used accordingly.
- ~4.5 million soundings in British Columbia
- 6 potential Notice to Mariners identified in the waters off British Columbia
- Lots of zero values and values where small vessel sonar lost the bottom in deep water.

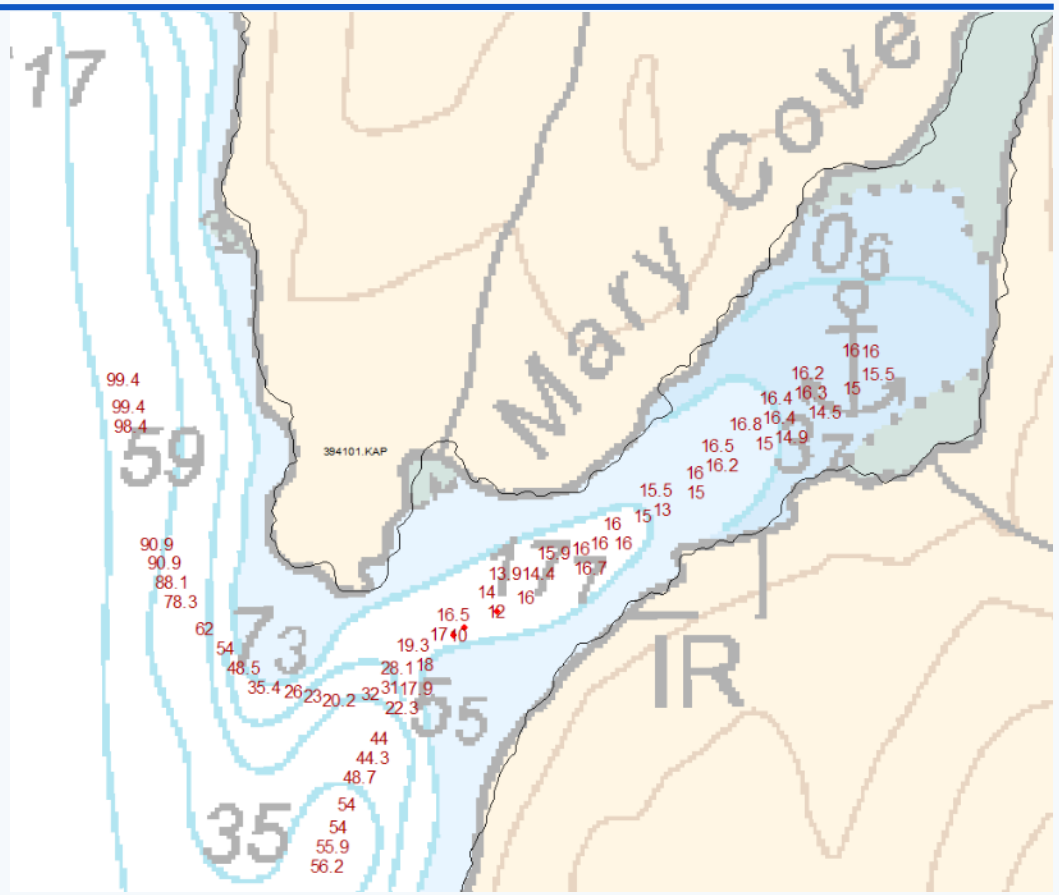


Some CSB agreed with shoaler superseded leadline data and NOT with more recent charted single beam data that met survey specifications at the time. Marked for revisory survey to resolve.

Use Case – CHS Pacific



CSB filled in between systematic line spacing in a narrows giving a better limiting depth.



CSB revealed some chart compilation problems. ***Don't use chart to figure out how much anchor chain you need!***

CSBWG Next Steps

- Increase awareness
- Increase data contributions
- Develop incentives on how and why to become involved in the initiative
- Identify potential uses of CSB data
- Provide guidance on data quality and standards for CSB for potential future use
- Liaise with industry, organizations and IHO bodies involved with and potential uses of CSB data.

"If we got 1% of all seagoing vessels logging data, and on average they spent half their time at sea, then that's about 5 billion data points a day."

