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(of UNESCO)

INFORMATION DOCUMENT

GEBCO GUIDING COMMITTEE BIENNIAL REPORT TO THE IOC ASSEMBLY FOR THE PERIOD 2019-2021

Summary

The GEBCO is an IHO and IOC Programme, which is guided by the Joint IHO-IOC Guiding Committee for GEBCO, made up of representatives from both IHO and IOC and is 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) and the Sub-Committee on Communications, Outreach and Public Engagement (SCOPE). Additional ad-hoc working groups are convened as necessary.

Through the work of its organs, 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, the GEBCO *Gazetteer of Undersea Feature Names* and the *GEBCO Cook Book*. GEBCO maintains a comprehensive website at: http://www.gebco.net. The progress of the GEBCO programme is reported below.

This document covers the GEBCO activities for the period 2019 to 2021.

Officers

GEBCO Guiding Committee:

Chair: Mr Shin Tani (Japan – IHO) until January 2021

Chair: Mr Evert Flier (Norway – IHO) from January 2021

Vice-Chair: Professor Martin Jakobsson (Sweden – IOC) until January 2021

Vice-Chair: Dr Marzia Rovere (Italy – IOC) from January 2021

Permanent Secretary: Mr David Wyatt (IHO)

Sub-Committee on Undersea Feature Names (SCUFN):

Chair: Dr Hyun-Chul Han (Republic of Korea – IOC)

Vice-Chair: Dr Yasuhiko Ohara (Japan – IHO)

Technical Sub-Committee on Ocean Mapping (TSCOM):

Chair: Dr Thierry Schmitt (France)

Vice-Chair: Ms Caitlyn Raines (USA)

Sub-Committee on Regional Undersea Mapping (SCRUM):

Chair: Dr Vicki Ferrini (USA)

Vice-Chair: Ms Pauline Weatherall (UK) until November 2019

Vice-Chair: Ms Aileen Bohan (Ireland) from November 2019

Sub-Committee on Communications, Outreach and Public Engagement (SCOPE):

Chair: Professor Hyo Hyun Sung (Republic of Korea)

Co-Vice-Chair: Professor Eunmi Chang (Republic of Korea) from November 2019

Co-Vice-Chair: Mr Timothy Kearns (USA) from November 2019

Introduction

GEBCO is an IHO and IOC Programme, which is guided by the Joint IHO-IOC Guiding Committee for GEBCO, made up of representatives from both IHO and IOC and is 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) and the Sub-Committee on Communications, Outreach and Public Engagement (SCOPE). Additional ad hoc working groups are convened as necessary. Through the work of its organs, 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, the GEBCO *Gazetteer of Undersea Feature Names* and the *GEBCO Cook Book*. GEBCO maintains a comprehensive website at: http://www.gebco.net. The progress of the GEBCO programme is reported below.

GEBCO started in 1903 and will likely continue after 2030. Whereas the GEBCO programme through its long history and until recently has been referred to as the GEBCO project, it makes sense to start referring to it as the GEBCO programme.

During the period cover by this report, a continuing and growing interest in the health and status of the oceans by many governments, international and philanthropic organizations and by the public more generally has been maintained. The current heightened awareness and global focus on the ocean and related topics resulting from a number of high profile initiatives, such as UN's 2030 Agenda for Sustainable Development Goals, The Paris Agreement under the UN Framework Convention on Climate Change, The Sendai Framework for Disaster Risk Reduction 2015–2030 and the UN Decade of Ocean Science for Sustainable Development (2021–2030), have all highlighted the lack of comprehensive global bathymetric coverage, which is recognised as a fundamental element to achieve the goals of these initiatives. The Nippon Foundation-GEBCO Seabed 2030 Project (Seabed 2030), which became operational in February 2018, has been at the forefront of this focus. Seabed 2030 has created a global movement to search out new datasets to be added to the currently available bathymetry with the IHO DCDB being identified as the preferred data store. The long-running GEBCO programme, previously rarely mentioned or recognised by the participants in any of the above related activities, has benefited from this raised awareness and focus, which has been further highlighted by the publication of the 15 arc second GEBCO_2019 grid as the first tangible result of the Seabed 2030 Project.

Meetings of relevant GEBCO bodies

GEBCO Guiding Committee

The 36th meeting of the GEBCO Guiding Committee (GGC) was held in Portsmouth, New Hampshire, United States of America, from 7 to 8 November 2019 and the 37th meeting of the GEBCO Guiding Committee (GGC) was held as a remote virtual meeting from 18 to 20 January 2021. Both meetings were chaired by Mr Shin Tani.

At its 36th meeting, the GGC received brief reports from its Sub-Committees and Working Groups and endorsed the work which they had undertaken. The GGC also received reports from key personnel performing functions on behalf of GEBCO as well as reports from its parent bodies - IHO and IOC, on activities since the previous meeting.

The Chair of the Sub-Committee on Undersea Feature Names (SCUFN) reported on an automatic discovery process for undersea features. He noted that this year was the first year that supporting data had been provided to the DCDB by states proposing feature names. He requested guidance on how the SCUFN should consider feature name proposals that were not visible on a ≥ 1:1 000 000 scale map. After detailed consideration, the GGC agreed that the use of the variable depth resolution approach with a provision for Polar Regions should be employed, which would align with the future GEBCO grid product.

The GGC considered outreach and ways to raise the profile of the GEBCO programme among the different stakeholder and user communities, including the IHO and the IOC Member States, the maritime and scientific community and the general public. The GGC reviewed the draft communications strategy and approved SCOPE to commence work in line with the proposed strategy. The GGC devoted considerable time on discussions on the Seabed 2030 Project. The acting Seabed 2030 Project Director provided a comprehensive presentation on the activities of the Seabed 2030 Project Team and the Regional Centres. The GGC reviewed a proposed GEBCO Funding Strategy, as well as reviewing the Year 2 Seabed 2030 Project report and the proposed Year 3 Project Work Plan and both were endorsed after inclusion of some amendments and recommendations. He highlighted the recent appointment of the Director, Mr Jamie McMichael-Philips, who who took up his post on 1 December 2019.

