IHO Crowdsourced Bathymetry Working Group

Production Information

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Background and Purpose

In 2014, the Fifth Extraordinary International Hydrographic Conference (EIHC-5), by Decision 8, tasked the Inter-Regional Coordination Committee (IRCC) with establishing a Crowdsourced Bathymetry Working Group (CSBWG) to prepare and maintain a new IHO publication on policy for crowdsourced bathymetry (Terms of Reference). This document would state the IHO's policy towards, and provide best practices for collecting and contributing, crowdsourced bathymetry. This document was envisioned to provide volunteer data collectors and interested parties with guidelines for gathering, submitting and assessing the quality of CSB data by providing technical guidelines only that in no way would supersede national or international laws and regulations.

Initial development of B-12, which began in 2016 and was approved by IHO Member States in 2019, was conducted primarily using general desktop and cloud word-processing tools. As the initial version was going through the IHO approval process, CSB data collection began to expand globally, B-12 was put into practice, and real-world feedback was provided to the CSBWG. It quickly became apparent that B-12 would require significant updates almost immediately after its initial publication.

By the time v 3.0.0 was approved by IHO Member States in 2022, it became clear that these tools, and the standard IHO approval timeline, were becoming challenging for the type of incremental maintenance required on a document meant to provide ever-evolving and improving technical guidelines. In addition, without searching into the CSBWG meeting reports, it could be difficult to determine the history of the modifications made, or the rationale by which changes were or were not agreed.

These issues, and an annual meeting cycle of the CSBWG, mean that it is difficult to achieve an update cycle for some components of B-12 (specifically within Chapter 3: Data and Metadata) consistent with the speed at which modifications to technical practice are occuring within the crowdsourced bathymetry community. This leads to the significant danger of a divergence of formal guidance in B-12 and actual practice in the field, which could result in *ad hoc* and *de facto* definition of extensions to the data being submitted to the IHO Data Center for Digital Bathymetry (DCDB). A worst-case scenario could include inconsistent data formats within the database, resulting in significant difficulties in data discovery and re-use and reducing the value of these potentially very valuable datasets.

During CSBWG14 and CSBWG15, the members of the CSBWG discussed these issues, and established a work item to address the maintenance issues with B-12 (CSBWG Work Plan 2023, Work Item A). The work item team concluded that an approach to maintenance that used modern digital tracking and versioning tools would be more efficient, and allow a more flexible and timely response to requests for changes to B-12, but still provide the tools to track decisions, enable transparency of process, and maintain oversight from the CSBWG and Member States (MS).

It is worth noting that the CSBWG is not unique in these concerns or in its selection of tools; other IHO working groups, particularly the S-102 Project Team, have used similar tools and protocols. The CSBWG acknowledges that switching to these new tools and processes is a significant departure from the established practice.

CSBWG also recognizes that changes to B-12 are subject to the requirements of IHO Resolution 2/2007, where B-12 is listed in Appendix 2, and therefore that any modifications to the document beyond "Clarifications" requires approval by IRCC and a vote of Member States, and consequently can advance at no more than an annual revision cycle. The work item team therefore concluded that splitting the maintenance of the rapidly evolving data, metadata and encoding recommendations, which are more closely aligned to the DCDB-managed guidelines and are not strictly necessary for CSB collection, from the more slowly evolving strategic components of B-12 had become a necessity.

This document, therefore, highlights the proposed protocols for future B-12 maintenance, including the tools that are expected to be used, how the maintenance of tactical (rapidly evolving) and strategic (slowly evolving) components should be managed, and how the tools and protocols outlined will ensure the tracking, transparency, and oversight outlined above.

Proposed Revisions and Maintenance Protocols

Recommended Revision to B-12 Guidance Document, v 3.0.0

B-12 is intended to be a guidance document, but during the initial development it was agreed that some description of mandatory, recommended and optional data and metadata, was required. Over time, this information became more detailed (see section 3.3 of version 3.0.0 of B-12) and more specific to data accession to DCDB. The reality is that it is entirely possible to collect useful CSB data without fulfilling all of these requirements, and the CSBWG now feel that it is not entirely appropriate for a minimal guidance document to be so prescriptive and that any DCDB requirements or recommendations should be hosted and encouraged by the DCDB (albeit with collaboration and cooperation of CSBWG).