- Tim Thornton, TeamSurv

The Nippon Foundation – GEBCO Seabed 2030 Project

April, 2019

GEBCO operates under the joint auspices of the International Hydrographic Organization (IHO) and UNESCO's Intergovernmental Oceanographic Commission (IOC)

Picture Source: Australian Transport Safety

NF-GEBCO Seabed 2030: Mission

- Currently about 9 per cent of our ocean floor is mapped. The project will map the entire seabed by 2030

- Seabed 2030 aims to empower the world to make *policy decisions*, *use the ocean sustainably* and *undertake scientific research* based on detailed bathymetric information of the Earth's seabed

Support the United Nations Sustainable Development Goal 14: to conserve and sustainably use the world's oceans, seas and marine resources

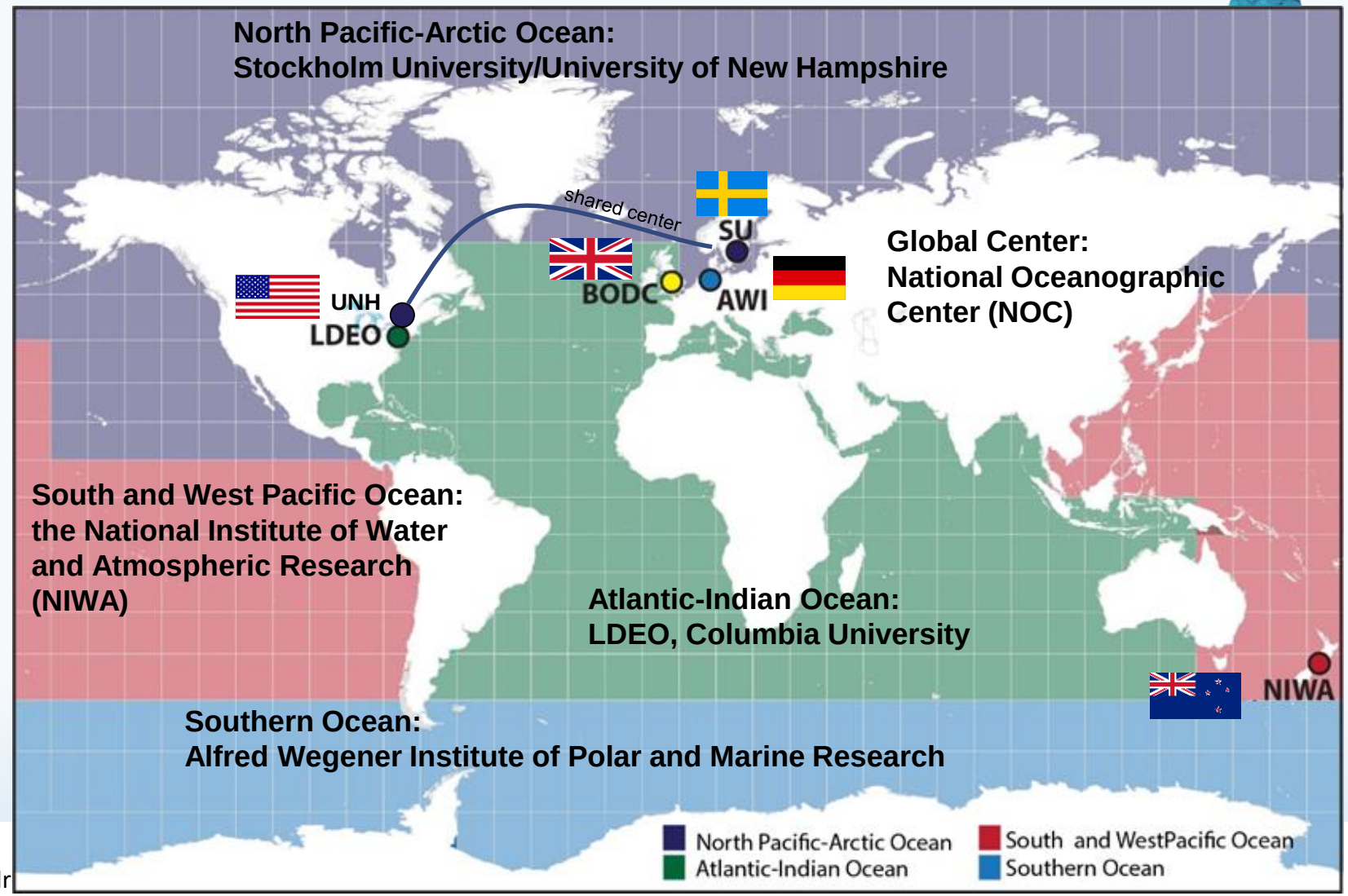
SDG #14 will be impossible to achieve without a comprehensive map of worlds ocean floor

