Seabed 2030 & Crowdsourced Bathymetry in the Arctic

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IHO International Hydrographic Organization

THE NIPPON FOUNDATION-GEBCO SEABED 2030

SEABED 2030

A collaborative project between The Nippon Foundation and GEBCO to inspire the complete mapping of the world's ocean by 2030 and to compile all bathymetric data into the freely-available GEBCO Ocean Map.

Forum for Future Ocean Floor Mapping

THE OCEAN CONFERENCE
UNITED NATIONS, NEW YORK, 5-9 JUNE 2017

June 2016

June 2017

THE NIPPON FOUNDATION-GEBCO SEABED 2030

Seabed 2030 Ambassador

- Liaise with appropriate GEBCO Seabed 2030 Regional Data Assembly and Coordination Centres
- Consider traditional hydrographic collection methods as well as others that may apply, including CSB, SDB, scientific data collection, and industry-specific data and serve as a point of contact for other working groups accordingly.
- Report the state of regional ocean mapping efforts, including national statistics (according to Reg. Centre data)
- Lead regional efforts to coordinate potential data collection opportunities, connecting data providers with the appropriate GEBCO Regional Centres.
- Encourage national commitments for data sharing and new data collection.
- Develop joint regional campaign mapping plans for areas outside national jurisdiction.
- Ensure that efforts to collect data for Seabed 2030 are coordinated within the region
- Place a strong emphasis on acknowledging participation from data providers.

Seabed 2030 Phase 2: Mapping the Gaps

$$X + Y + \mathbf{Z} = 100\%$$

- **Ocean Frontier Mapping**
  - Use GEBCO Grid to inform location of future mapping
  - Advocate for greater mapping activity
  - Identify funding for mapping expeditions

- **Crowd Sourced Bathymetry**
  - Promoting CSB around the world
  - Gaining support of, and data from, contributors at all levels

- **Technology Innovation**
  - What can Seabed 2030 do to accelerate uptake of technology to accelerate rate of bathymetric mapping?

GEBCO-NF ALUMNI

Shell OCEAN DISCOVERY XPRIZE

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What we ask of you……

Noting that

- Some 70% of the Earth covered by the ocean, yet today we have mapped only 19% of the ocean floor

- Seabed shape is fundamental not only to safety of navigation but also to many ocean processes that:
  - Drive ocean current circulation, affecting climate & sea level rise predictions.
  - Allow forecasting of tsunami wave propagation & other dynamic phenomena (inc sediment transportation; wave action; & underwater hazards).
  - Allow better understanding of marine habitats, eco-systems and much more
  - Offer opportunities for new discoveries …….

Please …

THE NIPPON FOUNDATION-GEBCO SEABED 2030

What we ask of you……

Please join us in supporting Seabed 2030 by:

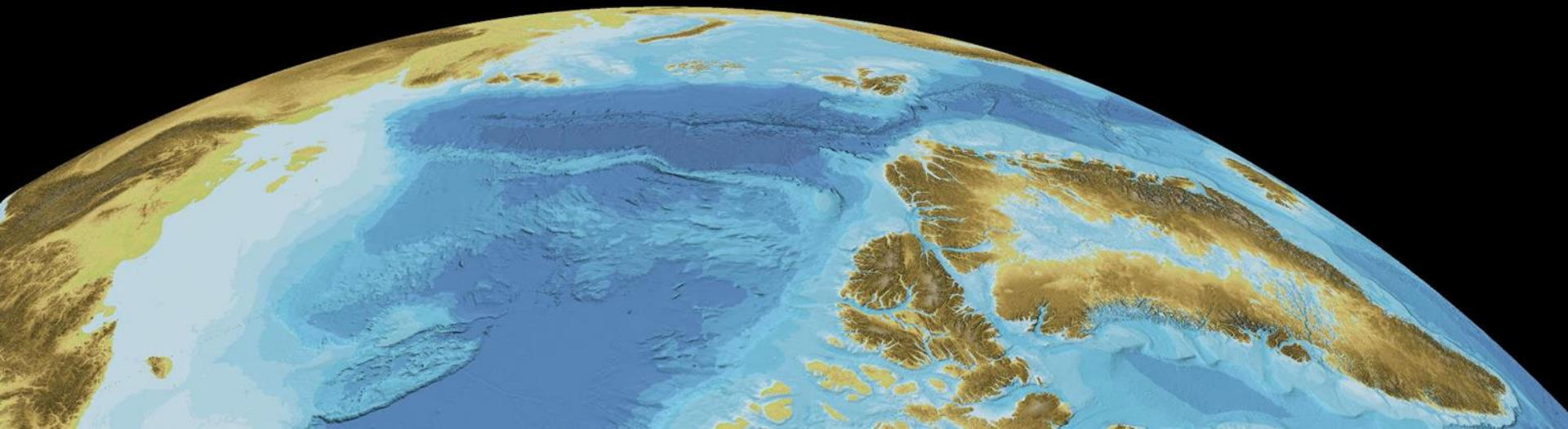
- ***Promoting*** the vital need to map the entire seabed
- ***Encouraging*** your own organisations and clients to make existing seabed mapping data available for use by Seabed 2030 in the GEBCO Grid
    - *Non commercially sensitive/sanitised data if possible*
    - *Transit data between projects*
    - **seabed2030.org/contributions**
- ***Helping*** us gather Crowd Sourced Bathymetry (CSB) for use by Seabed 2030 in the GEBCO Grid
- ***Supporting*** future seabed mapping projects where data can be used by Seabed 2030 in the GEBCO Grid
- ***Innovating*** technology that will accelerate seabed mapping

