Report of the Crowdsourced Bathymetry Working Group

Submitted by:	Director of the DCDB
Related Documents:	IHO CL23-1990 on Establishment of the DCDB
Related Projects:	IHO CSB Initiative, NF-GEBCO Seabed 2030 Project

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1. Meetings Held During Reporting Period

N/A

2. Work Programme

The IHO Data Centre for Digital Bathymetry was established in 1990 to steward the worldwide collection of bathymetric data. The Centre archives and shares, freely and without restrictions, depth data contributed by mariners. Data can be discovered and accessed from the IHO DCDB Data Viewer: maps.ngdc.noaa.gov/viewers/iho_dcdb/

The IHO DCDB is hosted by the U.S. National Oceanic and Atmospheric Administration (NOAA) on behalf of the IHO Member States.

As a result of the National Oceanic and Atmospheric Administration (NOAA) Data Center restructuring and consolidation in 2015, the IHO DCDB is now hosted and maintained by the National Centers for Environmental Information (NCEI), which means that the previous agreement with NOAA is out of date and needs to be revised to reflect the current structure. The current version of the draft revised ToRs are submitted as Annex A.

DCDB Data Holdings
Since establishment, the quantity of data archived in the DCDB has grown considerably both in area coverage and size, particularly in the last decade with the addition of multibeam echo sounder (MBES) data. Today, the DCDB archives over 60 terabytes (TB) of uncompressed oceanic soundings acquired by hydrographic, oceanographic and other vessels during surveys or while on passage. This includes about 3550 multibeam bathymetry surveys, approximately 5500 singlebeam bathymetry surveys, and nearly 200 unique contributing vessels in support of the IHO Crowdsourced Bathymetry (CSB) initiative.

DCDB data holdings are routinely used for the production of improved and more comprehensive bathymetric maps and grids, particularly in support of the GEBCO Ocean Mapping Programme and the Nippon Foundation-GEBCO Seabed 2030 project. The Seabed 2030 project has created a global drive to search out new datasets to be added to the currently available bathymetry and the IHO DCDB has been identified as the preferred archive and GEBCO grid. The publication of the 15 arc second GEBCO_2020 grid included 14.5 million square kilometres of new bathymetric data with coverage of the seabed increasing from 15% to 19% since 2019.

The largest data providers to the DCDB continue to be the U.S. Academic Research Fleet (ARF) and the NOAA fleet with 140 and 21 surveys, respectively, archived in 2020. Additional significant data contributions to the DCDB in 2020 include:

- Fugro - 35 surveys
- IFREMER – 1 survey
- GEOMAR – 2 surveys
- Federal Maritime and Hydrographic Agency of Germany (BSH) – 13 surveys
- Netherlands Institute for Sea Research (NIOZ) – 8 surveys

Over the last year, the DCDB worked with FarSounder Inc, MacGregor Germany, James Cook University and PGS in establishing data submission pipelines for crowdsourced bathymetry data.

DCDB Data Infrastructure
In response to the growing data demands from the Seabed 2030 project and IHO CSB initiative, the DCDB commenced a program to rebuild its infrastructure and enhance its interface to provide data ingest, archiving, discovery, display and retrieval of global bathymetric data contributed from mariners around the world. The new ingest-to-archive data pipelines will allow for improved reliability, greater ease in ingesting new data, greater flexibility in allowed data formats and simplified data delivery.

The DCDB is working to develop beyond its current basic file management capabilities to a continuous point store hosted in the cloud. Moving to the cloud will allow for CSB data (and theoretically all bathymetric data sources) to be stored as a seamless collection of points. It is anticipated that the DCDB could then provide a variety of enhanced services along with the data itself, such as the ability for users to generate bathymetric grids of a given area using user-specified resolution, to retrieve data density information, and better support the guiding of future data collection efforts.

CSB Geographic Filter
Last year, the DCDB implemented a geographic filter for all incoming CSB data taking into account Member States positions on the collection of CSB data in a country's area of jurisdiction. The result is that data from only 13 CSB-supporting countries are currently discoverable and accessible via the DCDB Viewer. However, since the release of the updated IHO Circular Letter 21/2020 and IRCC Circular Letter 1/2020, which changed the focus of the request from whether or not a nation allows "CSB activity" to whether they allow "CSB data provision into the public domain", an additional 16 countries have responded positively. The DCDB plans to update the filter with these countries in 2021.

DCDB Map Viewer
Once the contributed bathymetric data have been archived, they are made discoverable and accessible through the DCDB web map viewer (maps.ngdc.noaa.gov/viewers/iho_dcdb/).

Improvements to the viewer over the last year include:
- Added new multibeam bathymetric survey footprints layer made up of simplified polygons produced using the Multibeam Bathymetry Mosaic.
- Added "Japan" as the newest web services contributor.
    - Tracklines of multibeam bathymetric surveys from JAMSTEC DARWIN (Data and Sample Research System for Whole Cruise Information) are now discoverable.
- Added "Known Non-Public Data" layer which includes:
    - UNCLOS Coverage: the extent of coverage of data collected to support an extended continental shelf claim under Article 76 of the United Nations Convention of the Law of the Sea (UNCLOS).

