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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

Thirty-first Session of the Assembly
UNESCO, 14–25 June 2021 (online)

Items **3.5.1** of the Provisional Agenda

BIENNIAL ASSESSMENT OF THE WORKING GROUP ON USER REQUIREMENTS AND CONTRIBUTIONS TO GEBCO PRODUCTS, 2021

Summary

Through Decision Decision EC-LI/4.5, the IOC Executive Council decided *inter alia* to conduct the Review of User Requirements and Potential Contributions to GEBCO on a biennial basis through a dedicated Working Group tasked to collect, integrate and assess the user requirements to GEBCO products and address ways of potential increase contributions to GEBCO data and products from the IOC community.

This document contains the results of the review conducted by the working group, established in 2020 through IOC Circular Letter 2791, under the Chairship of IOC Vice-Chair Frederico Antonio Saraiva Nogueira (Brazil). The responses to the questionnaire conducted during the intersessional period are appended to the report.

Proposed decision: As proposed in Decision A-31/3.5.1, the Assembly is invited to take note of the report and request the Secretariat to convey it to GEBCO and IHO, as well as sharing it with relevant IOC communities. IOC Member States are also encouraged to cooperate to advance basin-scale campaign mapping and accelerate the delivery of GEBCO objectives and general knowledge of the ocean.

Introduction

1. The Working Group on User Requirements and Contributions to GEBCO Products, established through Circular Letter 2791 dated 21 January 2020, conducted the review and developed its report according to the following objectives:

(i) Collect, integrate, and assess the user needs and requirements to GEBCO data and products.

(ii) Facilitate and guide the use of GEBCO datasets and products through the user communities that represent relevant IOC programmes and regional subsidiary bodies.

2. In accordance with the terms of reference of the Working Group, the recipient of the questionnaire are the members of the Working Group as well as officers/experts nominated by relevant IOC programmes and regional subsidiary bodies. The list of members of the Working Group, the list of respondents to group and the recipient of questionnaire are attached in Appendices I and II.

3. Mr Frederico Antonio Saraiva Nogueira, IOC- Vice-chair, acted as the Chair of the Working Group.

4. The questionnaire was developed by the IOC Secretariat in consultation with the Working Group Chair and based on inputs from the members of the Working Group. It was dissimated between 5 and 31 March 2021 through the Members of the Group and beyond, and included a total of 38 respondents, representing views of Member States, national institutions and IOC programme areas. Detailed responses is available in Appendix III. The questionnaire template is presented in Appendix IV.

5. Following analysis of responses by the Secretaruat , these have been summarized as follows:

PART I – REQUIREMENTS

Relevance of GEBCO products[1] (questionnaire items 3–13,14,15,16,17–26, and 27)

6. All respondents are aware of the GEBCO products and designate the GEBCO's gridded bathymetric data sets as the most popular and pertinent product.

Many of respondents also indicated the GEBCO Undersea Feature Names as very popular and pertinent. On the other hand, respondents considered the Printable maps (hard_copy_charts) as the least pertinent product.

7. Possible areas of improvement of GEBCO products are proposed from a technical point of view as follows:

- GEBCO's gridded bathymetric data sets
  - Higher resolution/higher spatial resolution, more formats, datasets for the polar regions,

[1] The list of data and products can be found at https://www.gebco.net/data_and_products/

- Shoreline definition and coastal data provisions,
- Outreach to promote contribution of data to the GEBCO datasets,
- More straightforward way to access the valuable service,
- Spatial resolution and data coverage should be increased,
- Data accessibility should be improved.

- GEBCO Historical Datasets
  - More visual comparisons, more formats available,
  - Download option, easily findable, accessibility should be improved,
  - Data digitalize, spatial resolution,
  - Accessibility, format and resolution,
  - Comparison of the changes in the bathymetry and evolution of the final products,
  - An additional service with tools to make comparisons easily across data sets,
  - As detailed as possible, in order to be usable to estimate study shoreline evolution.

- Undersea Feature Names
  - Update the B6 publication,
  - Get more undersea feature names from Member States,
  - Shape file format, coverage,
  - Services that allow displaying Undersea Feature Names, services integration, inclusion of a contact tab,
  - Language, rules of names,
  - Most efficient feature name selection method,
  - Include well known names such as tectonic plates, failed ridges, subduction zones,
  - Update/add features metadata, bathymetric data, Increase the number of sea bottom features, to be more exhaustive,
  - Include the undersea feature categorization with each oceanic basin/region,
  - More detailed geographic delineation by polygons

- GEBCO web service
  - Indicated the URLs should be merged with the download service,
  - Create web services for the IBC[1],

- Accessibility, User-friendly functions, More help and guidance through webinars could be achieved,
- 3D domain direct link (if it is provided),
- Accessibility Tutorial, Better defined with examples,
- Updated data services.

- Printable maps
  - Availability of different maps, More maps, Make available Geopdf,
  - More resolution, printable map refers only to the 2014 grid and should be updated,
  - Update to portable holographic projections,
  - Resolution should be increaseds, Insert more undersea feature names.

- The IHO-IOC GEBCO Cook Book
  - Cook book1,
  - Could be more software agnostic, Accessibility,
  - To transform into a more contemporary style and structure,
  - Update periodically, Translate to other languages, More help and guidance/webinars?,
  - Needs a section on data flagging/editing,
  - Update some new methods, such as “Satellite-Derived Bathymetry”, translation service, trends in data processing and software,
  - DTMediting software is not working well for larger files,
  - More details on bringing different bathymetry sources to common benchmark.