THE NIPPON FOUNDATION-GEBCO SEABED 2030

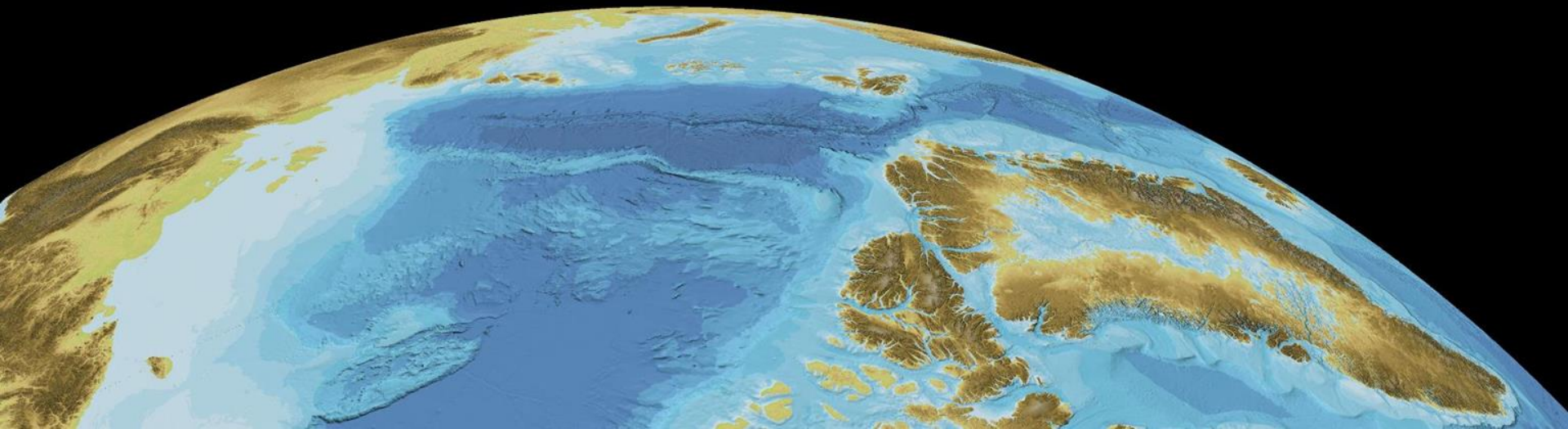
IBCAO 4.0

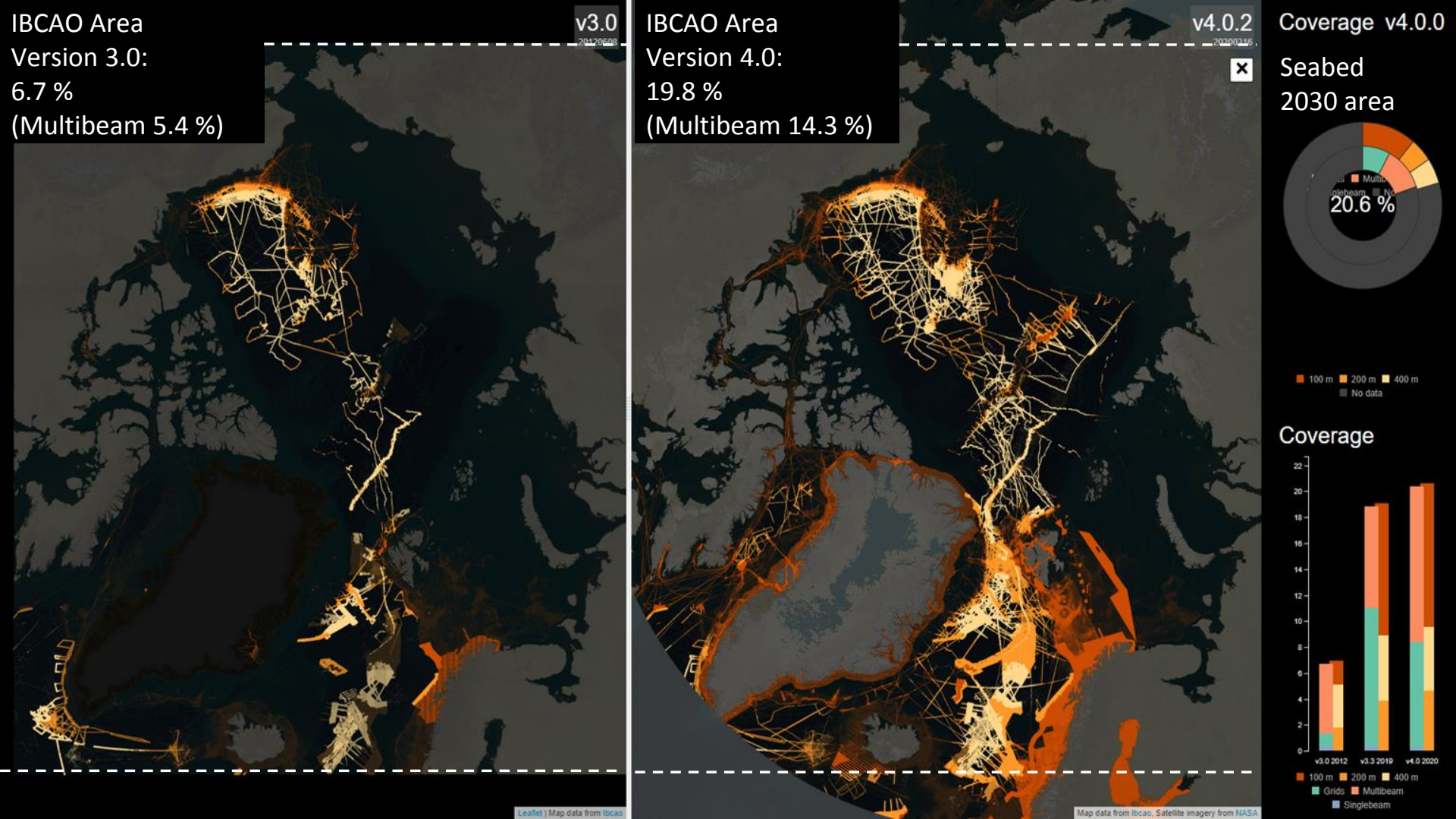
Status, gap analyses and plans ahead

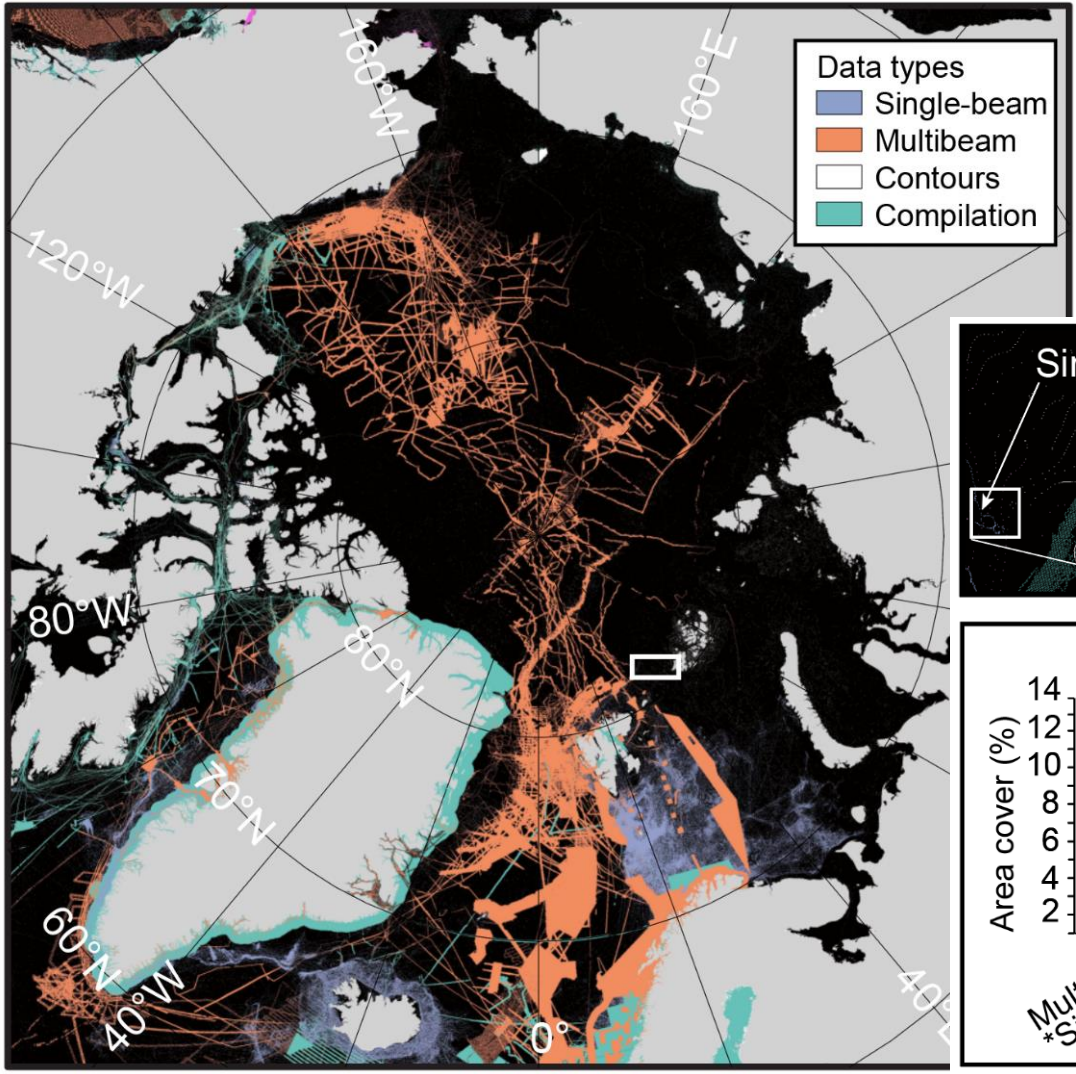
Presented by:
Martin Jakobsson on behalf of Larry Mayer, Caroline Bringensparr, Carlos Castro, Rezwan Mohammad, Paul Johnsson and Tomer Ketter,