    - Industry: Polygons and lines identifying known existing data that are not yet in the public domain. These data have been acquired, but are not owned, by Fugro and PGS. Included are web layers of PGS coverage and a web service displaying seep exploration polygons from Fugro.
- Added two new layers from the Canadian Hydrographic Service: Non-Navigational (NONNA) bathymetric products NONNA-10 and NONNA-100 at approximately 10 and 100-meter resolution respectively.
- Added several new and updated AusSeabed compilations layers (Australia).
- Added SevenCs WMS ChartServer as a basemap overlay option (Top right - Options).
- Added new GEBCO_2020 Type Identifier (TID) grid (Bathymetric Coverage Maps).
- The GMRT coverage map was automatically updated with the release of GMRT v3.8.

GEBCO Gazetteer
The DCDB developed and hosts, on behalf of the IHO, the GEBCO Gazetteer, a web tool that allows the public to search for, view, and download information (eg: geographic location, feature dimensions, the discoverer, and the origin of the name) on more than 3800 undersea features. Gazetteer v4.3.1 is now live at ngdc.noaa.gov/gazetteer. The GEBCO Subcommittee on Undersea Feature Names (SCUFN) is the primary stakeholder for the Gazetteer. SCUFN identified 27 areas of improvement for the previous version of the Gazetteer and v4.3.1 addresses 22 of those requested enhancements. These enhancements improve the user experience for both SCUFN and the general public. Some long standing defects have been addressed which will help reduce support requests from data managers. This version also includes an innovative new 3D Earth map to display undersea features. Gazetteer v5.0.0 will include an updated REST (Representational State Transfer) API which will allow for integration with the KHOA Beta-Gazetteer. Most of the development time spent this year was developing an initial version of this API.

3. Progress on IRCC Action Items

N/A

4. Problems Encountered

N/A

5. Any Other Items of Note

N/A

6. Conclusions and Recommended Actions

It is highlighted that the DCDB is an IHO Member States' resource that requires additional data to increase the coverage and move towards a comprehensive global bathymetric dataset. Therefore IHO Member States and stakeholders are invited to contribute and encourage the provision of bathymetric data regardless of its origin or reason for gathering.

7. Justification and Impacts

During this review of the DCDB activities and its future support and service provision, it has been recognised that there is also a need to revise the original (1990) Terms of Reference (ToR) for DCDB. It is intended that proposed revised ToR will be submitted to the Member States for approval later this year.

8. Actions Required of IRCC

The IRCC is invited to:

a. Encourage Member State and stakeholder bathymetric data contributions to the DCDB, regardless of origin;
b. Review draft revision of ToR at Annex; and
c. Take any other action it considers appropriate.

Annex A

TERMS OF REFERENCE OF THE IHO DATA CENTRE FOR DIGITAL BATHYMETRY
***UPDATED DRAFT** – original on following page*

The IHO Data Centre for Digital Bathymetry will provide the following services: -

1. Operation of the data centre with an infrastructure to allow the public to contribute, search for, display and download global singlebeam, multibeam, and crowdsourced bathymetry (CSB) data with a focus of activity on oceanic regions with depths greater than 100 metres.

2. Long-term data stewardship for bathymetric data, ensuring quality, integrity, and accessibility. Ensure that the data and information preserved is independently understandable to the designated community.

3. Provision, free of charge, of global bathymetric data via interactive map services and viewers (maps.ngdc.noaa.gov/viewers/iho_dcdb/) that provide visual display of one or more data layers with links to access the underlying data. Users can search all bathymetry in the archive and filter results by source, survey name, ship, date range, and geographic location.

4. Maintenance of a quality control facility whereby data provided to the Centre are at least subjected to simple checks for any irregularities in the data and/or metadata that are revealed by the data packaging and/or data ingestion processes. Member States Hydrographic Offices may be requested to assist in resolving matters of quality control concerning data originated by their nation's organizations.

5. Inventories of bathymetric data holdings can be generated upon request.

6. Collaboration with various international organizations in the development and enhancement of exchange formats and standards to expedite bathymetric data exchange.

TERMS OF REFERENCE OF THE IHO DATA CENTRE FOR DIGITAL BATHYMETRY
1990 ORIGINAL

The IHO Data Centre for Digital Bathymetry will provide the following services: -

1. Operation of the data centre with a focus of activity on oceanic regions with depths greater than 100 metres.

2. Provision, free of charge, to the IHO for use by its Member States, of the data needed for their national or international projects. The IHO Member States will submit their request for data through the International Hydrographic Bureau. Member States' Hydrographic Offices (HOs) will provide the Centre with the digital bathymetric data collected by their nation's institutions in oceanic regions.

3. Maintenance of a quality control facility whereby data provided to the Centre are at least subjected to simple checks for violation of physical principles (instantaneous changes in position, impossibly high ship speeds, etc.) and completeness of labeling, referring detected obvious errors back to suppliers of data for possible corrections. Member States Hydrographic Offices may be requested to assist in resolving matters of quality control concerning data originated by their nation's organizations.

4. Maintenance of inventories in digital form of all digital bathymetric data including digital contour data and the production of an annually updated catalogue of recently acquired bathymetric data. The Centre will provide this Catalogue to the IHB in a form analogous to the present IHO publication BP-0004.

5. Maintenance of trackline catalogues of newly collected data to be provided upon the request of a Volunteering Hydrographic Office for its area of GEBCO responsibility.

6. Collaboration with various international organizations in the development of exchange formats and standards to expedite bathymetric data exchange, including digital bathymetric contours.