The GGC also reviewed its current financial situation in relation to proposed planned projects. The Committee addressed the budget submissions from its subordinate bodies and approved revised allocations to ensure a suitable contingency balance was maintained for 2020 to cover emergent items. The draft consolidated GEBCO Work Plan and budget was reported to the 13th meeting of the IHO Inter-Regional Coordination Committee (IRCC) and the 53rd session of the IOC Executive Council, for consideration and endorsement of the parent organizations.

The GGC reviewed the state of membership and it was noted that one IOC appointed member had not attended for a second meeting. It was agreed that the Chair would investigate the membership status in collaboration with the IOC Secretariat.

At its 37th meeting, the GGC received brief reports from its Sub-Committees and Working Groups and endorsed the work which they had undertaken. The GGC also received reports from key personnel performing functions on behalf of GEBCO as well as reports from its parent bodies, IHO and IOC, on activities since the previous meeting.

The GGC considered outreach and ways to raise the profile of the GEBCO programme among the different stakeholder and user communities, including the IHO and the IOC Member States, the maritime and scientific communities and the general public. The GGC reviewed the communications strategy and approved SCOPE to continue its work in line with the strategy. The GGC devoted considerable time on discussions on the Seabed 2030 Project. The Seabed 2030 Project Director provided a comprehensive presentation on the activities of the Seabed 2030 Project Team and the Regional Centres. The GGC reviewed a proposed GEBCO Funding Strategy, as well as reviewing the Year 3 Seabed 2030 Project report and the proposed Year 4 Project Work Plan and both were endorsed after some clarifications and recommendations.

The GGC has started work on a GEBCO wide Code of Conduct in order to ensure procedures are in place to address potential conflicts of interest should they arise.

The GGC also reviewed its current financial situation in relation to proposed planned projects. The Committee addressed the budget submissions from its subordinate bodies and approved the proposed allocations. The draft consolidated GEBCO Work Plan and budget will be reported to the 13th meeting of the IHO Inter-Regional Coordination Committee (IRCC) and the 31st session of the IOC Assembly, for consideration and endorsement of the parent organizations.

The GGC reviewed the state of membership and it was noted that there were two IOC appointed vacancies with the cancellation of one appointment and the declaration than Dr Johnathan Kool (Australia) would not be seeking a second five-year term. The IOC has selected Kim Picard from Australia and CDR Prashant Srivastava from India to the GEBCO Guiding Committee. Besides, one of the GGC IHO appointed members' position will become vacant on 1 September 2021. With the IHO CL 17/2021 dated 21 April 2021, IHO Member States are therefore requested to consider nominating suitable experts to fill the resulting vacancy.

A virtual intersessional GEBCO Guiding Committee meeting is planned to take place 26 and 27 May to monitor and discuss workplans and other relevant issues. Agenda items will include a plan to establish a sub-committee on Education and Training (SCET), to coordinate the GEBCO Programme engagement with the numerous academic institutions offering Ocean Mapping related courses globally and from which the GEBCO does and could benefit, and a GEBCO strategic fundraising plan on opportunities for sponsoring of future ocean mapping activities.

The GEBCO Secretary, Mr David Wyatt (IHO), advised the GGC that he would completing his term at the IHO Secretariat at the end of September and therefore GGC37 would be his final meeting as GEBCO Secretary, which also coincided with completion of his five-year appointment as GEBCO Secretary. The GGC requested the IHO Secretariat continued to provide secretarial support to the GEBCO programme.

As a result of the completion of the terms of the current Chair and Vice-Chair and the confirmation that the current Vice-Chair would not be seeking to step-up to the Chair position, elections were held for both positions. The GGC unanimously elected Mr Evert Flier (IHO-Norway) as Chair and Dr Marzia Rovere (IOC-Italy) as Vice-Chair for the next triennium.

Technical Sub-Committee on Ocean Mapping (TSCOM), Sub-Committee on Regional Undersea Mapping (SCRUM) and the Sub-Committee on Communications, Outreach and Public Engagement (SCOPE)

The GEBCO Technical Sub‑Committee on Ocean Mapping (TSCOM), the Sub‑Committee on Regional Undersea Mapping (SCRUM) and the Sub-Committee on Communications, Outreach and Public Engagement (SCOPE) held joint meetings from 4 to 5 November 2019 and 15 January 2021 with the individual Sub-Committees holding two separate sessions each in the period 11 to 14 January 2021. The meetings were chaired by Dr Thierry Schmitt (France, Chair of TSCOM), Dr Vicki Ferrini (USA, Chair of SCRUM) and Professor Hyo Hyun Sung (Republic of Korea, Chair of SCOPE).

At the 2019 meetings, the initial sessions covered a number of topics relevant to TSCOM and SCRUM, including an update brief by the Director of the IHO Data Centre for Digital Bathymetry (DCDB) and the Chair of the Crowdsourced Bathymetry Working Group (CSBWG), which highlighted recent developments, current projects and future considerations. A comprehensive brief on the Seabed 2030 structure and the activities of the Regional Data Centres were received. A number of new applications were demonstrated, including the Arctic App and the Meso-American and Caribbean Sea Hydrographic Commission (MACHC) Discovery App, both of which greatly assist in gaining a better knowledge of data availability within the applicable region.

The new metadata working group (MWG) chaired by Federica Foglini (Italy) was introduced showing the aims of the group and the main activities carried out during the year. The results of the questionnaire compiled by the MWG member, about the scope and the usage of Metadata for managing bathymetric data, were shown. The feedback about the Seabed 2030 proposed metadata was explained and discussed during the meeting.

A detailed brief on the B-11 – GEBCO Cookbook – was provided and a number of new chapter titles were identified as well as those existing chapters which needed to be updated. Details of the generation of the GEBCO 2019 Grid were given, in which the new data was highlighted, and the current development state for the 2020 Grid was provided.

