

Report of the GEBCO Guiding Committee

Submitted by: Chair

Related Documents: IHO CL 11/2016 dated 1 March 2016
 IHO CL 34/2016 dated 21 July 2016
 IHO CL 7/2017 dated 24 January 2017
 See Annex B for IHO Publications and Resolutions

Chair: Shin Tani, Japan

Vice-Chair: Martin Jakobsson, Sweden

Secretary: David Wyatt, IHO

Member States: Australia, Chile, Germany, Italy, Japan, Malaysia, New Zealand, Republic of Korea, Russian Federation, Sweden, UK, USA

Expert: Contributors:

See Annex A for full details

1. Meetings Held During Reporting Period

The 33rd meeting of the GEBCO Guiding Committee (GGC) was held in Valparaíso, Chile, from 13 to 14 October 2016; the meeting was chaired Mr Shin Tani (Japan). The GEBCO Technical Sub-Committee on Ocean Mapping (TSCOM) and the Sub-Committee on Regional Undersea Mapping (SCRUM) held a joint meeting from 10 to 11 October 2016; the meeting was co-chaired by Dr. Karen Marks (USA), (Chair of the TSCOM), and Professor Martin Jakobsson (Sweden), (Chair of the SCRUM). These meetings were followed by the GEBCO Science Day, which was held on 12 October 2016. 38 delegates participated across the five days. The Sub-Committee for Undersea Feature Names (SCUFN) held its meeting in Boulder, Colorado, 19 to 23 September 2016; the meeting was chaired by Dr Hans-Werner Schenke (Germany).

2. Work Programme

For the eleventh consecutive year, the GEBCO project organized a “Bathymetric Science Day”. The Science Day, which included a poster session and involved contributions from a pleasing number of Scholars of the Nippon Foundation ocean mapping programme, featured presentations on a diverse range of topics.

At its 33rd meeting, the Chair of the Sub-Committee on Undersea Feature Names (SCUFN) highlighted difficulties that had been experienced with regard to some submissions considered at the recent SCUFN29 meeting in Boulder, Colorado, 19-

23 September 2016. He presented some proposed revision to the SCUFN Terms of Reference (ToRs) and Rules of Procedure (RoPs), which were aimed at clarifying the procedures for future meetings so as to enable SCUFN to better consider proposals that occur in the sea area between national territorial waters and the Area Beyond National Jurisdiction. It was proposed that the texts, once adjusted, should be included in the report of the 29th meeting of SCUFN and subsequently considered for endorsement by the GGC by correspondence.

The GGC devoted considerable time to discussions on the proposed Seabed 2030 Project, including its structure, governance, oversight and reporting. The Seabed 2030 Project Establishment Team presented a draft Roadmap and Business Plan and requested GGC endorsement to continue the development of the project, including a submission to the Nippon Foundation for funding support.

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 contingency balance of 9,000€ was maintained for 2017 to cover emergent items. It was agreed the draft consolidated GEBCO Work Plan and budget will be reported to the 9th meeting of the IHO Inter-Regional Coordination Committee (IRCC) and the 29th meeting of the IOC Assembly, for consideration and endorsement, see Annex B.

It was agreed that the 34th meeting of the Committee would take place, together with meetings of TSCOM, SCRUM and the GEBCO Science Day, in Busan, Republic of Korea, during the week 13 to 17 November 2017.

3. Progress on IRCC Action Items

IRCC8 Action 28: revise the report and the accompanying presentation to properly reflect the support provided by the IHO and to remove inconsistencies (deadline: 30 June 2016).

A revised report and presentation were passed to the IRCC secretariat.

IRCC8 Action 29: invite and encourage Member States to participate in the annual GGC meetings (Permanent)

GEBCO personnel attended a number of RHC meetings during the period covered by this report. It is intended to continue this level of representation to encourage engagement with the activities of the GEBCO Project. This is anticipated to increase as the Seabed 2030 activities increase over the following years.

4. Problems Encountered

The GEBCO ocean mapping programme is dependent on the availability of bathymetric data and undersea feature information. In order to achieve its goals, GEBCO proactively collects, stores and disseminates bathymetric data for the world's oceans. GEBCO has worked towards improving its participation in regional mapping activities and has also appointed representatives to participate in selected RHC meetings.