Support the United Nations Decade of Ocean Science for Sustainable Development (2021-2030): Coordinated by the Intergovernmental Oceanographic Commission (IOC) of UNESCO

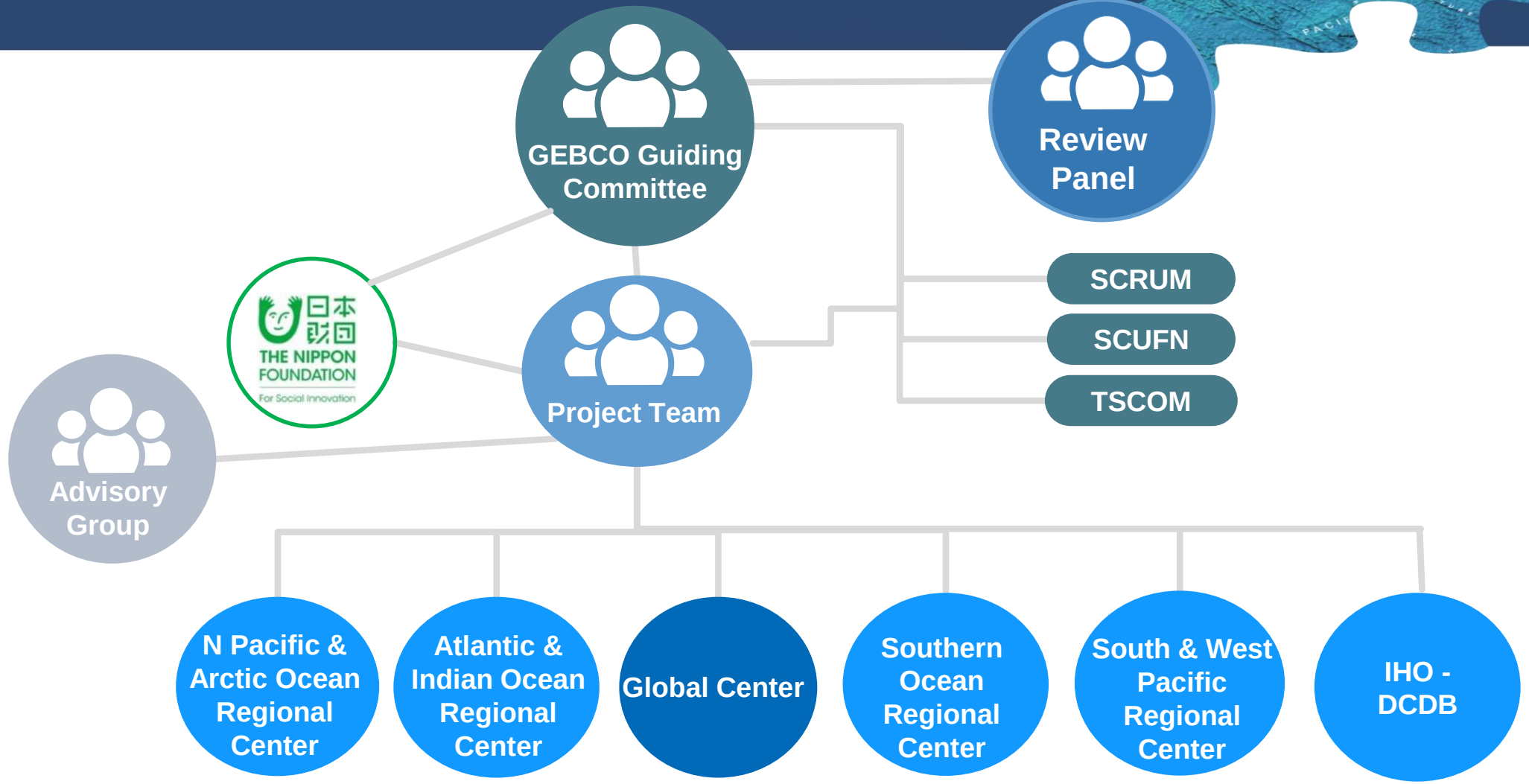
International Hydrographic Organization
Organisation Hydrographique Internationale