- Historical GEBCO Charts[2]
  - Include Chart list,
  - Searchable and accessible as images through the IHO website, All electronic sources into one single portal, To digitize, Accessibility, Format,
  - Expand to other geographical regions, Coverage,
  - Print on demand service,
  - To be as detailed as possible with reference.

- Imagery
  - Image 123, Greater/More/Higher resolution,

[2] International Bathymetric Chart (IBC) are not a currently GEBCO service

- Visual of more location,
- Imagery could be more effectively incorporated into printable maps to provide the user with a unique repository,
- Various viewing formats,
- Accessibility, Coverage and spatial resolution, as well as print on demand services, increased resolution.

- Hard copy charts
  - No longer exists as mailing service of hard-copy maps and is not required since now off-the-shelf printing services are widely available to user,
  - Format, additional services, coverage,
  - Resolution; Insert more undersea feature names,
  - Make it easy to use.

- History of GEBCO
  - It consists of a pdf file scanned from the original paper source that a smaller size would be better to make the download faster,
  - Should be presented in a more friendly way to attract early carreer audience,
  - Format, additional services, coverage,
  - Should be updated and provide the information about Seabed 2030 project,
  - Could be improved and published as an ebook, in order to easily spread this important information.

8. In terms of improvements, which ones could not be done without IOC?:
   - IHO had giving big contributions.
   - “GEBCO’s gridded bathymetric data sets”, “GEBCO Historical Datasets”, “Undersea Feature Names”, and “GEBCO web service” are the popular selections
   - Emphasize the importance for IOC Member States to provide data.
   - Its patronage beyond funding opportunities and through commitment of Member States mobilization, its role as a parent organization.
   - GEBCO’s gridded bathymetric data sets” is the most major selection, and “Undersea Feature Names”, and “GEBCO web service” are the popular selections.

User needs for GEBCO data and products (questionnaire items 28–31)

9. Who do you consider are users of GEBCO data and products?:
   - Cartographers, Hydrographic officers,
   - Universities (teachers and students), Institutions

- Scientific researchers (marine biologists, geologists, oceanography, tectonics, volcanism, …), Engineers
- Ship's rent agencies, Port companies and authorities
- Tsunami service providers, Digital Elevation Model (DEM) developers, Modellers
- Fisheries
- Ministries, national security/navies
- Idem
- NGOs

10. For what activities the users (would) use GEBCO products ?

- Professional and technical consultations, Safe navigation of vessels, Marine economics, Aquaculture, engineering, fisheries,
- Academic studies, Education,
- Modelling: Coastal inundation caused by tsunamis/storm surges, for warning from Tsunami, hazard models, oceanography, Creating model grids for global Tsunami propagation simulation,
- Research in Seabed mapping, bioacoustics and noise, geology, geophysics,
- Developing DEM,
- Marine habitats in order to get an environmental assessment, Marine spatial planning, Marine Protected Areas.
- Tsunami propagation chart.

11. What kind of products are used/needed for these purposes?

- Printable maps,
- Data (datasets): Gridded data, GEBCO gridded bathymetry, topo-bathymetric netCDF grid files, Undersea Feature Names,
- Charts, images: would be to have 4D, DEM images,
- Web service,
- Goe Tiff layers, APIs, WFS,
- Need the full resolution multibeam data,
- Idem,
- More printable and imagery maps for general use,
- Mostly digital products regarding bathymetry and coastal line.

12. Needs and specific requirements to GEBCO products

- Mapping in a specific maritime area, Arctic area, Improved extent and quality of data in shallow-water areas,

- Short technical trainings,
- Updated bathymetric data, Coastal bathymetric data,
- Tsunami modelling and mapping its impact in deep ocean/coastal level, Multi-resolution grids based on water depth,
- Formalization of the regional pacific IBC project,
- High resolution data (datasets) for simulating tsunami propagation and for other purposes,
- Most of the same as the above,
- Python library,
- To be able to easily identify which part of new data is available,
- Detailed information about the evolution of the coastal area.

User needs for GEBCO data and products: Focus on Shallow water bathymetry – depth of less than 200 m to the coastal zone (questionnaire items 32–35)

13. Who do you consider are users for these type of data and services?

- Universities and research centers, Scientific researchers and students (marine biology, geology, tectonics, volcanism, coastal/harbor dynamics, sedimentology, mophological) , modellers,
- Fisheries, Public biodiversity conservation organization, Tourism industry, Oil and gas industry,
- Engineers, cartographers,
- An accurate shallow water bathymetry is essential for tsunami modeling, Risk management officer, Coastal zone management, Marine Spatial Planning,
- DEM developers,
- Can be used for a wide-scope spectrum of applications including sedimentology studies, seafloor classification, tsunami velocity of propagation towards the coast, resource exploration,
- Important both for the generation of flood maps and for the elaboration of evacuation plans,
- Ministry, Coast guard, Hydrographic office,
- NGO’s for conservation use.

14. How the users would use the GEBCO products?

- Professional and technical consultations, Student study: marine environment,
- Base maps for identification of areas of interest on habitat mapping, environmental and risk assessment,

- Gridded bathymetric datasets integrated in their workflows, building product to support hydrography and cartography, for visualization, Mapping, Create high-quality model grids, image, digital format,
- Fisheries assessments,
- Modelling: Tsunami modeling and hazard assessments, inundation and propagation, evacuation maps,
- Developing DEM,
- Geographic information system for desktop and mobile,
- Combined with a knowledge of sea waves, Predicting sea heights on the coast,
- Most of the same as the above,
- Nautical chart creation,
- Morphological interpretations,
- Voyage, Marine ecological research and sea level assessment,
- As base maps.