Traditionally GEBCO has focused on areas deeper than 200m, however, it is now actively collecting data in shallower 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. See Annex C for current areas where ENC sounding data have been provided to GEBCO. Some new data was received in response to IHO CL 11/2016 dated 1 March 2016 – *Request for shallow water bathymetric data*; however the rate of contribution continues to be slow and there is a need for renewed efforts.

5. Any Other Items of Note

GEBCO continues to promote the importance of bathymetric data to the international community. A significant GEBCO annual outreach event is the annual Science Day which includes oral presentations and poster displays on topics relating to ocean-floor mapping and its applications.

In addition to the annual GEBCO Science Day, a series of meetings and workshops were held in Monaco from 15 to 17 June 2016 as part of the Forum for Future Ocean Floor Mapping. The Forum is organized by the Nippon Foundation and the General Bathymetric Chart of Oceans (GEBCO) Guiding Committee, under the joint auspices of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Organization (IOC) of UNESCO.

The Forum was preceded by the Polar Mapping Workshop held at the IHO Secretariat on 12 and 13 June 2016, at which around 40 ocean mappers, scientists, cartographers and hydrographic surveyors gathered to discuss ways to progress new editions of the International Bathymetric Chart of the Southern Ocean (IBCSO) and the International Bathymetric Chart of the Arctic (IBCA), what additional data has been gathered but is not reflected in the maps and how to obtain this additional and very useful data. The chairs of the Arctic Regional Hydrographic Commission (ARHC), Mr Denis Hains, Hydrographer-General of Canada, and the Hydrographic Commission on Antarctica (HCA), Mr Robert Ward, President of the IHB Directing Committee, gave presentations on the current state of charting and the problems that the lack of bathymetric data for the regions is causing.

The polar mapping workshop was followed by a day of briefings for graduates of the Nippon Foundation Ocean Mapping course at the University of New Hampshire, USA. Approximately 45 alumni students were welcomed to the IHO by President Robert Ward, before receiving briefings on the Forum and their role in it. Mr Yohei Sasakawa, Chairman of the Nippon Foundation, joined the alumni for part of their meeting.

The Forum opened at the Musée océanographique in Monaco with approximately 200 delegates from a wide community of participants, including hydrographers, oceanographers, cartographers, and representative from industry, science and academia. The Forum was honoured by the presence of His Serene Highness Prince Albert II of Monaco, who opened the Forum and inaugurated the associated GEBCO and Nippon Foundation posters display. During his address Mr Yohei Sasakawa

challenged the delegates to complete mapping the ocean floor by 2030. Opening addresses were delivered by President Ward and Dr Thorkild Aarup, representing the Executive Secretary of the IOC. These addresses were followed by thought-provoking presentations by Dr Robert Ballard, Dr Larry Mayer, Mr David Heydon, Mrs Kristina Gjerde, Ms Jyotike Virmani and Mr Bjorn Valving. Mr Simon Winchester, notable author and raconteur, closed the first day with his observations on the history and significance of the oceans to mankind.

The second day of the Forum consisted of four panel sessions which addressed:

- The Use of bathymetry: the deep ocean perspective,
- The Use of bathymetry: the coastal perspective,
- New tools and techniques in ocean mapping, and
- Mapping the world ocean floor.

These panel sessions generated active participation with all aspects of the four themes being explored through wide-ranging comments and discussion. These sessions led into a third day, that consisted of four focus group sessions, which explored the issues raised on the second day and discussions on how to take the key items forward to develop a roadmap for the next 10-15 years of GEBCO activity and to provide input to the Forum communiqué.

Capacity building for the future generation of ocean mappers has been successful. Since 2004 the Nippon Foundation has provided funding for GEBCO to train a new generation of scientists and hydrographers in ocean bathymetry. The 12-month course, leading to a Postgraduate Certificate in Ocean Bathymetry (PCOB), is held at the University of New Hampshire, USA. Almost all the 72 GEBCO Scholars, the graduates of the NF-GEBCO training course are active in the bathymetric field and 6 are now being trained.

The GEBCO Gazetteer of Undersea Feature Names is accessible via a web map application, hosted by the IHO Data Centre for Digital Bathymetry (IHO DCDB) co-located with the US National Centers for Environmental Information (NCEI). Much of the errors and inconsistencies of the contents were removed for the past year by an IHO contractor.