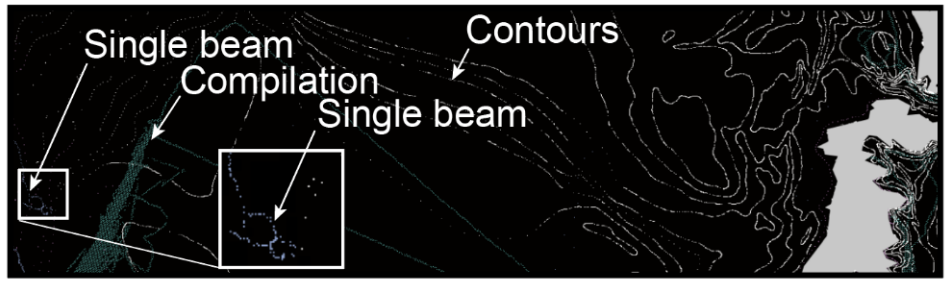
IBCAO 4.0
A crude gap analysis

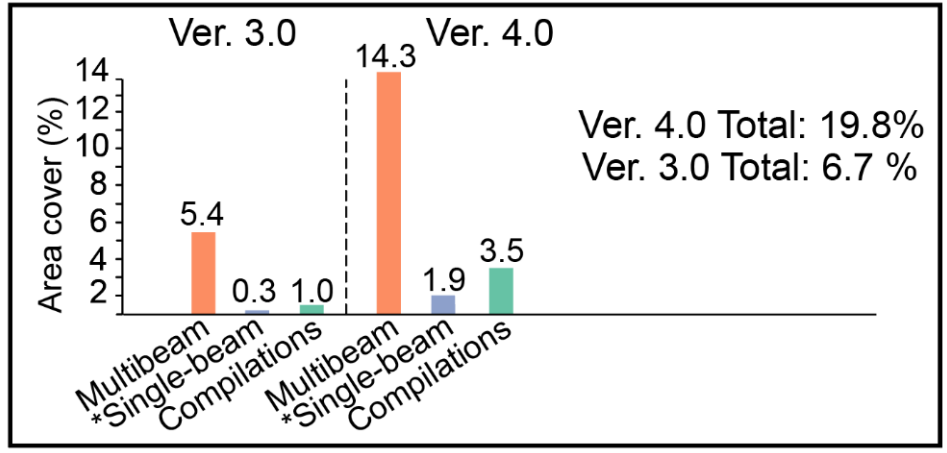



IBCAO Area
Version 3.0:
6.7 %
(Multibeam 5.4 %)
v3.0
IBCAO Area
Version 4.0:
19.8 %
(Multibeam 14.3 %)
v4.0.2
Coverage v4.0.0
Seabed
2030 area
20.6 %
100 m
200 m
400 m
No data
Coverage
v3.0 2012
v3.3 2019
v4.0 2020
Grids
Multibeam
Singlebeam
Leaflet | Map data from Ibcao
Map data from Ibcao, Satellite imagery from NASA

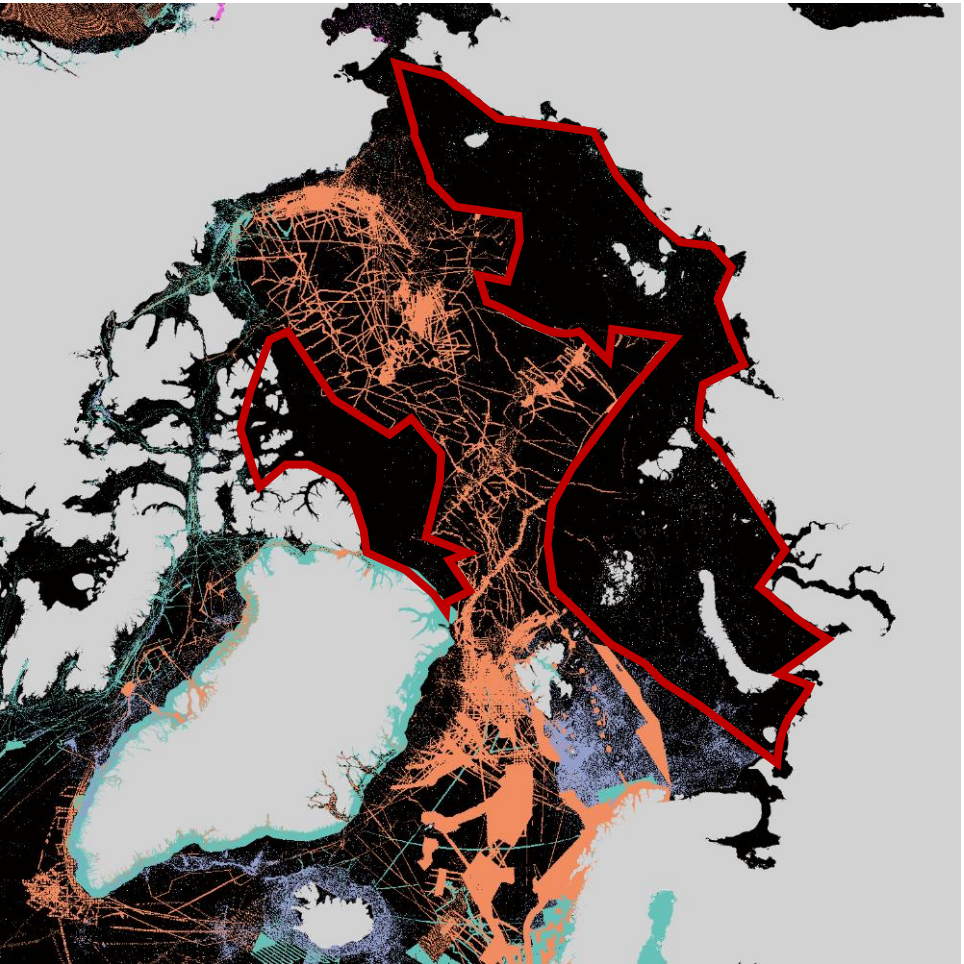


Jakobsson, M., Mayer, L. A., Bringensparr, C., Castro, C. F., Mohammad, R., Johnson, P., Ketter, T., Accettella, D., Amblas, D., An, L., Arndt, J. E., Canals, M., Casamor, J. L., Chauché, N., Coakley, B., Danielson, S., Demarte, M., Dickson, M.-L., Dorschel, B., Dowdeswell, J. A., Dreutter, S., Fremand, A. C., Gallant, D., Hall, J. K., Hehemann, L., Hodnesdal, H., Hong, J., Ivaldi, R., Kane, E., Klaucke, I., Krawczyk, D. W., Kristoffersen, Y., Kuipers, B. R., Millan, R., Masetti, G., Morlighem, M., Noormets, R., Prescott, M. M., Rebesco, M., Rignot, E., Semiletov, I., Tate, A. J., Travaglini, P., Velicogna, I., Weatherall, P., Weinrebe, W., Willis, J. K., Wood, M., Zarayskaya, Y., Zhang, T., Zimmermann, M., and





Data Type Identification Map (TID)