15. What kind of products would you like the GEBCO project to produce?

- A special guide or cookbook for shallow waters, including LIDAR,
- Topo-bathymetric netCDF grid files mainly,
- Access to any data collected for shallow water regions,
- Satellite derived bathymetry,
- Multi-resolution bathymetric grids based on water depth,
- Images, would love to 4D,
- GeoTiff files of bathymetry, as part of the GEBCO grid,
- Most of the same as the above,
- Shoreline evolution maps.

16. Your needs, requirements and challenges

- Mapping in a specific maritime area, Atlantic, over the coral reef, etc..
- To acquire bathymetry on estuaries and river mouths, and some other areas with reef influence,
- Request GEBCO to conduct LIDAR surveys,
- Tsunami modelling and mapping its impact at harbor scale all over the world,
- Seamless bathymetric and topographic DEMs for modelling,
- Multi-resolution bathymetric grids based on water depth; improved WMS and integrated tools providing information, Coastal bathymetric data sets,
- To draw up the bathymetric charts of the Pacific region,

- Most of the same as the above, especially Mapping in a specific maritime area is most major theme,
- Products to support coastal hazard management.

User's concerns related to data access and/or sharing data (questionnaire items 36)

17. Data collected within EEZs of nations:

- Exemples of EEZ data inclusion in the context of ICG/NEAMTWS,
- GEBCO identified that low resolution EEZ data may hinder the development and quality of marine research,
- Example of National Cartography Agencies (e.g. Mexico) providing EEZ data to GEBCO (IBCCA).

There are some specific concerns for data sharing/access based on each country's' situation and existing national data policy for e.g.:

- Survey permit must be requested prior to data acquisition and Data can be distributed after acceptance from the Defense based on specific area and intended use (Denmark),
- Data collected by foreign entity in partnership with a National institution must be devlivered to the national authority and cannot be shared if EEZ is part of subnmission to CLCS (Brazil),
- Database are being set up to facilitate access to coastal bathymetric data for MSP purpose (Mauritius),
- Several MS have concerns related to national security in specific and spatially limited areas.

User's benefit (questionnaire items 37–39)

18. Are there any products of ocean mapping activities from which your Programme/Subsidiary Body (would) benefit?

- Modeling numeric for research,
- Data provided by private offshore exploration companies,
- Datasets from national bathymetric acquisition campaigns from European countries,
- Data, metadata, images, new layers for outreach and education: 4D and holographic projections, virtual reality,
- An archive of the raw edited data,
- Multi-resolution bathymetric grids,.
- Global Multi-Resolution Topography (GMRT), GMRTMapTool,
- Products resulting from regional projects, Scientific Oceanographic Campaigns/Projects,

- DEM data, UKHO datasets, EO data,
- exploratory and research studies of the waters of the EEZ that carry out hydrographic and bathymetric surveys, SRTM PLUS, the IBCSO and IBCAO data,
- ETOPO products,
- Identification of various seabed features and Delineating fishing zones,
- Eumetsat web page data,
- Bathymetry mapping of the maritime zones,

User's suggestion about mechanism to identify user needs and requirement to GEBCO data and products (questionnaire items 40)

19. Please suggest any mechanism:

- Some of the Seadeb2030 project budget would be assigned for conducting hydrographic campaign,
- Virtual meeting with the Head of the Laboratory, Online consultation to local government, Communication with UN, IODE, IHO and others, Webinars, workshops, engagement and events,
- Expand the survey to DNAS, NODCs-RNODCs, WDCs, ocean experts, IOC community at large, Integrate with the IOC ocean data exchange policy and observation community,
- The IOC links in each country should seek to reach a greater number of users, to make an open GEBCO user registry,
- National consultation process is necessary, Communication in Spanish,
- Quick questions on the GEBCO websiteThe same as the above,
- Use some social media, Build relationship with UNGGIM,
- All time open consultation, based on predefined issues (for registered users only) on the web site.

PART II – CONTRIBUTIONS

Cooperation with GEBCO data and products (questionnaire items 41–43)

20. Has your Programme/Subsidiary Body/Country cooperated with GEBCO data and products? There is not much difference in the number of answers that is shown in the Chart and Tables 41-42, and if respondents hold the specific answers, it shows in the next.

Particular cooperation include

- Contribution of Antarctic surveys,
- IBCAO,
- EMODnet bathymetry, Directly to IHO DCDB,
- world atlas of the oceans,

- Specific Memorandum of Understanding signed between GEBCO and national authorities,
- Directorate of Hydrography and Navigation has contributed with bathymetric data,
- NMDIS participates GEBCO, SCUFN and SCRUM meetings every year. More than 100 undersea feature names had been proposed and submitted to GEBCO,
- Satellite imagery,
- Naming of undersea features,
- GEBCO produce bathymetric charts of our Maritime Dominium without cost.

Contribution data to GEBCO (questionnaire items 44–48, 49–50,)

21. If you contributed data to GEBCO, which option did you use?

a. Contributing data for public access Data contributed sent to the International Hydrographic Organization Data Center for Digital Bathymetry (IHO DCDB)" is the most major answer. This result is shown in the Chart and Tables 44–48.