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, gridding examples and provides an overview of different software applications used for producing bathymetric grids.

The Cook Book was first released as IHO Publication B-11 in April 2012 and as an IOC guide document in October 2012. The Cook Book has been adopted as an important resource by the University of New Hampshire, the Texas A&M University and various other educational institutions.

B-11 was last updated in December 2016. The updates include a new chapter on mosaics, a new chapter covering “Nautical Chart Adequacy” and updates to the sections on Satellite Derived Bathymetry and some of the internal references.

6. Conclusions and Recommendations

It was agreed by the GGC that the revised Terms of Reference and Rules of Procedure, together with IHO Publication B-11 (IOC Manuals and Guides 63) – *GEBCO Cookbook*, have superseded the contents of IHO Publication B-7 – *GEBCO Guidelines* – and therefore it was felt there was no requirement to continue with the revision process, which has been in progress for the past 4 years. It was agreed to recommend to the IRCC that the publication is withdrawn permanently and any minor items not already covered by the ToRs or B-11, could be included in an additional section in B-11.

7. Justification and Impacts

Although the entire ocean floor is covered by the 30 arc-second GEBCO grids, most of the values of the grids (depth) are not supported by real soundings. More than 80 percent of the grids have gotten its value as a estimated depth guided by the surface gravity field or the satellite altimetry.

The sad MH370 tragedy revealed the lack of dependable bathymetry in the open ocean. Long range propagation estimate of tsunami also needs detailed bathymetry of the deep ocean floor. Global ocean circulation modelling, especially for the deep ocean current, requires much finer resolution of bathymetry.

On the other hand, tsunami inundation modelling requires much finer bathymetry for coastal areas. Coastal management, including the establishment of marine protected areas also requires much finer bathymetry.

Seabed 2030, which aims to leave no features of the world ocean floor smaller than 100m unmapped by year 2030. It is not an easy goal but the outcome will and should provide much better understanding of the sea floor topography and contribute to the world.

8. Actions Required of IRCC

The IRCC is invited to:

- a. Note the contents of this report;
- b. Approve the withdrawal of IHO Publication B-7 – *GEBCO Guidelines*; and
- c. Encourage RHCs to organize contribution of bathymetric data in shallower coastal areas from their member states to GEBCO in order to support the production of higher resolution gridded data products of GEBCO;
- d. Encourage RHCs to invite and communicate with GEBCO members to their meetings as appropriate; and
- e. Take any actions deemed necessary.

**IHO-IOC GEBCO GUIDING COMMITTEE
(GGC)**

List of GGC members - 1 January 2016

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|--|---------------------|
| 1. IHO Appointed Members: | Term Period: |
| Mr Shin Tani (Japan) (<i>Chair</i>) | (2013-2018) |
| Rear Admiral Patricio Carrasco (Chile) | (2013-2018) |
| Dr Hyo Hyun Sung* (Republic of Korea) | (2014-2019) |
| Captain Norhizam Hassan (Malaysia) | (2015-2020) |
| Dr Graham Allen (United Kingdom) | (2015-2020) |
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| 2. IOC Appointed Members: | |
| Dr Martin Jakobsson (Sweden)* (<i>Vice-chair</i>) | (2013-2018) |
| Dr Robin Falconer* (New Zealand) | (2013-2018) |
| Dr Marzia Rovere (Italy) | (2014-2019) |
| Dr Johnathan Kool (Australia) | (2016-2021) |
| Captain Leonid Shalnov (Russian Federation) | (2016-2021) |
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| 3. Ex-officio Members: | |
| Dr Vicki Ferrini (USA) (<i>Chair of SCRUM</i>) | |
| Dr Karen Marks (USA) (<i>Chair of TSCOM</i>) | |
| Dr Hans-Werner Schenke (Germany) (<i>Chair of SCUFN</i>) | |
| Ms Jennifer Jencks (USA) (<i>Director of IHO-DCDB</i>) | |
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| * Members serving a second 5-year term. | |
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| 4. Secretary: | |
| Mr David Wyatt (IHB) | |
| (2015) | |

NOTE: Members of the Secretariats of the IHO and IOC are permanent non-voting Members in the Committee.