At the same time, the annual update cadence of B-12 mandated by IHO Resolution 2/2007 means that the recommended data and metadata, prescriptive or not, cannot be updated at a pace commensurate with that of technical innovation in the field. There is therefore real danger that *de facto* field practice could diverge from *de jure* recommendations, potentially resulting in a database at DCDB poisoned with variant and poorly controlled data formats. In addition, because B-12 is a guidance document, it contains no encoding recommendations for the data and metadata beyond a single worked example, and provides no method to validate any data before submission to DCDB for archiving. These are significant technical and practical limitations.

The CSBWG therefore recommend a Revision (within the meaning of IHO Resolution 2/2007) to B-12 v. 3.0.0 to add a statement to section 3.3 ("Metadata and Data Formats") indicating that the contents are *de minimis* guidance for data and metadata, but that updated recommendations specific to DCDB, including an

encoding guide and validation software, are maintained separately (with appropriate URLs for the locations of the recommendations, and how to request modifications or updates). This would form edition 3.1.0; a draft is included as an appendix to this proposal.

The CSBWG recognises that it would be better to redraft section 3.3 to avoid many of the current details on data and metadata format recommendations in order to avoid overlap and to simplify the guidance of B-12. This would, however, amount to a new Edition (within the meaning of Resolution 2/2007), that would not be ready for IRCC17 (June 2025). The potential for database damage is, however, a real and present concern and the CSBWG feel that these changes cannot be delayed for another full development and review cycle. We therefore request that the proposed v 3.1.0 of B-12 be considered temporary and transitionary, with a fully revised v 4.0.0 to be developed over the next year and submitted to IRCC for approval and Member State votes in 2026.

Recommended Technologies

The current B-12 guidance document, and the corresponding data and metadata guidelines, and encoding definitions will be maintained as simple text documents with appropriate mark-up indicators (e.g., MarkDown, AsciiDoc, MetaNorma) to allow them to be converted into different formats for distribution and use (e.g., HTML, PDF). To ensure a history of modifications is maintained, the documents will be kept in a version control system (technically: git). A separate repository will be maintained for the current B-12 guidance document and the data/metadata/encoding definitions.

In both cases, to allow for tracking of requested modifications, technical discussion of the requests, and approvals; and to allow for remote collaboration, the appropriate repository will be hosted in a cloud service that supports discussion and issue tracking (technically: GitHub).

Governance

The GitHub repositories for both the B-12 and data/metadata/encoding maintenance efforts will be owned by the IHO.

Responsibility for the repositories will be devolved to a Maintenance Group (MG) designated by the Crowdsourced Bathymetry Working Group (CSBWG) at one of their regular meetings. The MG shall consist of the CSBWG Chair *ex officio*, two or more members of the CSBWG, and a technical representative of the DCDB. The CSBWG Chair may designate replacement members of the MG between WG meetings as required and will notify the CSBWG of any changes to the membership by correspondence. The MG will maintain both repositories.

Modification requests for the B-12 guidance document will be accepted through its corresponding repository from any source. The MG will use the appropriate GitHub tools to encourage discussion of the request, to document a formal action to make any required changes if necessary, to recruit any WG technical expertise to comment on the proposed modifications, and to establish a branch (separate track of modification that does not affect the current approved version of B-12) to accumulate all such changes between CSBWG meetings. Approval of these recommendations will follow the process outlined in IHO Resolution 2/2007.

Modification requests for the data/metadata description (currently section 3.3 of B-12) will be accepted through its corresponding repository from any source. Since this guidance is specific to the format of data and metadata required for accession of data to the archive at DCDB, this maintenance is formally outside

the scope of B-12 and not subject to the requirements of Resolution 2/2007. However, the MG will use the appropriate GitHub tools as described above to manage the modification process. Modifications to the data/metadata description may, at the Chair's discretion, be mandated to the MG for direct updates (e.g., typos, clarifications), subject to a formal review (technically: a pull request) by the MG, or held over for review of the WG entire, as required. Whenever possible, electronic voting will be preferred in order to maintain an appropriate update cadence. All modifications will be preserved in perpetuity within the repository.