22. Do you consider there is any potential possibility that you will contribute to GEBCO data and products?

b. The potentiality contribution to GEBCO, which are as respondents' answers are more around 85%. This result is shown in the Chart and Tables 49–50.

Suggestions to GEBCO (questionnaire items 51–53)

23. Any potential approach to promote and increase the contribution of bathymetric data collected.

- Development of Capacity building programmes
- Engagement meetings with research/oceanographic agencies and cartographic organisations,
- Participation in national fora and conventions, Organize meetings with National Authorities,
- Fundraising for data acquisition through extra-budgetary resources
- International initiatives that raise awareness about the importance to release these datasets,
- Method for acknowledgment of the data sources: including Digital Object Identifier assignment mechanism for suitably-archived, or the use of external DOIs created by recognized organizations,
- GEBCO's participation as a partner in regional projects, building specific products for those projects,
- Increasing visibility of the undersea naming proposals,
- Need a central archive od edited/flagged data, collected through scientific activities,

- Tsunami assessment,
- Platform to show surveys carried out and planned surveys, for eg via EMODnet or other mechanisms.

24. Any potential needs of capacity-development in relation to GEBCO products:

- Subsidiary deep water survey,
- Scientific researchers require training and support to show the importance of bathymetric information, Training programs, Education and general outreach, Ocean literacy,
- Support for DEM development,
- Financial supports,
- Collaborations amongst nations on international mapping campaigns,
- To promote webinars, cookbook topics, trainings,
- GEBCO products to be publicized through other UN committee.

25. Any further points to be considered in the review of contributions to GEBCO data and products

- Support the bathymetric international projects, Keep up the good work of Seabed 2030, Establish partnerships,
- Some of the web services, hypertext is user friendly,
- Resources are required to acquire computer goods and software,
- Promoting education and training, Create a generation of young users inspired to better know their oceans,
- Find a way to mandate international registration of all hydrographic surveys on the ocean as a prerequisite,
- Improving the data quality assessment reports,
- Legacy data and spot soundings in different scales/datums should be considered for GEBCO data,
- The opportunity to provide data is not closed.

PART III – THE SINGLE GREATEST RECOMMENDATION

Recommendation (questionnaire items 54)

26. What is the single greatest recommendation you would like GEBCO to consider in order to improve the success of its provision of scientific information to you or stakeholders?

- Make more evident the need for support and commitment of official institutions to provide better data that allow new discoveries for science. Offer a series of

seminars that strengthen the knowledge about bathymetry, acquisition techniques and results.

- Access to any data collected in shallow water regions should be provided, not just the gridded bathymetric products.

- Find 3+ billion dollars to support Sail Drone/ Ocean Infinity and other mass mapping missions. These quantities of money are frittered away every week on projects of far less importance to man-kind.

- Improve the metadata format and catalogue.

- Promote actions through IOC and IHO to manage contribution of hydrographic surveys to be deposited in IODE NODCs.

- The inherent value of adding new data, involving new expertise and addressing omissions.

- Have a product dissemination program that reaches the users' knowledge.

- Develop a mission statement that states the ultimate goal of GEBCO is to have all sounding data free and open just like GNSS data or climate data.

- improve the success of its provision of scientific information of data depth, image, resolution, fomat, popular format for users.

- GEBCO should be the global data center that brings together all thorganizations/institutions that make information available at regional level. In this regard, we recommend greater coordination with those organizations (e.g. EMODNet, SEABED 2030, etc.) so that the products made available have the same sources/resolution, i.e. that they are a common solution.

- Improve spatial resolution on the GEBCO's gridded bathymetric data sets in the South Hemisphere areas.

- It is recommended that GEBCO awareness events should be organized to increase the visibility of GEBCO data and products.

- Update geomorphological features from published literatures.

- Speed up the generation of high resolution bathymetry data for areas near the coasts.

- It is necessary to consider the contributor's benefits and increase their visibility.

PART IV – LESSONS LEARNT FOR CONDUCTING THE REGULAR ASSESSMENT OF IOC USER REQUIREMENTS TO GEBCO

27. In this survey we had only 38 responses. Probably they don't know the project and/or aren't aware of the paramount importance of bathymetry for ocean sciences and ocean services (under the point of view of IOC).

Considering that this survey will be repeated periodically, maybe we can encourage MS and organizations and even users in their individual capacity to increase the number of responses.

LIST OF APPENDICES (in English only)

APPENDIX I

LIST OF MEMBERS OF THE WORKING GROUP

No	Name	Country	Institution
1	Boris DORSCHEL	Germany	Alfred Wegener Institute (AWI)
2	Gabriel ION	Romania	GeoEcoMar
3	Hakyeol YOU	Republic of Korea	Korea Hydrographic and Oceanographic Agency (KHOA), Ministry of Oceans and Fisheries
4	Eunni CHANG	Republic of Korea	University of Seoul
5	Prashant Kumar SRIVASTAVA	India	Ocean Sciences and Resources division of the Ministry of Earth Sciences (MoES)
6	Lorenada FONSECA SAMPAIO	Brazil	Centro de Hidrografia da Marinha (Brazilian Navy Hydrography Centre)
7	Serge PANGU SANGHY	Domocratic Republic of the Congo	University of Kinshasa
8	Mohamed Ahmed Mohamed SAID	Egypt	National Institute of Oceanography and Fisheries (NIOF)
9	Reynaldo CASTANO	Nicaragua	Instituto Nicaragüense de Estudios Territoriales (INETER)
10	Syed Waseem HAIDER	Pakistan	National Institute of Oceanography
11	Nurun Nahar CHOWDHURY	Bangladesh	Ministry of Defence
12	Helge SAGEN	Norway	Institute of Marine Research
13	Boele RKUIPERS	Norway	Norwegian hygrographic Service Terrain modelling group
14	Kouadio Salomon YOU	Cote d'Yvoire	Centre de Recherches Oceanologiques (CRO)
15	Gary MITCHUM	GLOSS	USF College of Marine Science
16	Nathalia MarisOTALORA MURILLO	Colombia	Colombian Ocean Commission
17	Miao FAN	China	National Marine Data And Information Service
18	John NYBERG	USA	NOAA
19	Marzia Rovere	Italy	Istituto di Scienze Marine, Consiglio Nazionale delle Ricerche
20	Reynaldo CASTAÑO	Nicaragua	Instituto Nicaragüense de Estudios Territoriales