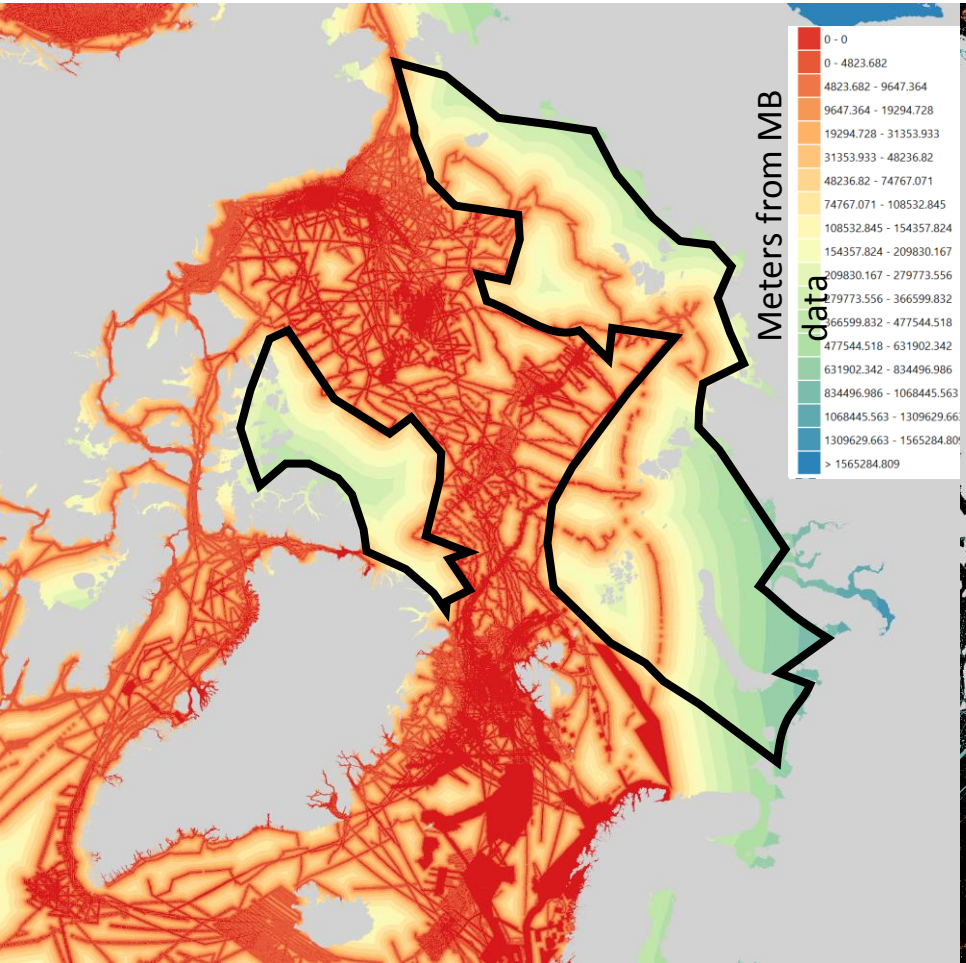


The first order crude visual approach of identifying main data gaps

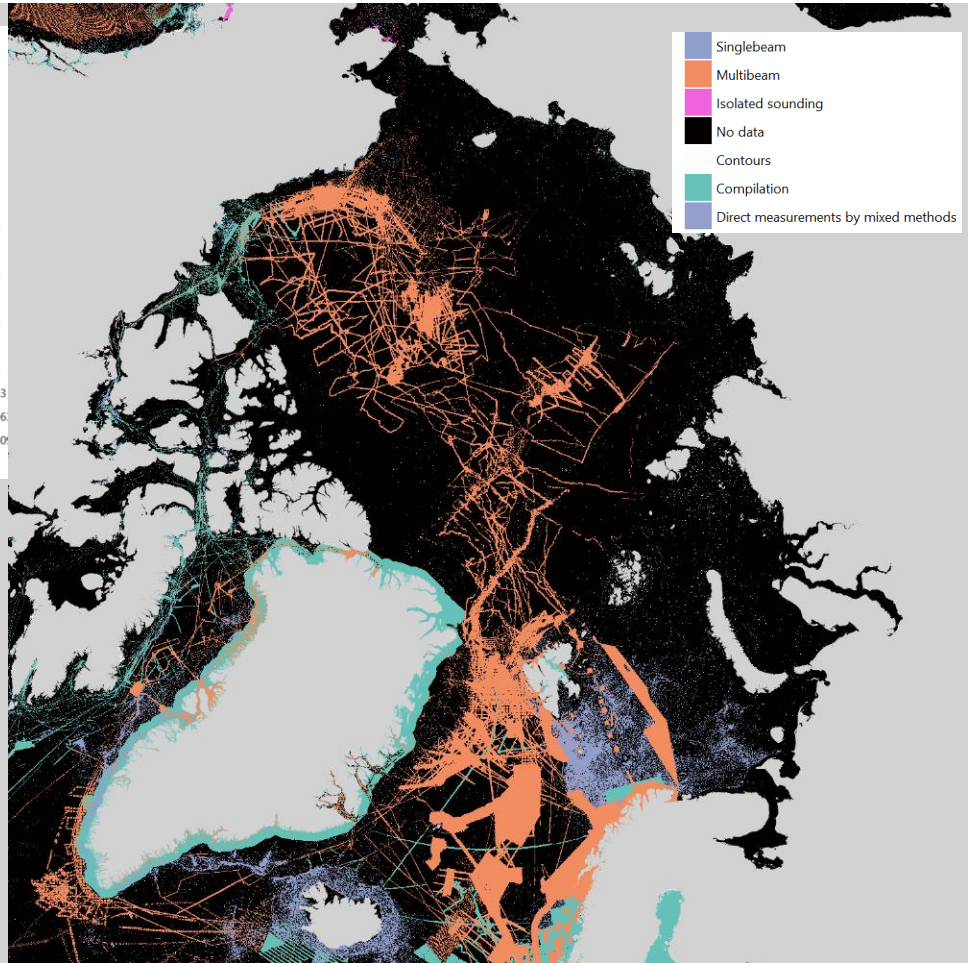
Do we get an accurate view?

- Singlebeam
- Multibeam
- Isolated sounding
- No data
- Contours
- Compilation
- Direct measurements by mixed methods

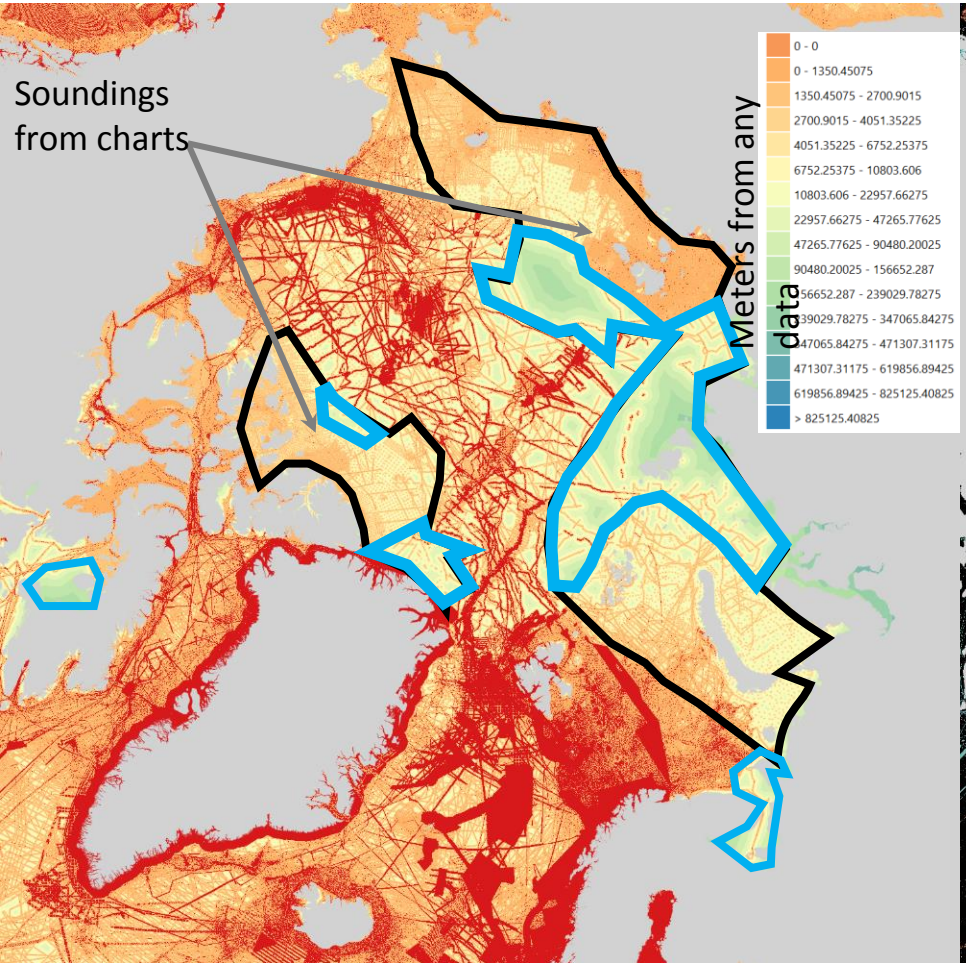
Distance in meters from multibeam data (TID=11)



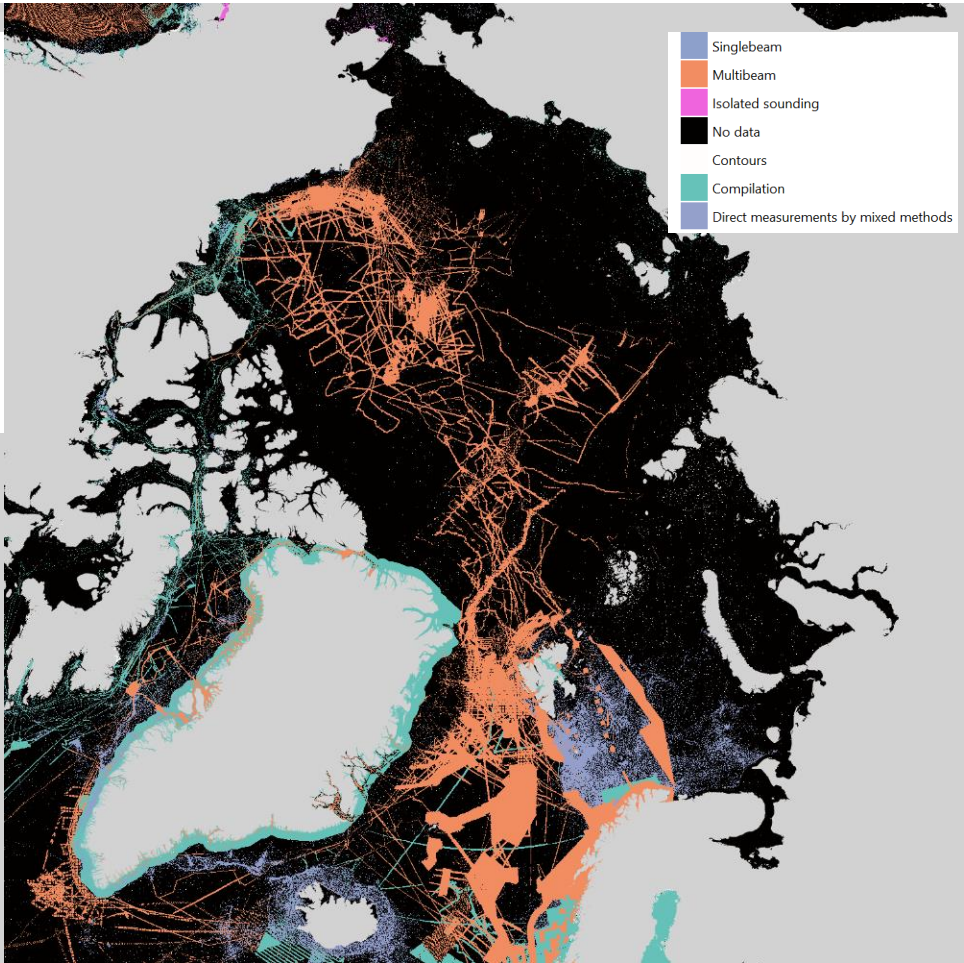
Type Identification grid (TID)