Professor Hyo Hyun Sung, Chair SCOPE, presented a detailed update on activities, the proposed GEBCO communications, outreach and capacity building strategies and suggested activities to increase the public engagement with GEBCO and the subordinate Seabed 2030 project. The updating and improvements to the GEBCO and Seabed 2030 websites were noted and the proposal to generate a new world map version from the 2020 Grid was considered.

As a result of the increased interest in ocean mapping and the significant increase in participation at the Sub-Committee meetings and the symposium, it was proposed that a restructuring of the GEBCO

week could be considered by the GGC to allow more time to review the various activities and generate more measured future work plans and funding applications.

Over 500 attendees virtually joined the annual Map the Gaps symposium over the course of five days. More than 80% of the attendees were first time participants. The symposium convener provided an overview of the benefits and disadvantages of holding a virtual symposium, in particular the cost differential of between $2000 to $45,000-$50,000, time zone challenges and lack of interaction and networking opportunities, as well as loss of attention / focus among participants.

The Vice-Chair of SCRUM, Pauline Weatherall, advised the Chair of her desire to step down, and as a result Aileen Bohan (Ireland) was elected as Vice-Chair of SCRUM for the period 2019 to 2022.

At the 2021 meetings, TSCOM continued to investigate ways to provide technical and methodological advice in order to maintain and improve GEBCO products and supporting data. In particular a comprehensive report was received from the Chair of the Metadata Working Group, which included work on the development of the Seabed 2030 metadata schema and the engagement with the Seabed 2030 Regional Centres to review the different metadata services being employed. It was agreed that the main task should be to harmonise the different metadata schemas and provide input to B-11 - GEBCO Cookbook. The Chair of the GEBCO Cookbook Working Group reported on the ongoing investigation on how best to transform the current format into a suitable e-Publication format, for which contract professional assistance may be required. The Sub-Committee agreed to disband the Cookbook Working Group and establish a Cookbook Editorial Board under the leadership of the Dr Karen Marks, the current Chair of the Cookbook Working Group.

The Sub-Committee also received a progress report on the GEBCO website development work and confirmation that all International Bathymetric Chart (IBC) pages and the GEBCO community contact list had been transferred successfully from the IHO Data Centre for Digital Bathymetry (DCDB) website. A brief was given on the further development of the GEBCO grid reviewing application as a result of the feedback received. Updates on the production of the annual GEBCO grid and the ongoing developments of the IHO DCDB were followed by a demonstration of a prototype Track Planning application and an explanation on the integration of the Shuttle Radar Topography Mission (SRTM) data into the GEBCO grid.

SCRUM continued to liaise, engage and cooperate with all existing regional mapping efforts relevant to GEBCO products, to foster coordination between relevant regional bathymetric mapping projects and the IHO Data Center for Digital Bathymetry (IHO DCDB) to capture, for long-term archive, the bathymetric data used by these projects and to encourage the establishment of new IHO/IOC regional bathymetric mapping projects to fill current gaps in global bathymetry. In particular reports on progress from the groups involved with the IBC for the Arctic Ocean (IBCAO), the IBC of the Southern Ocean (IBCSO) and the IBC of the Caribbean Sea and the Gulf of Mexico (IBCCA) were received, all of which included increases in percentage coverage due to the receipt of additional data.

The engagement with the IHO Crowdsourced Bathymetry Working Group (CSBWG) and the various Regional Hydrographic Commissions were noted and a number of regional projects and initiatives were highlighted, including AusSeabed and work with the Schmidt Ocean Institute vessel RV Falkor around the Australian coast, various projects in Canada and an initiative to restart the South East Pacific Bathymetric Chart through collaboration between the South East Pacific Regional Hydrographic Commission (SEPRHC) member states. Activities in China, Ireland, USA and Europe under the European Marine Observation and Data Network (EMODnet) were presented.

SCOPE continued to support the external relations and communications efforts of GEBCO by developing and advising on communications strategies, developing and reviewing material, and identifying opportunities for engagement with GEBCO's diverse community of stakeholders, to foster coordination and consistency across the external relations and communication activities of IHO-IOC GEBCO sub-committees and projects and to identify the current issues related to the potential usage

of GEBCO products and generate publicity. In particular progress on the finalisation of the communication strategy was noted.

The Sub-Committee discussed various elements related to communication and outreach including the development of a generic presentation template and GEBCO slide deck, the current GEBCO Map Production Principles, which it was agreed were in need of review and revision, the need to manage on a full time basis the GEBCO social network presence, the SCOPE website and how to transfer the contents into the main GEBCO website. A proposal to update the IHO publication B-10 - History of GEBCO - in time for the 120th anniversary of GEBCO in 2023 was presented. Initial statistics and analysis of the GEBCO Map the Gaps symposium were provided and the advantages and disadvantages of the online format were discussed.

During the Joint Sub-Committees session, the Work Plans and budget resource bids were discussed; in particular the various tasks and actions identified during the individual sessions were discussed and prioritised. It was proposed to hold the GEBCO week for the Sub-Committees and the Symposium in late October/early November, with the Symposium containing a virtual element to maintain the broad participation at all career levels, which was evident for the solely online version this time. The exact dates and location will be published on the IHO, IOC, GEBCO and Map the Gaps websites when confirmed.

Sub-Committee on Undersea Feature Names (SCUFN)

SCUFN is tasked with selecting the names of undersea features to appear in the products of the GEBCO programme and on international nautical charts. These names, widely used in scientific publications also, are made available in the GEBCO Gazetteer of Undersea Features Names (www.gebco.net > Data and products > Undersea feature names > view and download).