APPENDIX II

LIST OF RESPONDENTS TO THE QUESTIONNAIRE

Responses from IOC programmes, IOC Regional Subsidiary Bodies and others

No	IOC programmes, IOC Regional Subsidiary Bodies and others/ Countries	Name	Name of IOC Programmes/IOC Subsidiary Bodies/ national institutions
1	Argentina	Fabricio Gabriel Cardillo	Naval Hydrography Service (SHN)
2	Canada	LTB	OTNDC
3	Colombia	DAGOBERTO URIEL DAVID VITERI	Dirección General Marítima DIMAR CIOH
4	Colombia	Julian José Pizarro Pertuz	Marine and Coastal Research Institute – INVEMAR
5	Danmark	Belen Jimenez Baron	Danish Hydrographic Office
6	Ecuador	Nilton Sanchez Espinoza	Navy of Ecuador
7	ICG/NEAMTWS France	Audrey Gailler	ICG/NEAMTWS Working Group 1 - Hazard Assessment and Modelling
8	ICG/CARIBE-EWS	Nicolas Arcos	Working Group on Hazard Assessment for the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS)
9	Israel	Dr. John K. Hall	IBCM, GEBCO since ~1980
10	GEBCO Italy	Marzia Rovere	GEBCO
11	Mexico	Mario Jahuey	INEGI Editor principal proyecto IBCCA
12	Mexico	Mario Angel Jahuey Amaro	Director de información topográfica INEGI
13	IODE Mexico	Carlos Rodolfo Torres Navarrete	IODE/MEXICO
14	Mexico	Octavio Gomez Ramos	Geophysics Institute, National Autonomous University of Mexico
15	Mexico	Elva Escobar	UNINMAR UNAM
16	Mexico	Sergio Ignacio Larios Castillo	CENDO / Sec. Relaciones Exteriores / MEXICO
17	Nicaragua	Marcia Estrada	Nicaragua/Instituto Nicaragüense de Estudios Territoriales
18	Peru	Raul Vasquez Gianella	GRASP / PERÚ

No	IOC programmes, IOC Regional Subsidiary Bodies and others/ Countries	Name	Name of IOC Programmes/IOC Subsidiary Bodies/ national institutions
19	Portugal	Commander Delgado Vicente	Portuguese Hydrographic Office (IHPT)
20	Republic of Korea	Hyun-Chul Han	Marine Geohazard/KIGAM/Koreas
21	Spain	Elisa Berdalet	GlobalHAB
22	UK	Caitlin Allan	Centre for Environment, Fisheries and Aquaculture Science, UK
23	United States	Diego Arcas	NOAA Pacific Marine Environmental Laboratory, USA
24	United States	David Sandwell	Scripps Institution of Oceanography/USA
25	Viet Nam	Trung Ba Pham	Institute of Oceanography
26	Brazil	Lorena da Fonseca Sampaio	Brazil – Directorate of Hydrography and Navigation (Brazilian Navy Hydrographic Service)
27	CHILE	Hugo Gorziglia	Chile
28	China	Fan Miao	China
29	Ecuador	Willington Renteria	Ecuador
30	Egypt	Dr. Suzan El-Gharabawy	National Institute of Oceanography and Fisheries - Egypt
31	Germany	Boris Dorschel	IOC Working Group on User Requirements and Contributions to GEBCO Products
32	India	Cdr. P K Srivastava, Scientist-F	Ministry of Earth Sciences, Government of India
33	Kazakhstan	Aizat	Kazakhstan
35	Mauritius	Hemanaden RUNGHEN	Republic of Mauritius
35	Nicaragua	Wilfried Strauch	Nicaragua
36	Peru	Jaime Valdez	Peru
37	Republic of Korea	Peter You	Republic of Korea
38	Romania	Ion Gabriel	Romania

APPENDIX III

RESULTS OF QUESTIONNAIRE ON THE REVIEW OF USER REQUIREMENTS AND CONTRIBUTIONS TO GEBCO PRODUCTS

Please see the Link.

APPENDIX IV

QUESTIONNAIRE ON THE REVIEW OF USER REQUIREMENTS AND CONTRIBUTIONS TO GEBCO PRODUCTS

Introduction/guidance

The IHO-IOC General Bathymetric Chart of the Oceans (GEBCO) project is a joint project of the International Hydrographic Organization (IHO) and the IOC. Its aim is to provide the most authoritative public domain global reference bathymetric dataset and based on all available information provided through the interest, participation, support and effort of scientists, institutes, research centres and national Hydrographic Services who provide data and expertise to the programme at no cost in the interest of science, safety and the environment. More information on the GEBCO governance and activities is provided in Apprendix I.