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Seabed 2030 - Regional and Global Centres

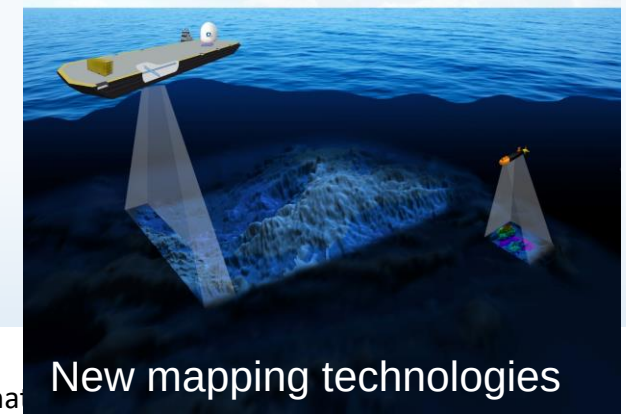


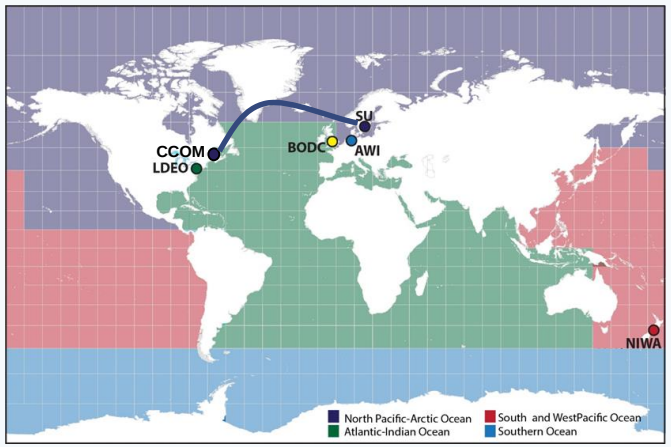
Seabed 2030 Structure



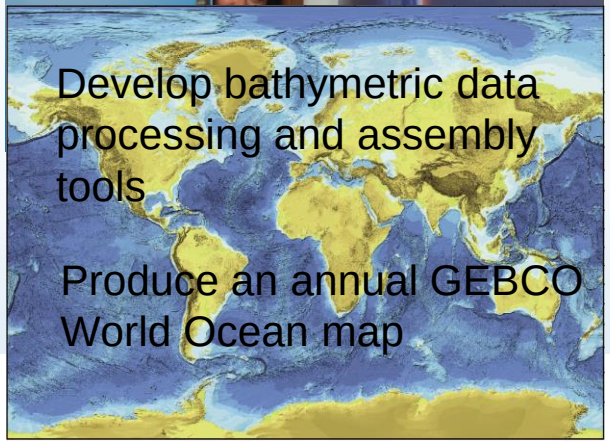
4 Regional Data Assembly & Coordination Centres (RDACC)
1 Global Data Assembly and Coordination Centre (GDACC)
1 International data repository (IHO-DCDB)

What will the centers do?