The 32nd meeting of the IHO-IOC GEBCO Sub-Committee on Undersea Feature Names (SCUFN) was hosted by the Royal Malaysian Navy and Petronas in Kuala Lumpur, Malaysia, from 5 to 9 August 2019. The meeting, chaired by Dr Hyun-Chul Han (IOC representative) from the Korea Institute of Geoscience and Mineral Resources (KIGAM – ROK), was attended by 28 registered participants, which considered of eleven of the 12 SCUFN members (six IOC and five IHO representatives) and 17 observers, including Vice-Admiral (Ret.) Shin Tani, Chair of the GEBCO Guiding Committee, Mr Tetsushi Komatsu (IOC Secretariat), Marine Regions and representatives of NOAA and KHOA in charge of the integration of SCUFN operational web services and GEBCO Gazetteer were also present. Assistant Director Yves Guillam (SCUFN Secretary) represented the IHO Secretariat.

The meeting was opened by Senator Liew Chin Tong, Deputy Minister of Defence (Malaysia). Sen Tong was joined by Vice Admiral Datuk Khairul Anuar bin Yahya, Deputy Chief of Royal Malaysian Navy, Rear Admiral Hanafiah bin Hassan, Chief Hydrographer of Malaysia and Ms Zuhaidah Binti Zulkifli, Senior General Manager, Governance and Strategic Relationships, Malaysia Petroleum Management (MPM), PETRONAS. Sen Tong stressed the importance of the work of SCUFN and called for multilateralism in order to achieve progress amidst a setting of disputes and escalating interest in maritime issues, especially in Southeast Asia. A specially-prepared montage video was shown as part of the event and mementos were presented to the SCUFN Members.

The Sub-Committee considered proposals for 187 undersea feature names, submitted by various bodies and supporting organizations from Argentina (2), Ascension - St Helena (1), Brazil (15), China (35), Germany (1), Japan (52), Japan together with USA (9), Malaysia (2), Philippines (37), Republic of Korea (3), Republic of Palau (11), New Zealand (18) and (1).

Thanks to the increasing quality of submissions, a large number of the names proposed to the Sub-Committee were accepted in a very efficient and speedy manner, under the Chairmanship of Dr Han who made the best of the outcome of the pre-review made by SCUFN members through the https://scufn.ops-webservices.kr/ assessment interface. SCUFN thanked the NOAA representative

for the major enhancements made recently in the GEBCO Gazetteer as well as KHOA representatives for the development of the integration of different SCUFN web services. The general principles of this integration, depicted in the diagram below, were agreed and the full integration aiming to avoid duplication and make the whole process much more efficient, is expected within two years.

In addition to the analysis of naming proposals, the Sub-Committee considered several "corporate" issues, including:

- The first comments received through the voting procedure by the IHO Member States for the adoption of the new edition 4.2.0 of B-6 that includes pragmatic suggestions on the release of associated bathymetric data to the IHO Digital Centre for Digital Bathymetric;

- The importance of multilateral consultations between proposers prior to SCUFN meetings when the feature may be located in areas of mutual interests, such as the South China Sea, otherwise some coastal States will never be in a position to make naming proposals if these cases are systematically categorized as being "politically sensitive" in accordance with SCUFN Rules of Procedures 2.10.

SCUFN noted the statements made by some coastal States by which they wish to be kept informed of the proposals located in their areas of jurisdiction.

SCUFN also agreed on the need to pursue the development of a general strategy and possible guidelines defining the optimal horizontal resolution between undersea features that are eligible for naming. Several objectives need to be considered for this task:

- the consequences of the development of GIS tools (by Canada for instance) able to discover features automatically, as long as the generic term definitions become more geometrically robust, a task which is in the scope of the Undersea Feature Names Project Team and the Generic Term Sub-Group;

- clutter reduction;

- the categorization minor features that can be now unveiled by new sensors technologies.

The 33rd meeting of the IHO-IOC GEBCO Sub-Committee on Undersea Feature Names (SCUFN) initially scheduled in Saint Petersburg, Russian Federation, was re-arranged by video teleconference (VTC) from 9 to 10 November 2020 due to the Covid-19 pandemic.

The meeting, chaired by Dr Hyun-Chul Han (IOC representative) from the Korean Institute of Geoscience and Mineral Resources (KIGAM – ROK), was attended by 30 registered participants, which consisted of eleven of the 12 SCUFN members (five IOC and six IHO representatives) and 17 observers, including Mr Evert Flier, Member of the GEBCO Guiding Committee (GGC), Marine Regions and representatives of Brazil, Canada, Chile, Colombia, India, Indonesia, Malaysia, Russian Federation and Viet Nam. Representatives of NOAA (USA) and KHOA (ROK) in charge of the development and integration of SCUFN operational web services and GEBCO Gazetteer were also present. A special "Questions & Answers" session was arranged after the closure of the meeting on request of Ms Laura Trethewey, an ocean journalist and writer. Director Luigi Sinapi and Assistant Director Yves Guillam (SCUFN Secretary) represented the IHO Secretariat.

The meeting was opened by the Chair who welcomed two new SCUFN Members: Dr Marie-Françoise Lequentrec-Lalancette (France, IHO parent organization) and Prof. Millard Coffin (Australia, IHO parent organization). This opening was followed by IHO Director Luigi Sinapi's who stressed the importance of SCUFN role and activities in particular in the context of the United Nations Decade of Ocean Science for Sustainable Development, inviting SCUFN at its own level, to transform the *Ocean we have* to the *Ocean we want*.

The Chair reported on the directions given a year ago to SCUFN at the last GEBCO Guiding Committee meeting. For the benefit of new Members and Observers, he also gave an "introduction course" on the on-line review process. Despite the VTC format of the meeting, the Sub-Committee was able to consider proposals for 35 undersea feature names, submitted by various bodies and supporting organizations from: Australia (6), Germany (15 +1), the Russian Federation (1) and the United Kingdom (12).

Thanks to the pre-review made by SCUFN members through the scufn.ops-webservices.kr assessment interface, the VTC process led by the Chair was efficient enough to approve 16 names. Most of the other names were kept with the PENDING statute for reasons often encountered in SCUFN meetings: lack of good bathymetric data, absence of mutual consultation between proposer and national naming boards in some specific areas.