The purpose of this questionnaire is to inform the work of IOC Working Group established through EC-XLIX, Dec. 4.4, tasked with the assessment of user requirements to GEBCO products, from the IOC perspective, and identify ways to strengthen potential contributions to GEBCO data and products from the oceanographic community. The Working Group will report to the 31st Session of the IOC Assembly in June 2021. The report and any decision that the IOC Assembly may take will be forwarded to IHO and GEBCO Guiding Committee.

The recipient of the questionnaire are the members of the Working group as well as officers of /experts nominated by relevant IOC technical and regional subsidiary bodies and GOOS Regional Alliances.

Kinldy provide your inputs by 31 March 2021 through this electronic form. It is estimated that 25 min is required to fill all questions. Please note that depending on the respondant position (eg representing MS, IOC programme designated expert, institutional) some of the questions may be more relevant to your own institutional background. We invite you to respond in the broadest context of your capacity and knowledge. We thank you for your valuable inputs to this process. In case of questions, please contract the IOC Secretariat (j.barbiere@unesco.org and t.chiba@unesco.org).

GENERAL	
1. Name of Programmes/Subsidiary Body/Member State	
2. Respondent name	
3. Contact details	Phone: E-mail:

PART I REQUIREMENTS

1. Please specify which products/service of the GEBCO project are especially beneficial for your Programme/Subsidiary Body. (For the details of each product, please refer to GEBCO website links provided under each products) (In the report, it is displayed as Q3 to Q13)

- ☐ GEBCO's gridded bathymetric data sets

  https://www.gebco.net/data_and_products/gridded_bathymetry_data/

- ☐ GEBCO Historical Datasets

  https://www.gebco.net/data_and_products/historical_data_sets/

- ☐ Undersea Feature Names

  https://www.gebco.net/data_and_products/undersea_feature_names/

- ☐ GEBCO web service

  https://www.gebco.net/data_and_products/gebco_web_services/

- ☐ Printable maps
  https://www.gebco.net/data_and_products/printable_maps/

- ☐ The IHO-IOC GEBCO Cook Book

  https://www.gebco.net/data_and_products/gebco_cook_book/

- ☐ Historical GEBCO Charts

  https://www.gebco.net/data_and_products/historical_gebco_charts/

- ☐ Imagery
  https://www.gebco.net/data_and_products/imagery/

  Printable Maps

  https://www.gebco.net/data_and_products/hard_copy_charts/

- ☐ History of GEBCO

  https://www.gebco.net/data_and_products/history_of_gebco/

- ☐ Capacity Development/Training

  https://www.gebco.net/training/

- ☐ None of these

- Any others (please specify: _____)

2. Please specify in order of priority which existing products of the GEBCO project your Programme/Subsidiary is most likely to use and least likely to use

(In the report, it is displayed as Q15 to Q16)

Most likely to use	Least likely to use
1.	1.
2.	2.
3.	3.

3. Improvement of GEBCO products

Please describe which GEBCO products could be improved from a technical point of view? (e.g. this may be in relation to accessibility, format, coverage, spatial resolutions, additional services…)

(In the report, it is displayed as Q16 to Q26)

GEBCO products	Areas of improvement
GEBCO's gridded bathymetric data sets	
GEBCO Historical Datasets	
Undersea Feature Names	
GEBCO web service	
Printable maps	
The IHO-IOC GEBCO Cook Book	
Historical GEBCO Charts	
Imagery	
Hard copy charts	
History of GEBCO	

4. In your opinion, from the improvements listed above, which ones (if any) could not be done without IOC?(In the report, it is displayed as Q27)

5. Who do you consider are (would be) users of GEBCO products in your Programme/Subsidiary Body/ or national authorities?

For what activities the users (would) use GEBCO products? How the users (would) use GEBCO products?

What kind of products are (would be) used/needed? Please explain your needs and requirements to GEBCO products. (for example, mapping in a specific maritime area, type of products, resolution of products, web services, etc.)

(In the report, it is displayed as Q28 to Q31)

User	Activities	Type and specifications (e.g., resolution) of GEBCO products

6. Traditionally, GEBCO's data sets and maps have shown the bathymetry of areas at the water depths of 200m and deeper of the world's oceans. In addition to those data sets and maps, the GEBCO project has been working to improve its gridded bathymetric data sets in the shallow waters (at the depth of less than 200m to the coastal zone), in cooperation with IHO.

As for the shallow water bathymetry, who do you consider are (would be) users of GEBCO products and for what activities the users (would) use GEBCO products in your Programme/Subsidiary Body?

How the users (would) use GEBCO products? What kind of products concerning the shallow waters would you like the GEBCO project to produce? Please explain your needs, requirements and challenges to GEBCO products. (for example, mapping in a specific maritime area, type of products, resolution of products, web services, etc.)

(In the report, it is displayed as Q32 to Q35)

User	Activities	Type and specifications (e.g., resolution) of GEBCO products	Specific needs/requitements/challenges

7. Does your country and/or organization have any concern about accessing and/or sharing data collected within in EEZs? (Please describe)

(In the report, it is displayed as Q36)

8. Are there any products of ocean mapping activities from which your Programme/Subsidiary Body (would) benefit other than those currently developed under GEBCO data and products?