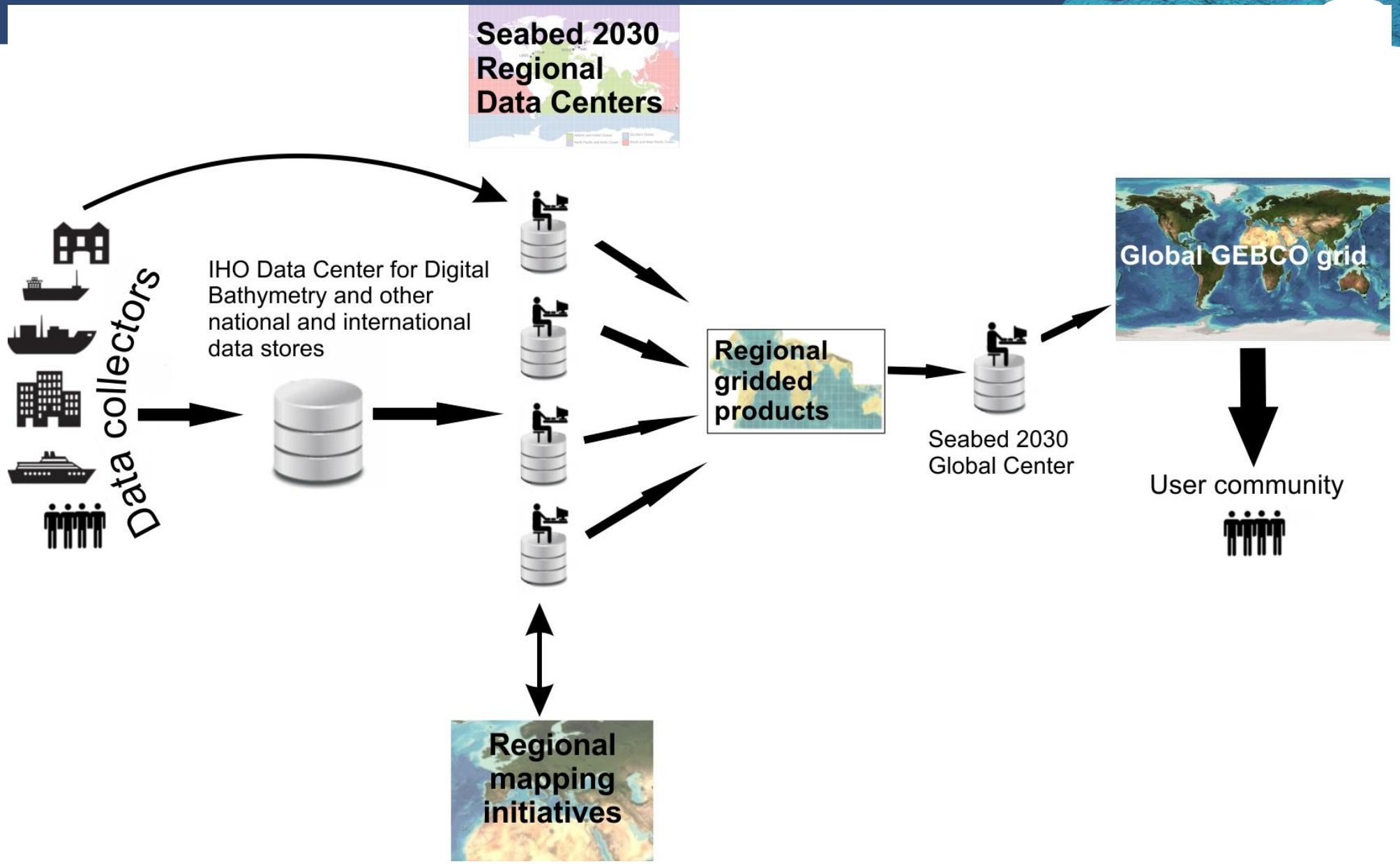


Co-operate and work closely with existing regional mapping initiatives



Internat
Organisation Hydrographique Internationale

Seabed 2030 Work Flow



At what resolution will Seabed 2030 map the ocean floor?