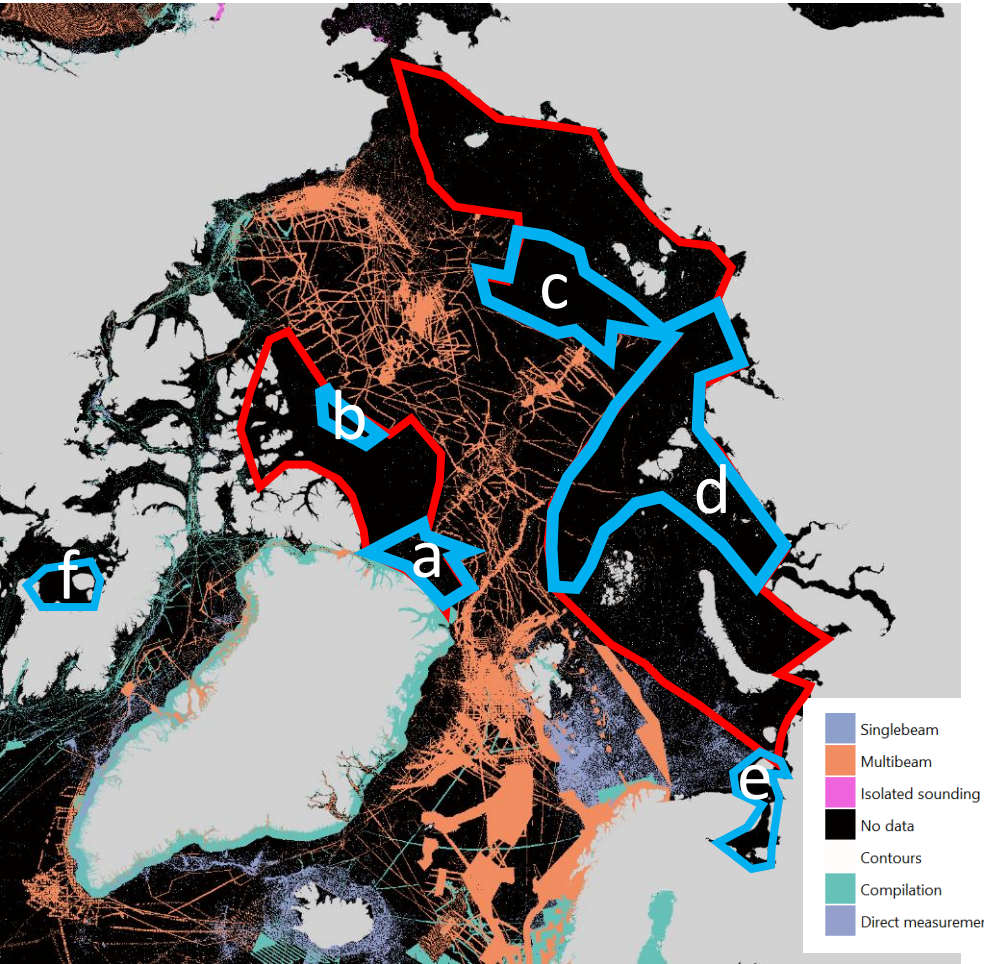
Distance in meters from any data point



Type Identification grid (TID)



Data Type Identification Map (TID)



Conclusions of gap analysis

1. **Ca 80 % left to map!**
2. **Least data constrained areas in IBCAO 4.0: a) North of Greenland, b) North of the Canadian Arctic Archipelago, c) East Siberian-Laptev-Kara seas' outer margins and slopes, c) Kara sea (based on contours with unknown underlying data), e) White Sea, f) Around Prince Charles Island**
3. **To fulfil the Seabed 2030 target resolution criteria, multibeam bathymetry and some areas of crowd sourced bathymetry (Olex) are high-resolution enough to meet the criteria.**
4. **Provided compilations are key to IBCAO, but difficult to handle in a gap analysis if the location and type of underlying data points not are made available. <u>Can TIDs be provided for future releases?</u>**

IBCAO 4.0
Way ahead

- Collaboration between all; industry, nations, scientific communities……
- Always collect mapping data during expeditions
- Crowd source bathymetry; initiate new campaigns
- Extending mapping of the remote areas; new campaigns and innovative approaches

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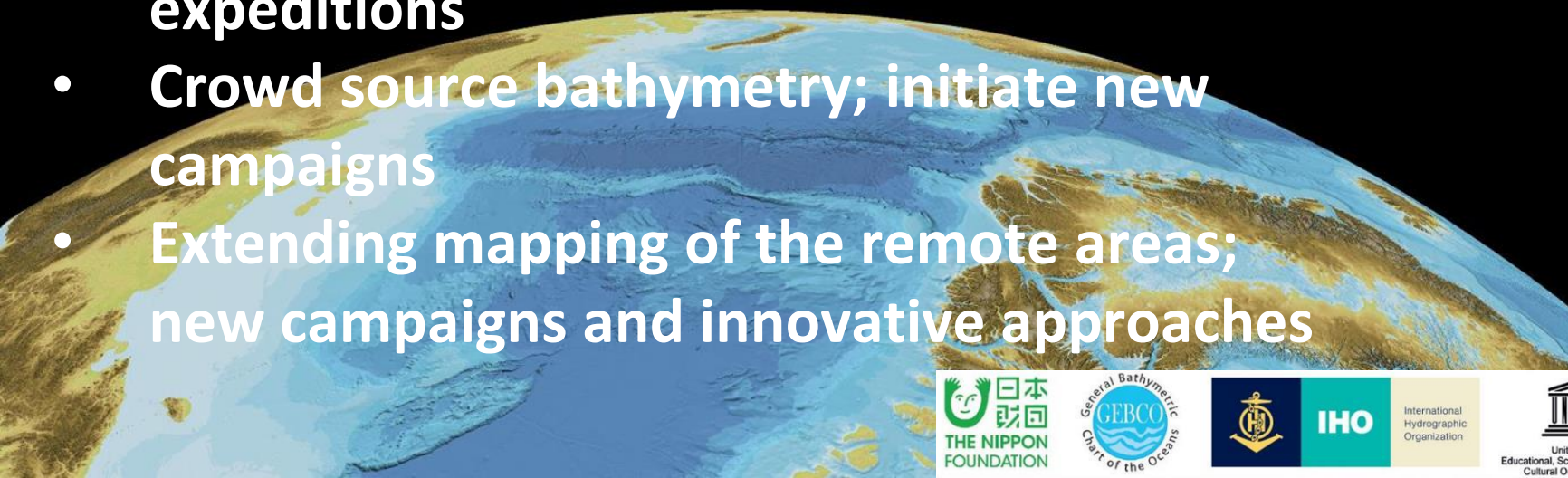


THE NIPPON FOUNDATION · GEBCO General Bathymetric Chart of the Oceans · IHO International Hydrographic Organization · UNESCO United Nations Educational, Scientific and Cultural Organization · Intergovernmental Oceanographic Commission

IHO Crowdsourced Bathymetry Initiative

In 2014, the International Hydrographic Organization (IHO) initiated a collaborative project to enable mariners to collect “crowdsourced bathymetry”.