(yes / no): _____ (In the report, it is displayed as Q37 to Q39)

If yes, please specify:

9. Beyond the IOC consultation process, please suggest any mechanism to identify user needs and requirement to GEBCO data and products and to provide them to GEBCO from the viewpoint of your Programme/Subsidiary Body (this may also include mechanism for strengthened cooperation with GEBCO) (In the report, it is displayed as Q40)

PART II CONTRIBUTIONS

10. Has your Programme/Subsidiary Body/Country cooperated with GEBCO data and products?

(yes / no): _____ (In the report, it is displayed as Q41 to Q43)

If yes, please specify in what areas:

11. If your progamme has contributed data to GEBCO, which option did you use?

(In the report, it is displayed as Q44 to Q48)

1. Contributing data for public access

- Data contributed sent to the International Hydrographic Organization Data Center for Digital Bathymetry (IHO DCDB)
- Discovery metadata, spatial footprints and the retrieval URL for online Data provided to IHO DBCP

2. Contributed data for GEBCO's use only

- data provided to GEBCO via GEBCO's data holding centre at the British Oceanographic Data Centre (BODC)

Any other mechanism (Please specify): _____

12. Do you consider there is any potential possibility that your Programme/Subsidiary Body will contribute to GEBCO data and products? (yes / no): _____

(In the report, it is displayed as Q49 to Q50)

If yes, please specify:

13. Please suggest any potential approach to promote and increase the contribution of bathymetric data collected through scientific activities to GEBCO. (In the report, it is displayed as Q51)

14. Please suggest any potential needs of capacity-development in relation to GEBCO products from the viewpoint of your Programme/Subsidiary Body: (In the report, it is displayed as Q52)

15. Please suggest any further points to be considered in the review of contributions to GEBCO data and products from the viewpoint of your Programme/Subsidiary Body:

(In the report, it is displayed as Q53)

PART III – CONCLUDING QUESTION

16. What is the single greatest recommendation you would like GEBCO to consider in order to improve the success of its provision of scientific information to you or stakeholders?
(In the report, it is displayed as Q54)

APPENDIX V

GEBCO overview

The General Bathymetric Chart of the Oceans is a joint Project of IOC and the International Hydrographic Organization (IHO). A resolution of the 7th International Geographic Congress in Berlin in 1899 established the necessity of a bathymetric map of the World Ocean to be compiled using all the known data. The Congress nominated a Commission which was chaired by Albert I Prince of Monaco who organized and financed the production of a new chart series designated: "The General Bathymetric Chart of the Oceans" (GEBCO). The first sheet was published in 1903. In 1922, the responsibility for GEBCO was passed to the Director of the Oceanographic Museum of Monaco and in 1929, it was transferred to the International Hydrographic Bureau (today the IHO). GEBCO became a joint Project of the IHO and the IOC in 1973.

The Nippon Foundation and GEBCO announce the launch of Seabed 2030 in June 2016. Seabed 2030 is a collaborative project between GEBCO and the Nippon Foundation with the aim to facilitate the complete mapping of the ocean floor by the year 2030. It builds on more than 100 years of GEBCO's history in global seafloor mapping. The GEBCO Guiding Committee provides oversight to the implementation of the Seabed 2030 project.

The key goals of GEBCO are to:

- Make available and improve the authoritative description of global ocean depths;
- Act as the designated international authority for undersea feature names;

Important additional roles are:

- Promoting education and training in ocean mapping;
- Building global capacity in mapping the World oceans;
- Developing ocean mapping products for science, education and general outreach;
- Encouraging and assisting local and regional ocean mapping efforts;
- Enhancing the exchange and preservation of bathymetric data;
- Encouraging the mapping of areas that are insufficiently surveyed;
- Advancing the development and application of sea floor mapping technology.

Organization

GEBCO is a non-profit organization that relies on the voluntary contributions of an international team of geoscientists and hydrographers. GEBCO's work is directed by a Guiding Committee and supported by the Technical Sub-Committee on Ocean Mapping (TSCOM), the Sub-Committee on Undersea Feature Names (SCUFN), the Sub-Committee on Regional Undersea Mapping (SCRUM), , the Sub-Committee on Outreach, Communication and Public Engagement (SCOPE), relevant working groups and the Nippon Foundation/GEBCO Training Project Management

Committee. Through the voluntary work of its committees and working groups, GEBCO produces and makes available a range of bathymetric data sets and products, including gridded bathymetric data sets, the GEBCO Digital Atlas, the GEBCO world map and the GEBCO Gazetteer of Undersea Feature Names. GEBCO also manages each year a capacity building course for six international students at University of New Hampshire, USA, that is fully funded by the Nippon Foundation.

GEBCO maintains a comprehensive website at http://www.gebco.net.

Bathymetric grids

GEBCO's bathymetric product is a global terrain model at 30 arc-second intervals. The bathymetric portion of the GEBCO grid is based on a database of ship-track soundings with interpolation between soundings guided by satellite-derived gravity data. Data sets developed by other methods have also been included.

The GEBCO grid is accompanied by a Source Identifier (SID) grid that identifies which of the corresponding cells in the GEBCO grid are based on soundings or existing grids, and which have been interpolated.

Further information about current and previous releases of the GEBCO grid can be found on GEBCO's web site: http://www.gebco.net/data_and_products/gridded_bathymetry_data/gebco_30_second_grid/#history

GEBCO's grids can be downloaded from the internet: http://www.gebco.net/data_and_products/gridded_bathymetry_data/.