The MG lead will report to CSBWG on updates and accepted modifications to the data/metadata and encoding recommendations during the annual WG meeting. Although not a formal requirement, the CSBWG expects that modifications approved over the previous year will be reviewed and adopted, if necessary, into the B-12 guidance document (i.e., to keep B-12 in sync, at its annual update cadence, with the faster evolving DCDB recommendations).

Discussion

Intent

As stated above, the overall goal of this proposal is to separate the maintenance of the relatively static (strategic) portion of B-12 from the more rapidly changing (tactical) data/metadata requirements for accession of data to DCDB, and therefore to enable more rapid development of CSB data to match the pace of the technical development in the field. It is also a goal to improve the tools used for maintenance of these documents using modern digital versioning and collaboration methods.

It is recognized that without oversight by the IHO Member States, there is a risk that B-12 could diverge from the original intent of the IHO, IRCC, and CSBWG.

This proposal has been constructed to find a balance by building in enough flexibility to allow for timely response to technical changes in the field while still ensuring that significant changes receive appropriate oversight, and that the decision-making process is documented and maintained.

Benefits

The primary benefit of the proposed maintenance protocol is that B-12 will meet its original intent of providing best practices for collecting, contributing, assessing and using crowdsourced bathymetry by recognizing that these practices are ever-evolving. Having a more timely and flexible development process for the data/metadata format recommended will break an annual (and often longer) update cycle, allowing for more rapid adaptation as requests are made and ensuring that the guidance stays relevant within not only IHO Member States, but the global community.

A more subtle benefit is that this process will build community and trust. That is, at present it is well known that changes to the data/metadata recommendations for CSB data accession to DCDB will take at least a year to be approved, and many developers either cannot or will not wait that long. This encourages them to just make (non-standard) modifications to data or metadata since they need to move on; the potential for database damage is therefore high. If, however, developers know that they can make suggestions for changes using mechanisms that they already understand and use themselves (i.e., issue trackers and GitHub repositories) and, critically, have these requests actioned in a timely manner (e.g., within a couple of weeks), then there is an impetus to use this mechanism for change. This will more likely keep changes

within the standard model, and reduce the probability of incompatible (or unusable) data appearing in the IHO databases.

Potential Risks and Mitigations

The proposal for use of new tools to maintain the B-12 guidance document changes only the method of implementation for modifications, but not the process for approval or oversight. The tools being proposed for use are commonly recognized and used for many massive open and closed source projects world-wide. This is therefore considered very low risk.

Separately maintaining the data/metadata recommendations has the potential risk of incompatibility with the current definition in B-12, or that the implementation will develop orthogonal to the IHO's intent, or that of the Member States. With the constraints of a Maintenance Group nominated by CSBWG with the Chair an *ex officio* member, this risk is relatively low. The Chair always has the ability to remit any development item to the CSBWG for review and vote, and has the choice of which type of vote is required.

In addition, the technical mechanisms used to make modifications to the documents are intrinsically designed so that each modification is tracked and can be reversed if required: an entire history of each document is maintained as a core feature of the tools used. Therefore any changes that are subsequently considered damaging can always be reversed if required.

The overall risk of adopting the proposed methods is therefore considered very low.

Requested Actions

The CSBWG, having reviewed and approved these recommendations, request that IRCC:

1. Acknowledge this request for a new maintenance method.
2. Approve separation of the maintenance of the B-12 guidance document from the data/metadata recommendations for data accession to the DCDB archive.
3. Approve the Revision to B-12 at section 3.3 as outlined above (see draft v 3.1.0 of B-12 attached).
4. Approve CSBWG to move ahead with maintenance of B-12 under these premises and consistent with IHO Resolution 2/2007.
5. Acknowledge the outlined maintenance protocols for the data/metadata recommendations for data accession at DCDB, not subject to IHO Resolution 2/2007.