At the best possible resolution within practical limits

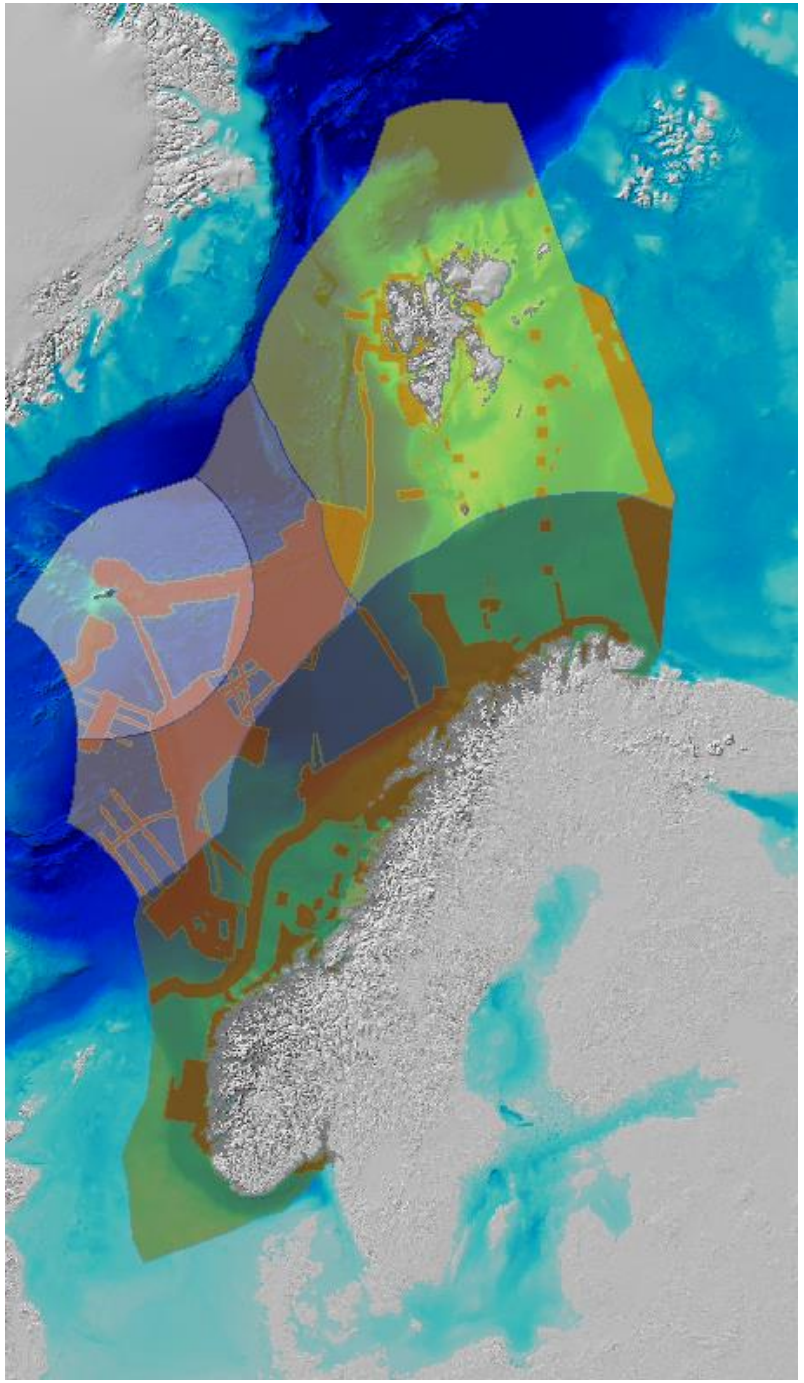
- Gathering bathymetric data gets more difficult as the ocean gets deeper
- An overall minimum requirement for different ocean depths has been set, based on what we can achieve with state-of-the-art multibeam technology

The table below shows the minimum resolutions aimed to be achieved at each depth range by Seabed 2030

Depth Range	Grid-Cell Size	% of World Ocean
0–1500 m	100 × 100 m	13.7
1500–3000 m	200 × 200 m	11
3000–5750 m	400 × 400 m	72.6
5750–11,000 m	800 × 800 m	2.7

Seabed 2030: Status Norway

area	tot_km2	SB_data_km2	missing_km2	coverage_%
Norway	935,635	314,185	621,450	33.6%
Svalbard	805,143	117,014	688,129	14.5%
Jan Mayen	296,493	81,404	215,089	27.5%
International waters	319,706	151,709	167,997	47.5%
total	2,356,977	664,312	1,692,665	28.2%



Kartverket

Four Pillars of Seabed 2030

- **Data Assembly and Coordination**
  - Integrate and process existing data & identify data gaps to inform future mapping missions
  - Promote data sharing by encouraging contribution of data to the IHO DCDB
  - Create new GEBCO data products
- **Global Community Engagement**
  - Identify & engage the GEBCO community as well as other stakeholders through community events, traditional & digital media
- **Consolidate Technical and Human Capacity**
  - Explore and leverage new technology
  - Engage GEBCO Nippon Foundation Training Project Alumni
- **Cross-cutting area of Corporate Governance**
  - Strong stakeholder communication

NF-GEBCO Seabed 2030 Culture

- **Co-operation and Community Building**
- **Coordination**
  - Initial Seabed 2030 focus on > 200 meters water depth
  - Hydrographic Offices concentrate on < 200 meters water depth
- **Crowdsourcing**
  - Fishing boats, cargo, passenger and cruise ships, private yachts…
- **Credit and Attribution**
  - Recognize data contributions, in-kind services, promotion, capacity building.
  - E.g. Recent film with FUGRO