The Sub-Committee also considered several "corporate" issues during the meeting:

- The SCUFN Secretary confirmed that the list of national naming authorities that wish to be consulted with features in their areas of interest was maintained on request and available on the SCUFN webpage;

- SCUFN thanked the NOAA representative for the last new release of the GEBCO Gazetteer which incorporates major enhancements;

- KHOA representatives gave an overview of the actions supporting the development of different SCUFN web services. Even if the transition is not completed yet, SCUFN commended KHOA for their sustainable commitment before the operational commissioning expected in 4 years. In addition to a repository of generic terms and to "*scufnsubmission"* and "*scufnreview"* web services, this project was requested in 2020 to consider additional requirements for a true SCUFN Digital Archive (meeting reports and associated documents, proposals, data..) from SCGN-01 (1975) until now aiming to replace the current data on the former IHO website if the supporting servers are no longer maintained;

- The development of more detailed internal guidelines which cover several criteria (dimensions, depth, steepness and length to width ratio) that are used to help classify the morphological shape and hence identify the correct Generic Term.

Following the general guidance provided by the GGC, the Sub-Committee agreed on the need to further develop a general strategy and possible guidelines defining the optimal horizontal resolution between undersea features that are eligible for naming. The following general principles were agreed:

"The areal size of an undersea feature should generally be identified on the GEBCO gridded bathymetric map between 60 S and 60 N and in the IBCSO and IBCAO maps below respective above these latitudes. Features not shown at these gridded bathymetric maps, it should be an important landmark of science or hydrography" …

…to which Mr Kevin Mackay, SCUFN Member and Head of Seabed 2030 South and West Pacific Ocean Regional Center, agreed to add some annexes depicting the bathymetric grid resolutions targets around the world. This objective was noted by Ms Anna Hendi, Chair of the Undersea Feature Names Project Team (UFN PT) who leads the development of S-100 compliant UFN datasets and a national project for Canada on the automated detection of undersea features.

At the end of the meeting, the need to arrange a couple of extra special VTC sessions in January and June 2021 prior to the next formal meeting was agreed in order to clear a back log of accumulated proposals (more than 130) already received by the SCUFN Secretariat.

The 34th meeting of the IHO-IOC Sub-Committee on Undersea Feature Names (SCUFN) was held by video teleconference (VTC) on the 7th of January 2021 due to the COVID19 pandemic.

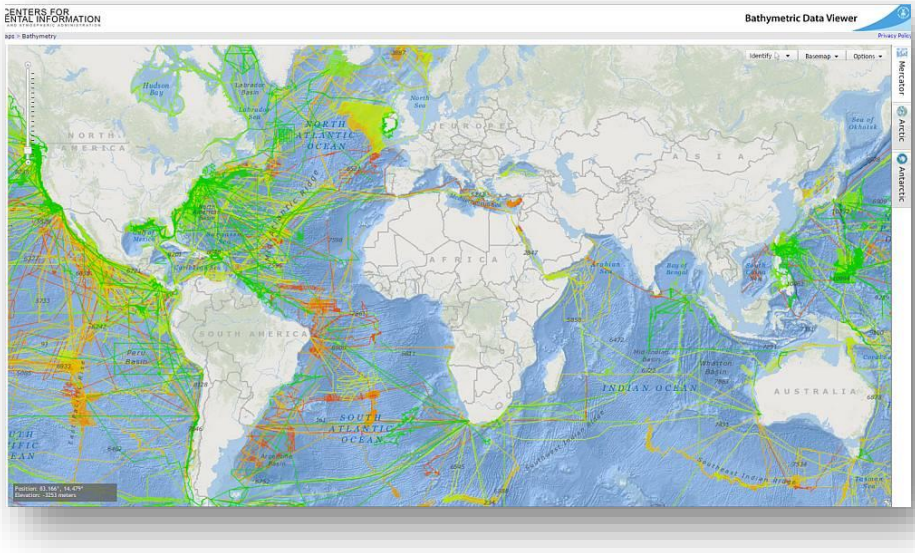
The meeting, chaired by Dr Hyun-Chul Han (IOC representative) from the Korean Institute of Geoscience and Mineral Resources (KIGAM – ROK), was attended by 29 registered participants, which consisted of eleven of the 12 SCUFN members (four IOC and six IHO representatives) and 16 observers, including Mr Evert Flier, Chair of the GEBCO Guiding Committee (GGC), Marine Regions and representatives of Brazil, Canada, Chile, India, Malaysia, Portugal and Viet Nam. Representatives of KHOA (ROK) in charge of the development and integration of SCUFN operational web services were also present. Director Luigi Sinapi and Assistant Director Yves Guillam (SCUFN Secretary) represented the IHO Secretariat.

The Sub-Committee was able to consider proposals for 150 undersea feature names, submitted by various bodies and supporting organizations from: Canada (2+12), Republic of Korea (3), China (13), New Zealand (12+3), Viet Nam (70), Malaysia (11), Brazil (15+1), Russian Federation (2), Chile (1), US (1) and Serbia (4). Thanks to the pre-review made by SCUFN members through the scufn.ops-webservices.kr assessment interface, the VTC process led by the Chair was efficient enough to approve 51 names. Most of the other names were kept with the PENDING statute for reasons often encountered in SCUFN meetings: lack of good bathymetric data, absence of mutual consultation between proposer and national naming boards in some specific areas.

The Sub-Committee is also planned to have another VTC meeting on the 7th of June and will discuss the possibility of face to face meeting at Saint Petersburg this November.

Operation of IHO Data Centre for Digital Bathymetry

Since its inception, the IHO Data Centre for Digital Bathymetry (DCDB) has become a prominent repository of digital oceanic bathymetry and is used by IHO Member States and other ocean science communities. The IHO DCDB facility is generously hosted by the National Oceanic and Atmospheric Administration (USA) on behalf of the IHO Member States.