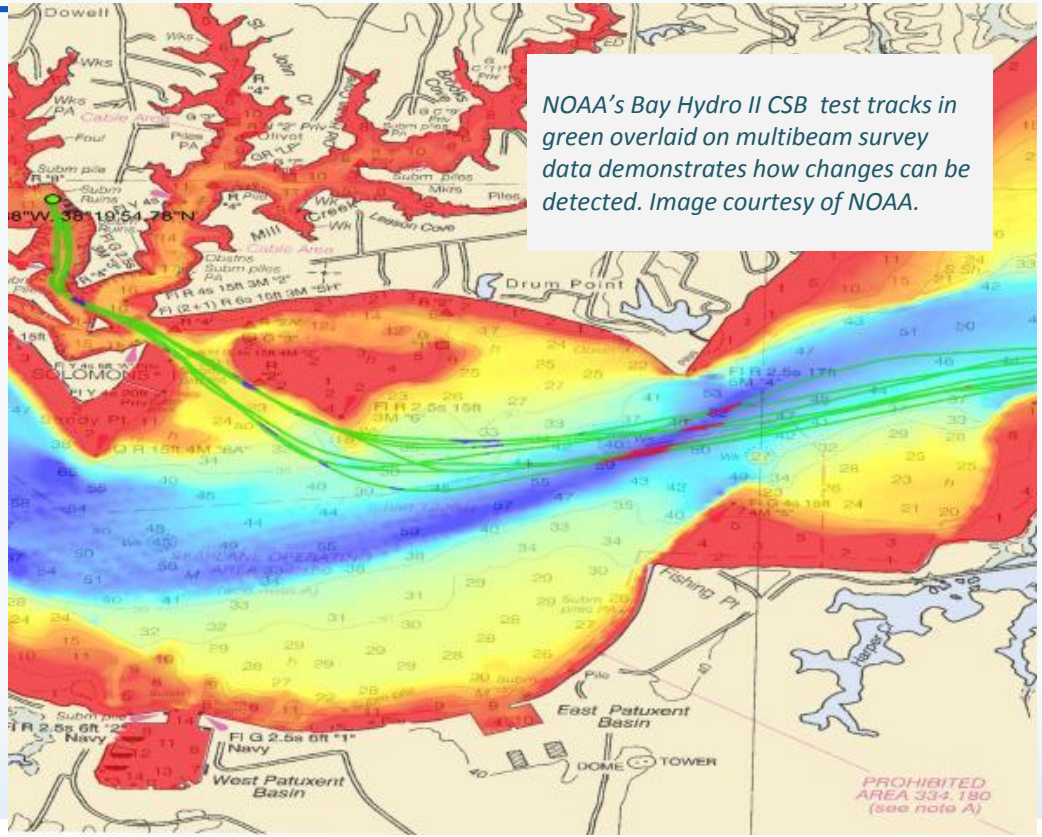
Crowdsourced bathymetry (CSB) is the collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations.

A Working Group was formed and tasked to develop ***B-12 IHO Guidance on Crowdsourced Bathymetry*** that states the IHO’s policy towards, and best practices for, the collection and contribution of CSB.

IHO DCDB built a data pipeline that allows the public to contribute, and discover and download CSB data via a web-based map viewer interface.

The Value of CSB Data

- Data with scientific, commercial & research value at **no cost** to the public sector
- Fill gaps where data is scarce (eg: Arctic, SIDS)
- Useful along shallow, complex coastlines
- Identify uncharted features
- Assist in verifying charted information
- Confirm whether charts are appropriate for the latest traffic patterns.

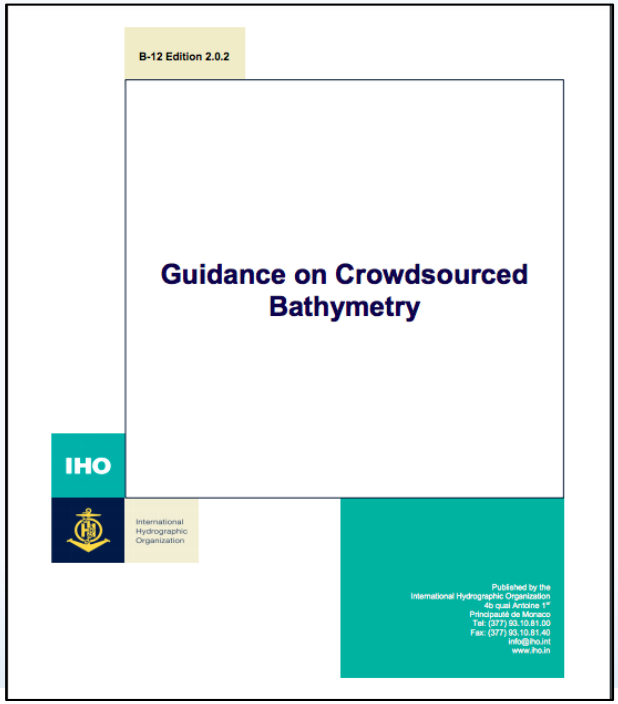


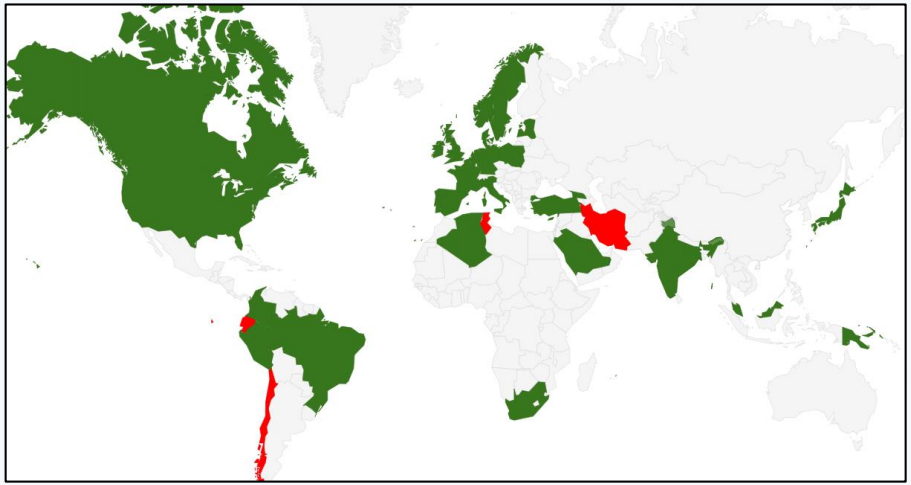
NOAA's Bay Hydro II CSB test tracks in green overlaid on multibeam survey data demonstrates how changes can be detected. Image courtesy of NOAA.

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

IHO CL 11/2019

“CALL FOR APPROVAL OF EDITION 2.0.0 OF IHO PUBLICATION B-12”





35 Member States approved the adoption of B-12 out of 38 replies.

IHO CL 11/2019 **Annex B**

"ACCEPTANCE OF CROWDSOURCED BATHYMETRY ACTIVITIES IN NATIONAL WATERS OF JURISDICTION"

- 15 IHO MS replied "positive"
  - CL 47/2019 provides a summary analysis of positive responses (Canada not listed) **==>**
- The DCDB will filter out CSB data collected from the waters of all coastal countries not included on the positive list.
- The initial results showed two things:
  - The CL ask was not clear
  - There is a lot of work to do to convince nations of the value and importance of CSB