Standardization of Undersea Feature Names

The main task of the IHO-IOC GEBCO Sub-Committee on Undersea Feature Names (SCUFN) is to evaluate and select names for undersea features, on the principles contained in the IHO Publication B-6 *Standardization of Undersea Feature Names*. Proposals for undersea feature names can be submitted to GEBCO or its parent organizations, IHO and IOC, by national and international authorities, individuals and scientific organizations. Based on the accepted undersea feature names, SCUFN compiles and maintains, as major product, the global Gazetteer of Geographical Names of Undersea Features (IHO Publication B-8).

The *Gazetteer* contains a global data base of Undersea Feature Names maintained by SCUFN and managed by the IHO. The gazetteer is now available via an interactive web map application (http://www.ngdc.noaa.gov/gazetteer), hosted by the International Hydrographic Organization Data Centre for Digital Bathymetry (IHO DCDB) co-located with the National Oceanic and Atmospheric Administration' National Centers for Environmental Information in USA. The data are available for download in a number of formats including spreadsheet, shapefile, KML, WMS and ArcGIS layer and can be accessed as a REST-style API. Administrative functionalities are now available to the SCUFN secretary for managing the database at the IHO.

SCUFN maintains liaison and data exchange with:

- United Nations Group of Experts on Geographic Names (UNGEGN)

- SCAR Standing Committee on Antarctic Geographic Information (SCAGI)

- Diverse national committees on undersea feature names

GEBCO World Map

Printing is planned to take place by setting up several print shops in different countries in order to avoid the large cost of shipping maps across the World. The map, downloadable free of charge, is available for printing by Member States and the general public. http://www.gebco.net/data_and_products/gebco_world_map/.

Capacity Building

GEBCO has been training a new generation in ocean mappers since 2004 through the GEBCO designed and managed Postgraduate Certificate in Ocean Bathymetry (PCOB) graduate certificate course in ocean mapping at the University of New Hampshire (UNH).This training course has been fully supported and funded by the Nippon Foundation since the inception of the program in August of 2004. There are now 60 PCOB course graduates working in their home country organizations, in academic institutes and in international industry.

The GEBCO PCOB training course is a one-year Master's level course, where students study and take classes alongside Earth Sciences and Ocean Engineering M.S. and Ph.D. graduate students at the Center for Coastal and Ocean Mapping/Joint Hydrographic Center at UNH. Students are taught theoretical and practical aspects of ocean mapping through an intensive academic schedule, work on a team project. One of the important aspects included in the Nippon Foundation / GEBCO training program at UNH is a working visits by students to other ocean international organizations and /or the opportunity to take part in a deep-ocean cruise to round out the students training, to help them build networks and to deepen some of their newly-acquired theoretical knowledge. This training/internship includes familiarization with the programs that the visited organization is engaged in, as well as some directed work under their supervision.

https://www.gebco.net/training/

Regional Mapping

Improving bathymetry of all the world oceans is important but in practice, significant progress will be made only through addressing it on a regional basis. Regional projects also provide opportunity for capacity building and data sharing between countries and organizations.

https://www.gebco.net/about_us/committees_and_groups/scrum/mapping_projects/

Through the Sub-Committee on Regional Undersea Mapping (SCRUM), GEBCO is aiming to build on and extend its collaboration with regional mapping groups in order to improve its global bathymetric model.

The regional groups that GEBCO collaborates with include:

International Bathymetric Chart Projects

- International Bathymetric Chart of the Arctic Ocean (IBCAO)

- International Bathymetric Chart of the Southern Ocean (IBCSO)
- International Bathymetric Chart of the Caribbean Sea & Gulf of Mexico (IBCCA)
- International Bathymetric Chart of the Central Eastern Atlantic (IBCEA)
- International Bathymetric Chart of the Mediterranean (IBCM)
- International Bathymetric Chart of the South Eastern Pacific (IBCSEP)
- International Bathymetric Chart of the Western Indian Ocean (IBCWIO)

International Hydrographic Organization (IHO) regional coordination work

GEBCO's regional mapping projects

- GEBCO/Nippon Foundation Indian Ocean Bathymetric Compilation (IOBC) Project

Other collaborative projects

- European Marine Observation and Data Network (EMODnet) Bathymetry
- Baltic Sea Bathymetry Database (BSBD)

GEBCO Cook Book

Started in 2009, the IHO-IOC GEBCO Cook Book was published in 2012 as IHO Publication B-11 and IOC Manuals and Guides 63. It is available for free download from the GEBCO website: http://www.gebco.net/data_and_products/gebco_cook_book/

The IHO-IOC GEBCO Cook Book provides an educational resource for preparing gridded datasets and bathymetric data. It contains chapters that span basic to advanced topics, written by expert GEBCO contributors from international research organizations, universities, governments, and companies.It is a "living document" this is continuously updated and expanded as new or amended techniques and software become available.

Crowd Source Bathymetry data

Traditionally GEBCO had focused on waters deeper than about 200 m but that has changed, firstly because of the importance of the coastal zone and secondly because bathymetric grids used by modellers, even on a global scale, have to be complete and consistent up to the coastline.

To address the significant lack of bathymetric data available globally, especially in the near shore areas, the IHO initiated a collaborative pilot project in 2014 with the IHO Data Centre for Digital Bathymetry (DCDB), the Professional Yachting Association (PYA), and SeaID to enable a group of super yacht owners to collect crowd-sourced bathymetry (CSB) using data accumulation devices approved by the IHO. The IHO and DCDB in partnership with other member states and private companies intend to expand the collection of CSB data to a broad range of qualified mariners and professionally manned vessels.