1.1. IHO-IOC GEBCO Guiding Committee (GGC) Work Plan 2017-2018

1.1 GGC Tasks

- A Organise and conduct GGC XXXIV meeting in 2017 (IHO Task 3.8.1.1)
- B Ensure conduct of TSCOM, SCRUM and SCUFN meetings in 2017 (IHO Tasks 3.8.1.2, 3.8.1.3 and 3.8.1.4)
- C Ensure effective operation of IHO DCDB (IHO Task 3.8.2)
- D Encourage the contribution of bathymetric data to the IHO DCDB (IHO Task 3.8.3), identify priority areas for regional mapping (IHO Task 3.8.3.1) and promote data contribution through GEBCO participation in RHCs meetings (IHO Task 3.8.3.2)
- E Maintain IHO bathymetric publications (IHO Task 3.8.4) including: B-4 (IHO Task 3.8.4.1), B-6 (IHO Task 3.8.4.2), ~~B-7 (IHO Task 3.8.4.3)~~, B-8 (IHO Task 3.8.4.4), B-9 (IHO Task 3.8.4.5), B-10 (IHO Task 3.8.4.6) and B-411(IHO Task 3.8.4.7)
- F Develop the on-line function of B-4 (Information concerning recent bathymetric data) (IHO Task 3.8.4.8)
- G Contribute to outreach and education about ocean mapping (IHO Task 3.8.5) by development of outreach and educational materials (IHO Task 3.8.5.1) and printing of IHO-IOC GEBCO World Map (IHO Task 3.8.5.2)
- H Ensuring IHO-IOC GEBCO Web site is kept current and updated regularly (IHO Task 3.8.6)
- I Develop short course and course material on compiling digital bathymetric models (DBMs) to be included in GEBCO from a heterogeneous bathymetric source database (IHO Task 3.8.7)
- J Update and enhance the GEBCO Gazetteer (B-8) for internet access (IHO Task 3.8.8) including providing the GEBCO Gazetteer as a web service via a geospatially enabled database (IHO Task 3.8.8.1) and develop and make available public and management on-line interfaces to the Gazetteer (IOH Task 3.8.8.2)

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard	Funding Bid (€)	Approved Funding (€)
A	Organise and conduct GGC XXXIV meeting	H		2017	2017	P	Chair GGC Sec			0

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard	Funding Bid (€)	Approved Funding (€)
B1	Ensure conduct of TSCOM, SCRUM and SCUFN meetings	H		2017	2017	P	Chair GGC, Chair, TSCOM, Chair SCRUM and Chair SCUFN			0
B2	Oversee work of subordinate bodies – TSCOM, SCRUM, SCUFN and Outreach WG – for completion of directed tasks	H		Continuous	Continuous	O	Chair GGC		4,000 (per diem only, for 6 days, 2 SCUFN Members)	0
C	Ensure effective operation of IHO DCDB	H		Continuous		O	Director DCDB			0
D1	Encourage the contribution of bathymetric data to the IHO DCDB	H		Continuous		O	All members of GEBCO GC through the Chair			0
D2	Identify priority areas for regional mapping and support the organization of regional mapping projects.	H		Continuous		O	Chair SCRUM			0
D3	Promote data contribution through GEBCO participation in RHCs meetings	H	Identify GEBCO people who are able to attend for meetings in 2016 – 2018	Continuous		O	All members of GEBCO GC through the Chair		5,000	5,000

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard	Funding Bid (€)	Approved Funding (€)
D4	Organize regional mapping meetings/workshops	H		Continuous						0
		M	Arctic and Antarctic Mapping meeting	2017-2018	2018	P	Chair SCRUM		10,000	0
	Maintain IHO bathymetric publications	M		Continuous	Continuous	O	All members of GEBCO GC through the Chair	B-4 - Information concerning recent bathymetric data B-7 - GEBCO guidelines		0
		M	Update GEBCO global 30 arc-second grid with new compilations	2016	2017	O	Chair SCRUM	B-9 - GEBCO digital atlas		0
		M	Update GEBCO World Map to include updated versions of GEBCO grid and adopted undersea feature names from SCUFN.	2017	2018	O	Chairs SCRUM/SCUFN	B-6 - Standardization of undersea feature names B-8 - Gazetteer B-9 - GEBCO digital atlas	See J1 7,000	0
		L						B-10 - The history of GEBCO		0
		M						B-11 - GEBCO Cookbook		0
F	Develop the on-line function of B-4	M		2015	Continuous		Director DCDB			0