Summary analysis of positive responses

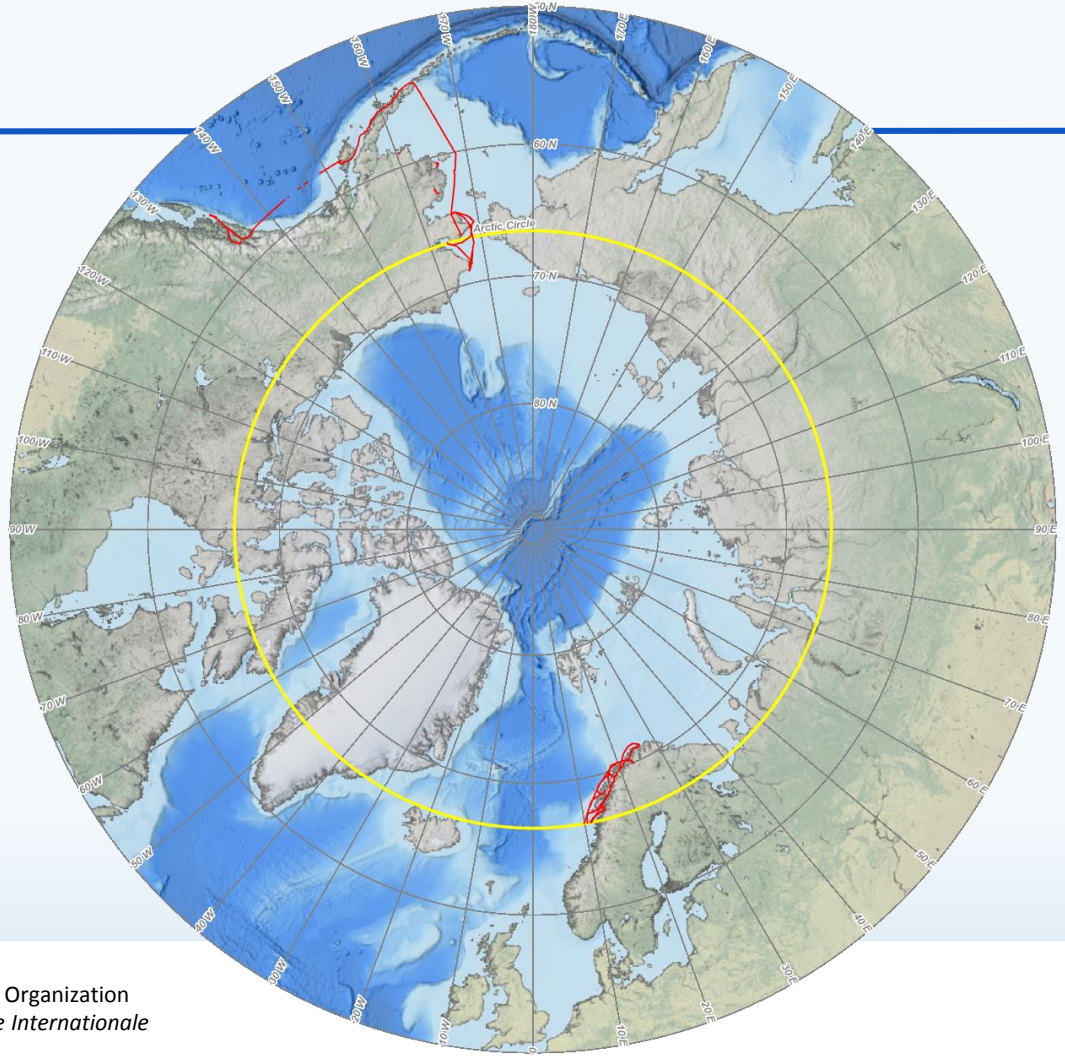
1. Based on the comments received to the questionnaire in Annex B to IHO CL 11/2019, the following table will be published as the Positive List to guide potential data gathering activities undertaken by the wider maritime community in waters of national jurisdiction:

Member State	Area	Specific actions required
Argentina	EEZ only	Provide copy of dataset to Hydrographic Office
Brazil	EEZ only	Provide copy of dataset to Hydrographic Office
Cyprus	All waters	Provide copy of dataset to Hydrographic Office
Denmark	All waters	Inform Hydrographic Office of any variance with published chart
Georgia	All waters	Provide copy of dataset to Hydrographic Office
Germany	All waters	Inform Hydrographic Office of new dataset
Monaco	All waters	Provide copy of dataset to Hydrographic Office
Netherlands	All waters	Inform Hydrographic Office of new dataset
New Zealand	All waters	Inform Hydrographic Office of new dataset
Norway	All waters – no multibeam activity without prior permission	Inform Hydrographic Office of new dataset
Philippines	Shipping routes and transit passages only	None
South Africa	EEZ only	Provide copy of dataset to Hydrographic Office
Sweden	EEZ only	Inform Hydrographic Office of new dataset
USA	All waters	None

IHO CL ***21/2020***

"...the IHO Secretariat...has revised the original questionnaire to simplify and clarify the information requested. Member States are requested to indicate their position on the ***provision of CSB data from ships within waters subject to their national jurisdiction into the public domain*** *as well as highlighting, via the questionnaire provided in the Enclosure, any caveats they wish to apply to such provision."*

The IHO encourages member states to review CL 21/2020 and, if possible, offer a positive response by the requested deadline of 4 September.


Arctic Circle
60°N
70°N
80°N
90°W
90°E

CSB Contributors

Rose Point Navigation System

- Mariners can enable their electronic charting system log file to record *position, depth, and time*.
- When a mariner updates their software or chart catalog, data is transmitted to the DCDB

www.pcmaritime.com

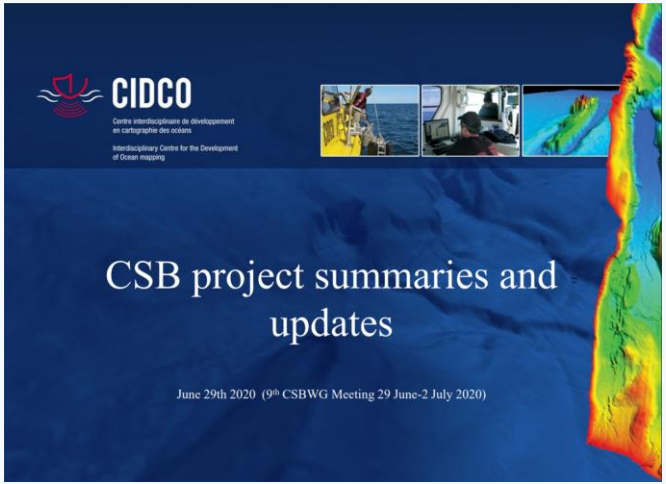
www.rosepointnav.com

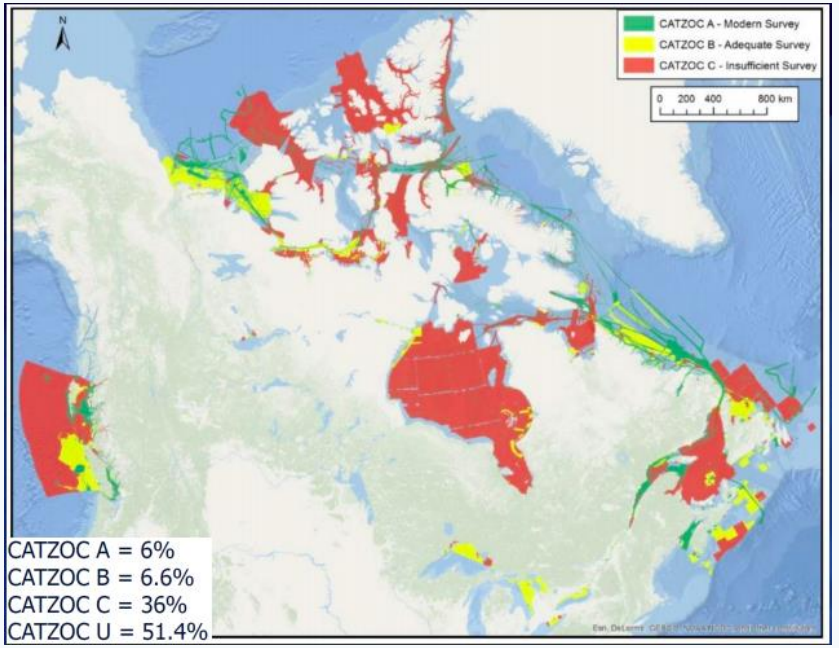
MacGregor/Carnival Cruise Line

- Voyage Data Recorders (VDR) are a mandated device for effectively all ships on international voyages.
- By default, this device is logging depth sounding data for IMO mandated shipborne single beam devices.

Voyage Data Recorder

CSB in Northern Canada - CIDCO





About 47% of the 4.4 million km2 of the Canadian Arctic is underwater and only 10% of these waters are adequately surveyed.