IHO DCDB Web Map Interface

The IHO DCDB data store contains oceanic soundings that have been acquired by hydrographic, oceanographic, and other vessels during surveys or while on passage. These data are used for the production of improved and more comprehensive bathymetric maps and grids, particularly in support of the GEBCO programme. Bathymetric data located at the IHO DCDB can be viewed/filtered via a web map interface, and freely downloaded. The map interface can be accessed from: https://maps.ngdc.noaa.gov/viewers/iho_dcdb/

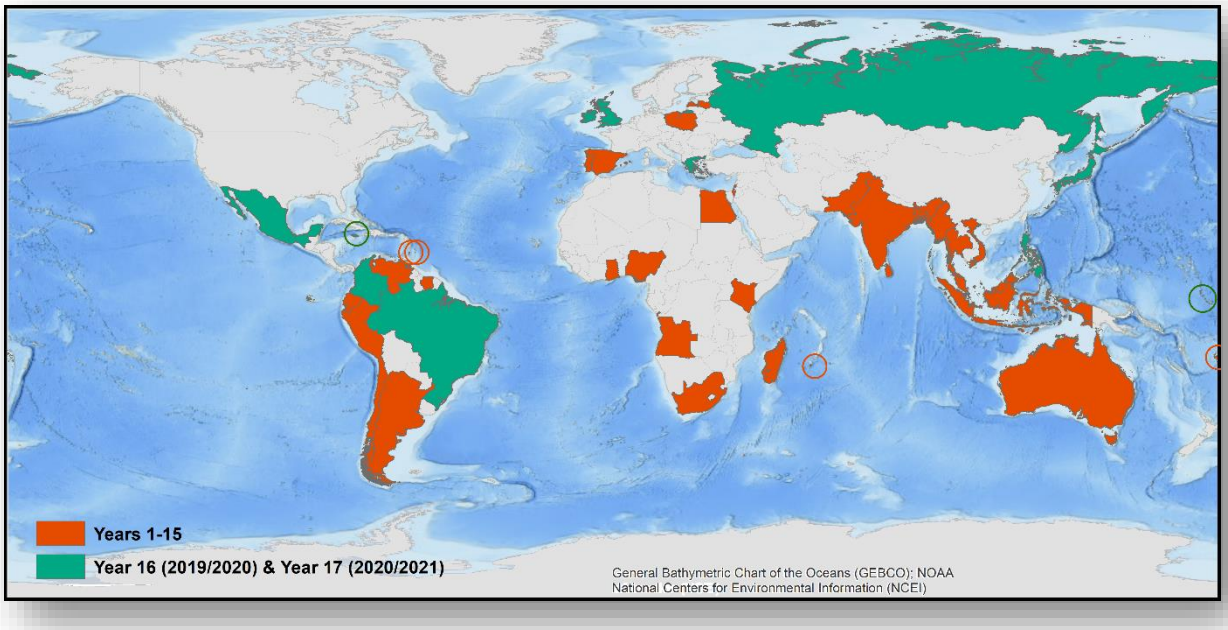
Contribution of bathymetric data to the IHO DCDB

The GEBCO Ocean mapping programme is dependent upon the availability of bathymetric data. In order to achieve its goals, GEBCO actively encourages data contributions from the bathymetric community. In 2020, GEBCO, in collaboration with the DCDB, stood up a new Data Contribution webpage (gebco.net/about_us/contributing_data/) to simplify the answer to the often-asked question, “how can I contribute data?” GEBCO has also worked towards improving its participation in regional mapping activities by attending most IHO Regional Hydrographic Commission (RHC) meetings.

Traditionally GEBCO has focused on areas deeper than 200 m, however, its focus has expanded to data gathering in shallow water areas to support activities such as coastal zone management and the mitigation of seaborne disasters such as storm surges and tsunami inundation. IHO Member States are encouraged to contribute bathymetric data in shallower coastal areas to support the production of higher resolution gridded data products and to complete the GEBCO grid coverage.

GEBCO Training Programme

The Nippon Foundation / GEBCO Training Programme leading to a Graduate Certificate in Ocean Mapping from the University of New Hampshire continues to be funded by the Nippon Foundation, with funds for Year 18 (2021/2022) confirmed in March 2021. The Training Programme at the Center for Coastal and Ocean Mapping/Joint Hydrographic Center has produced 102 alumni from 43 coastal states to date. These alumni continue to take home their gained knowledge to build skills in their home organizations and beyond.



Distribution of Alumni of the Nippon Foundation / GEBCO Training Programme

The GEBCO-Nippon Foundation Alumni Team, a team led by alumni of the Nippon Foundation / GEBCO Training Programme, were declared grand prize winners of the Shell Ocean Discovery XPRIZE in May 2019. Following this success, the alumni continue to self-organize themselves underneath the Map the Gaps non-profit in order to do work around the world and grow their skills and to support each other, as well as GEBCO and Seabed 2030 projects.

Seabed 2030 Project

The Nippon Foundation-GEBCO Seabed 2030 Project (Seabed 2030) is now in its 4th year of operation. For a significant part of the reporting period, much activity has been undertaken whilst set against the global backdrop and challenges of the COVID global pandemic; and has allowed a demonstration of the true resilience of the geographically dispersed Project Team members who have shown real strength in overcoming the disruption of remote working to provide continuity of activities across the majority of work streams.

Previously in October 2019, the Project facilitated a successful Vision to Action event at the Royal Society in London. Here a wide variety of stakeholders, supporters and senior leaders came together in the presence of The Nippon Foundation Chairman to focus on the future of Seabed 2030. Chairman Sasakawa announced three initiatives to support increased data acquisition through collaboration in the fields of Ocean Frontier Mapping (OFM), Crowd Sourced Bathymetry (CSB), and innovation. The event also provided a platform to announce the appointment of the new Director who assumed duties in December 2019.