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard	Funding Bid (€)	Approved Funding (€)
G1	Contribute to outreach and education about ocean mapping	H		Continuous		O	Chair Outreach WG	See G3 below	7,000	0
G2	Development of outreach and educational materials (jigsaw puzzle for World Map and presentation files)	H		2015	2018	P	All members of GEBCO GC through the Chair Outreach WG		2,000	2,500 per year (2017-2018)
G3	Printing of IHO-IOC GEBCO World Map	M		2015	2018		Chair SCRUM	B-9 - GEBCO digital atlas	2,000	2,000
G4	Development of webpage (for secondary school student etc.)	M		2015	2018	O	All members of GEBCO GC through the Chair Outreach WG		11,000	4,000 per year (2017-2018)
H	Ensuring IHO-IOC GEBCO Web site is kept current and updated regularly	M		Continuous		O	BODC		5,000	5,000
I	Develop short course and course material on compiling digital bathymetric models (DBMs) to be included in GEBCO from a heterogeneous bathymetric source database	M	Discussions at 2016 TSCOM/SCRUM meeting (leader for course development needed)	2019	2021	P	Chair TSCOM/All members of GEBCO GC through the Chair Outreach WG	B-11 - GEBCO Cookbook	Not defined, review in 2017	0

Task	Work item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Contact Person(s) * indicates leader	Related Pubs/Standard	Funding Bid (€)	Approved Funding (€)
J1	Update and enhance the GEBCO Gazetteer (B-8) for internet access	H		Continuous	Continuous	O	Chair SCUFN	B-8 – Gazetteer	15,000 /year	15,000 per year
J2	Provide the GEBCO Gazetteer as a web service via a geospatially enabled database	H		Continuous	Continuous	O	Chair SCUFN	B-8 – Gazetteer	10,000 Depends on NOAA Decision (tbd at SCUFN29)	0
J3	Develop and make available public and management on-line interfaces to the Gazetteer	M		Continuous	Continuous	O	Chair SCUFN	B-8 - Gazetteer		0
J4	Develop a S-100-based product specification for Undersea Feature Names	M / L		2015	2019	O	Chair Project Team (K Fadaie)	S-100, B-6	To be discussed at SCUFN-29	0

1.2 GGC Meetings (IHO Task 3.8.1.1 refers)

Date	Location	Activity
1-4 October 2012	IHB, Monaco	XXIX th Meeting
7-11 October 2013	Venice, Italy	XXX th Meeting
13-15 June 2014	IHB, Monaco	XXXI th Meeting
5-9 October 2015	Kuala Lumpur, Malaysia	XXXII th Meeting
10-14 October 2016	Valparaiso, Chile	XXXIII th Meeting
13-17 November 2017	Busan, Korea	XXXIV th Meeting

5-9 November 2017

Canberra, Australia

XXXVth Meeting

Chair: Shin Tani

Email: soarhigh@mac.com

Vice-Chair: Martin Jakobsson

Email: Martin.Jakobsson@geo.su.se

Secretary: David Wyatt

Email: adso@iho.int

IHO PUBLICATIONS AND RESOLUTIONS

Publications and Resolutions for which GEBCO is the lead or subject matter expert:

Title	IHO Number	IOC Number	Edition/date
<i>Standardization of undersea feature names</i>	B-6	-	Edition 4.1.0 September 2013
<i>GEBCO guidelines</i>	B-7	-	Under review
<i>Gazetteer</i>	B-8	-	V1.1.1
<i>GEBCO digital atlas</i>	B-9	-	08 Grid March 2015
<i>The history of GEBCO</i>	B10	-	April 2003
<i>GEBCO Cookbook</i>	B-11	Manuals and Guides 63	11 January 2016

Resolution3/1929 as amended (*Centralization of oceanic soundings*);
 Resolution3/1932 as amended (*Collecting oceanic soundings*);
 Resolution4/1932 as amended (*Metadata for oceanic soundings*);
 Resolution2/1962 as amended (*Oceanographic observations*); and
 Resolution8/1962 as amended (*Oceanographic information*).

AREAS WHERE ENC SOUNDING DATA HAVE BEEN PROVIDED TO GEBCO