Seabed 2030-funded CSB Field Trials

Objective:

1. Facilitate field trials that will accelerate CSB activity
2. Collect data in data scarce areas
3. Grow excitement about the CSB initiative
4. Develop a repeatable regional CSB mapping project strategy

In return, a potential program must guarantee the provision of staff to:

1. Hand out data loggers to the community
2. Assist local mariners in set up
3. Act as a data assembly center
4. Provide a copy of these data to the IHO DCDB to be used in the GEBCO grid

Seabed 2030-funded CSB Field Trials

The Institute For Maritime Technology & The South African Navy Hydrographic Office

- Most loggers have arrived (supply chain delays due to sourcing components post COVID)
- Testing to begin soon
- Data receipt expected in mid 2021

Bureau of Marine Transportation - Palau

- Loggers en route

Provision of data loggers

- NMEA0183 and NMEA2000
- Installation support (where needed)

Seabed 2030-funded CSB Field Trials

Collaboratory Mapping Greenland (CMG) - as Greenland Institute of Natural Resources

- Aim is to provide depth data acquired through collaboration between local communities.
- Data collection will be done through on-ship engagement across Greenland:
  - >50 fishing vessels of various sizes
  - >10 transport vessels
  - numerous small boats.
- 30 loggers en route

IHO CSB Working Group

- **9 meetings; 1 Industry workshop**
- Chair (Jennifer Jencks, USA) and Vice-Chair (Marta Pratellesi, Italy)
- **Representatives from 14 Member States:**
  - *Canada, Croatia, Italy, Nigeria, Norway, Philippines, Denmark, Finland, France, Germany, India, Netherlands, Portugal, UK, & USA*
- **Observers and expert contributors:**
  - *CCOM-JHC, ChartWorld/SevenC's, CIDCO, Da Gamma Maritime Ltd, Dongseo U, ECC AS, ESRI, FarSounder, FLIR Systems AB, Fugro, GMATEK, Inc., James Cook U, JAMSTEC, Navico/C-Map, ONE Data Tech Co., Olex, PYA, Seabed 2030,TeamSurv, Teledyne CARIS, Sea-ID, World Maritime University, and World Ocean Council*
- **IHO:** Assistant Director David Wyatt

CSBWG2: 10-11 Jan 2016
Boulder, Colorado, USA

CWBWG8:23-25 Oct 2019
Monaco

Norwegian Hydrographic Service to host CSBWG10 and CSB Industry Forum in Stavanger, 12-16 April 2021

CROWDSOURCED BATHYMETRY

DATA COLLECTION, PROVIDER & USER COMMUNITIES

COMMERCIAL

- Shipping
- Submarine Cable
- Energy
  - Seabed Mining
  - Geophysical Industry
- Fishing
- Cruise Ships
- Yachting
- Maritime legal, insurance, investment companies

NON-COMMERCIAL

- Recreational boating
- Recreational fishing
- Vessel operators
- NGOs

SOFTWARE COMPANIES

- Rosepoint
- CARIS
- Garmin/ActiveCaptain
- Navionics
- NobelTec/Time Zero

ACADEMIC & RESEARCH COMMUNITIES

INDIGENOUS COMMUNITIES

HARDWARE COMPANIES

- Sea-ID
- FarSounder
- GMATek
- Garmin
- WASSP

IHO

- Hydrographic Offices
- IHO Working Groups

GOVERNMENT VESSELS

- Coast Guard

TRAINING ORGANIZATIONS

- Warsash

COMMERCIAL CROWDSOURCE COMPANIES

- Olex
- TeamSurv

PRODUCT GENERATORS

- SevenCs

OBSERVATION COMMUNITIES

- Voluntary Observing Systems (VOS)

CSB/Seabed 2030 Ambassador

The CSBWG has submitted a paper to the IRCC requesting:

“Support for the modification of the current “RHC Seabed 2030 Ambassador” to a joint “RHC CSB/Seabed 2030 Ambassador.”

This figure would also serve as a member of the IHO CSBWG and as the point of contact to the relevant Seabed 2030 regional centers and be charged with leading the discussion of the future tasks for RHCs that will be formalized with the new IHO Strategic Plan (to be discussed during A-2).”

CSB/Seabed 2030 Ambassador

- Liaise with appropriate GEBCO Seabed 2030 Regional Data Assembly and Coordination Centres
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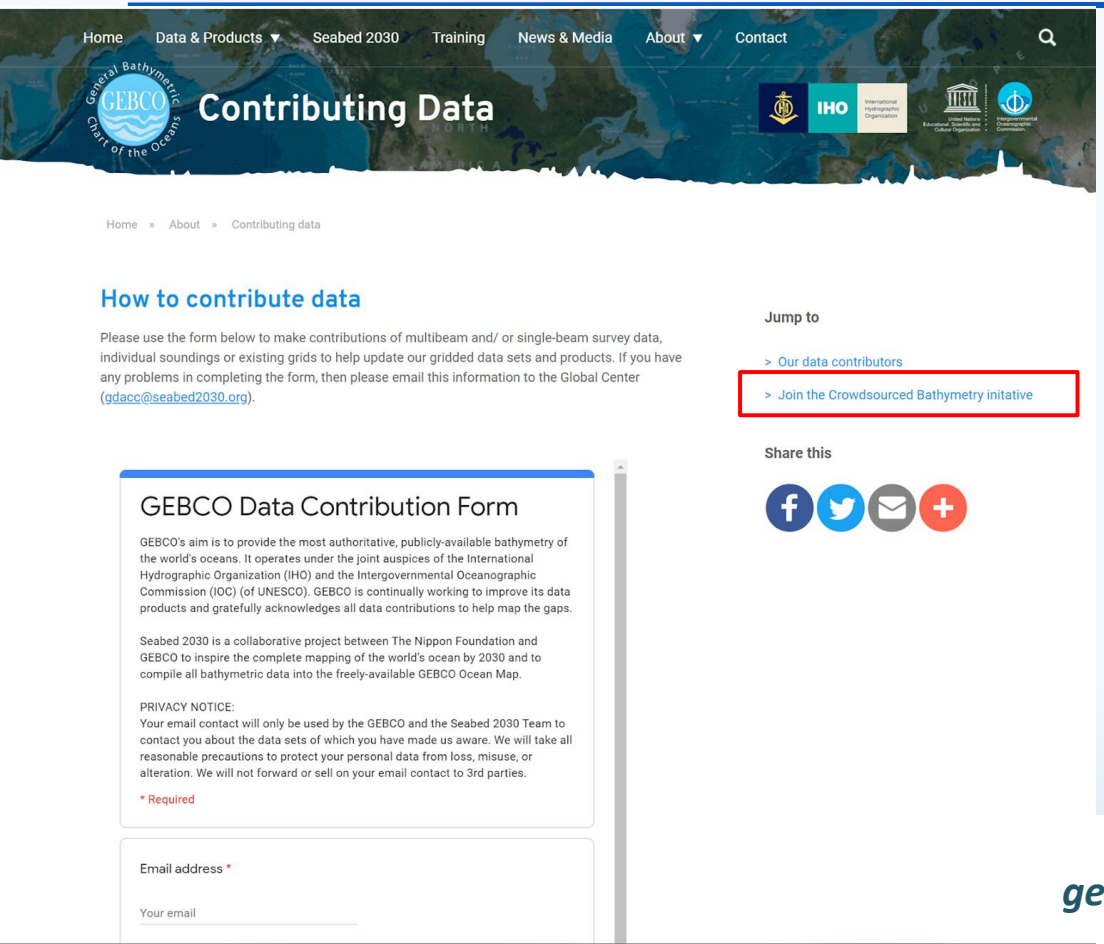
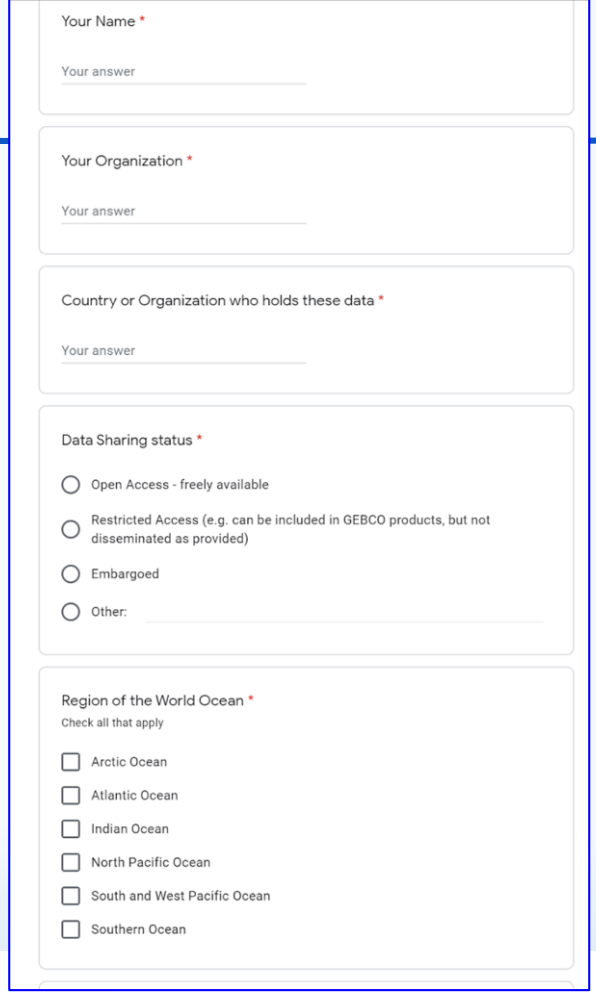
How to Contribute Data





gebco.net/about_us/contributing_data/

Thank you

Evert Flier
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