Team members, supported by others within the GEBCO community, have been able to participate in a large number of national and international fora at all levels: in person in the early part of the reporting period; and, in spite of COVID-related disruption, at virtual events in the latter part. Complementing these engagement opportunities, and within a revised Project Media Strategy, there has been an increase in publication of material across mainstream and social media channels, and within the period newsletter. Overall, this has allowed the Seabed 2030 message to be broadcast, calls for action to be made, and industry and technical engagement to take place thus maintaining the engagement theme, amongst an extensive network of partners, contributors and supporters. An additional, and important, engagement strand has been the launch of Community Survey to seek user views that will allow the Project to better collate and quantify the value and benefits of seabed mapping and to identify user-defined priority areas. Again, this has further raised awareness of Seabed 2030 across a wider of community of organisations and individuals that use geospatial data. First launched in mid-2020, the survey recorded input from some 366 respondents, a number of whom had data to contribute. Based on this success, it was launched for a second time in February 2021 and will run for 5 months.

As part of investment in incremental mapping days within an externally-sponsored and wider scientific project, Seabed 2030 provided support to the very successful Ryder 2019 Expedition in northernmost Greenland. Bathymetry was contributed to the GEBCO Grid. Building on this Ocean Frontier Mapping success, Seabed 2030 has partnered in separate mapping activities, in the Atlantic and Pacific Oceans, with Seakit, Saildrone and Caladan Oceanic; benefitting in new data acquisition either via incremental mapping days or provision of sonar operators (where none exist onboard) for transit legs. These activities, generously offered by Seabed 2030 partners, cannot replace the mission-essential need for wholesale wide-area surveys in remote regions. However, they do deliver a hugely cost- effective method of gathering discrete quantities of important data in otherwise unmapped areas.

Separately but related, the Project is proud to be associated with the Schmidt Ocean Institute, and the work of Research Vessel FALKOR, that collected the first public seafloor data of 2021 in support of Seabed 2030 and the UN Decade of Ocean Science. The Project has also had significant transit bathymetry contributions from key industry partners including Fugro and PGS.

To encourage collaboration in CSB, and working closely with IHO's DCDB and other IHO experts, the Project has rolled out a number of data loggers in Greenland, Palau and South Africa. This is to demonstrate the ease and utility of gathering such data and also to encourage wider participation in collection. The activity is greatly reliant not only on the goodwill of those marine stakeholders who have offered to embark the loggers but also on the support of key country stakeholders who will engage with vessel operators, oversee the rollout and assist in the subsequent harvesting of data.

Innovation strategy work is still ongoing and the Team has been active in engaging across a broad sector of technical stakeholders to determine future areas of collaboration and opportunity. In addition to collection of data and gridding, focus areas also include use of web services for handling big data. Within the Project, innovative work has seen development of a new statistics tools that allow a speedier and even more accurate assessment of mapping progress.

The value of the Nippon Foundation-GEBCO Training Programme Alumni to the field of ocean mapping, and more specifically to Seabed 2030, is widely recognised. There has been extensive discussion on ways of involving individuals within the Project and some have already been greatly involved out Ocean Frontier Mapping activities. Work is well advanced to establish a new post within the Project that will deliver a comprehensive plan that utilizes the skills and experience of members of the Alumni to support a wide range of Seabed 2030 activities.

Invaluable work pioneered by the Centres Heads has continued apace on a range of work that includes the publication of IBCAO v4.0; progression of IBCSO v2.0 revisions; and leveraging tools to improve multibeam integration. Development and subsequent delivery of a new type identifier (TID) grid was a significant achievement; as was delivery of the download app which has resulted in a 10-fold increase in user download requests in 2020. In addition to the technical skills, experience and gravitas required to do the job and to represent Seabed 2030, the Centre Teams have significant expertise in engagement and have well developed, and increasing, networks of contacts and contributors that continue to support the Project. DCDB continues to strongly support the Project not only in CSB field trials but also with crucial data ingestion and improvements in the data submission process.

Whilst much crucial work happens behind the scenes at the Centres, the most acclaimed and visible output has been publication of the GEBCO Grids. Within this reporting period, the 2019 GEBCO Grid release saw an increase from 6% to 15 % of ocean floor mapped. This was followed a year later by delivery of the 2020 GEBCO Grid with almost one fifth, or 19%, of the world ocean floor now mapped. It is worthy of note that a large proportion of data contributed was already archived but had yet to be incorporated in the Grid. Whilst there have been “newly gathered data” contributions in both 2019 and 2020, there is still much more to be gathered to achieve the 2030 Mission. On current assumptions, the forecast for the 2021 Grid release will be around 21% of ocean mapped.

Collaborative work and professionalism are evident amongst the Team and, the Project continues to receive the welcome leadership and support from The Nippon Foundation, GEBCO, IHO and IOC. Without losing sight of the huge resource implications in achieving the mission to deliver 100% mapping of the seabed by the year 2030, Seabed 2030 is well placed to continue work that supports UN Sustainable Development Goal 14 and is a programme within the UN Decade of Ocean Science for which it is a foundational pillar.

Bathymetric publications

B-4: Information concerning recent bathymetric data

Since 1990, the IHO DCDB is a recognized international repository for all deep ocean bathymetric data (greater than 100 m) collected by hydrographic, oceanographic and other vessels. For the last several years, the DCDB has also become the international repository for crowdsourced bathymetric data (CSB). CSB is defined as is the collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations. CSB can be used to supplement the more rigorous and scientific bathymetric coverage done by hydrographic offices, industry, and researchers around the world.

These data can be viewed and accessed from: maps.ngdc.noaa.gov/viewers/iho_dcdb/.

The DCDB data are publically available and used for the production of improved and more comprehensive bathymetric maps and grids, particularly in support of the GEBCO Ocean Mapping Programme.

B-6: Standardization of undersea feature names

Edition 4.2.0 of Publication B-6 on the Standardization of Undersea Feature Names entered into force in October 2019. This publication provides guidelines for naming features, a naming proposal form and a list of generic terms with definitions with significant clarifications and improvements compared to the previous Edition that was issued in 2013. The work continues within SCUFN to improve the geometric parameters of some specific features (Seamount versus Ridge for instance) but nothing is mature enough to move to another Edition of B-6 yet.

Following the general guidance provided by the GGC, SCUFN confirmed the need in 2020 to further develop a general strategy and possible guidelines defining the optimal horizontal resolution between undersea features that are eligible for naming (and also to prevent from some inflation). The following general principles were agreed:

"*The areal size of an undersea feature should generally be identified on the GEBCO gridded bathymetric map between 60°S and 60°N and in the IBCSO and IBCAO maps below respective above these latitudes. Features not shown at these gridded bathymetric maps, it should be an important landmark of science or hydrography*" …

A policy paper is to be drafted and the rules experimented. This document will define the current resolution of the GEBCO gridded product and the future goal of the gridded product as it moves towards a variable resolution, as a supportive action to GEBCO and Seabed 2030 Project.

B-8: GEBCO Gazetteer of Undersea Feature Names

The database of the on-line GEBCO Gazetteer of Undersea Feature Names, developed by the IHO DCDB (co-located at one of the US National Centers for Environmental Information (NCEI), NOAA), was maintained by the IHO Secretariat through contract support. Some maintenance issues were fixed in 2019 by the NOAA, USA.

In 2020, all outstanding issues identified mainly by the SCUFN Secretariat were addressed by NOAA in a version 4.2.0 of the GEBCO Gazetteer. Plans were made to develop a new version 5.0 in spring 2021 aiming to integrate, through an API, NOAA and KHOA SCUFN web services. KHOA also prepared the development of a repository where all SCUFN Data Archive will be stored in the future; the migration is planned from the IHO website to the new repository, after experimentations to be conducted in 2021.

B-9: GEBCO Digital Atlas

IHO publication B-9 - GEBCO Digital Atlas (GDA) is currently outdated and will be replaced by a new publication describing the GEBCO global gridded product and the GEBCO Grid Web Map Services.

B-10: History of GEBCO

The history of GEBCO was published in 2003 to celebrate 100 years of GEBCO. SCOPE has started the work on updating the GEBCO history for its 120-year celebration in 2023.

B-11: IOC Manuals and Guides, 63 - GEBCO Cook Book

The GEBCO Cook Book (IHO publication B-11) is a technical reference manual that has been developed to assist and encourage participation in the development of bathymetric grids. It is an important GEBCO reference document that is used by academic institutions and hydrographic

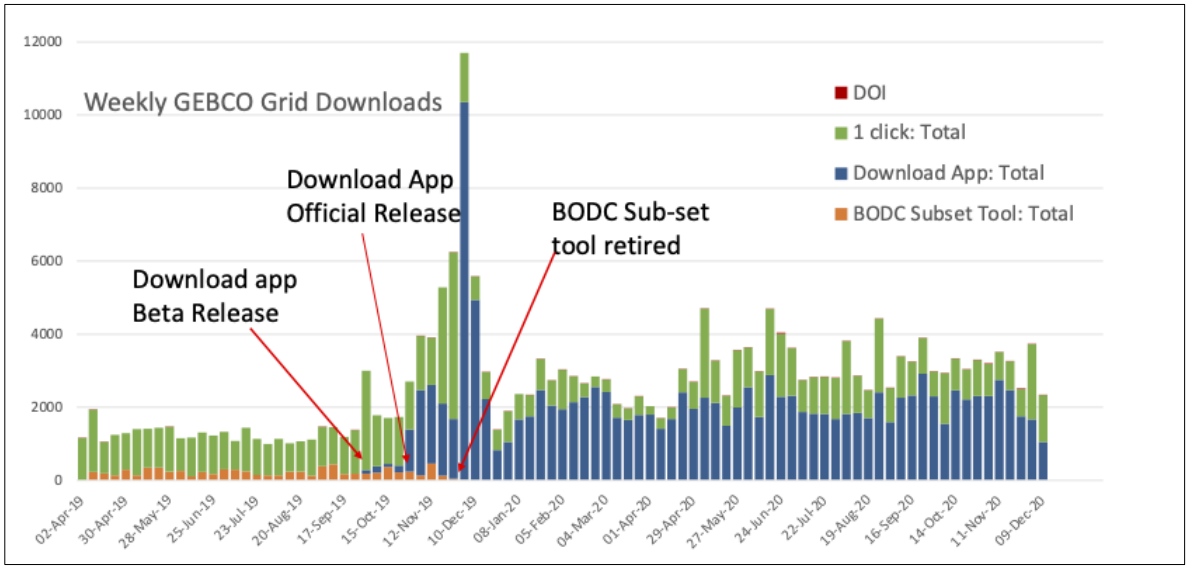
organizations. The Cook Book covers a wide range of topics such as data gathering, data cleaning, examples of gridding, and provides an overview of different software applications used for producing bathymetric grids.

The brochure was first released as IHO Publication B-11 in April 2012 and as an IOC guide document in October 2012. It is planned to convert the current pdf version into an e-Publication, which will enhance its usability, easy the maintenance task and allow for a more flexible presentation. This work is planned to be completed in 2021.

GEBCO Website

The GEBCO website provides access to information about GEBCO's products, services and activities. The website can be viewed at http://www.gebco.net. The GEBCO's website has been maintained and updated on behalf of GEBCO by the British Oceanographic Data Centre (BODC) since July 2008. The GEBCO website underwent a complete revamp in 2018, the result being a much more modern and refreshed appearance with improved links to the relevant partner websites of the IHO, IOC, DCDB and Seabed 2030.

GEBCO bathymetric maps and data sets can be downloaded from the website. These continue to be accessed by a wide user community that includes commercial and academic sectors and the general public. Utilising funding from the Seabed2030 Project, a dedicated download application has been developed. The application is hosted on a cloud server (https://download.gebco.net) to provide a sub-setting service for the GEBCO global grid. Since the introduction of this new service, there has been a three-fold increase in the total number of downloads, with more users choosing to download regional subsets, and fewer users downloading the full global grid, indicating this is a more efficient solution for most users.



There were 139,255 downloads of the full, or partial, grid between 1 October 2019 and 30 September 2020.

The GEBCO website also provides access to the world grid via a Web Map Service (WMS).