

Sea-level rise in relation to international law

Report of the IHO on the Implementation of Paragraph 43 and 44 of GA Res. 58/240 of 23 Dec 2003

Reference A: LA/COD/72

Reference B: Paragraph 43 and 44 of GA Res. 58/240 of 23 Dec 2003

The International Hydrographic Organization is honored to respond to the request of the Under-Secretary General for Legal Affairs and United Legal Counsel to report on the Implementation of Paragraph 43 and 44 of GA Res. 58/240 of 23 Dec 2003 (Reference A and B)

The reporting period is understood as reaching from 2004 until today.

Introduction/Background

1. The International Hydrographic Organization (IHO) is the inter-governmental international organization whose principal aim is to ensure that all the world's oceans, seas and navigable waters are properly surveyed and charted. The work is done by bringing together the national agencies responsible for the conduct of hydrographic surveys, the production of nautical charts and related publications, and the distribution of Maritime Safety Information (MSI) in accordance with the requirement set out in the International Convention for the Safety of Life at Sea (SOLAS) and other international regulations. The current membership of the IHO stands at 98 Member States.

2. Although safety of navigation remains a major driver for the IHO, hydrographic products and services support all activities associated with the oceans, seas, and navigable waters. As accurate depth data (bathymetry) and sea level data is essential to the generation of nautical charts and publications and the substantiation of the UNCLOS claims of coastal states to maritime territory and resources, hydrography is essential in helping coastal states protect their maritime zones and populations in the face of sea level rise. All coastal states should be encouraged to ensure that their seas and coastal areas are properly surveyed and charted. This will directly allow them to protect their maritime rights, mitigate and adapt to the impacts of climate change and displaced persons.

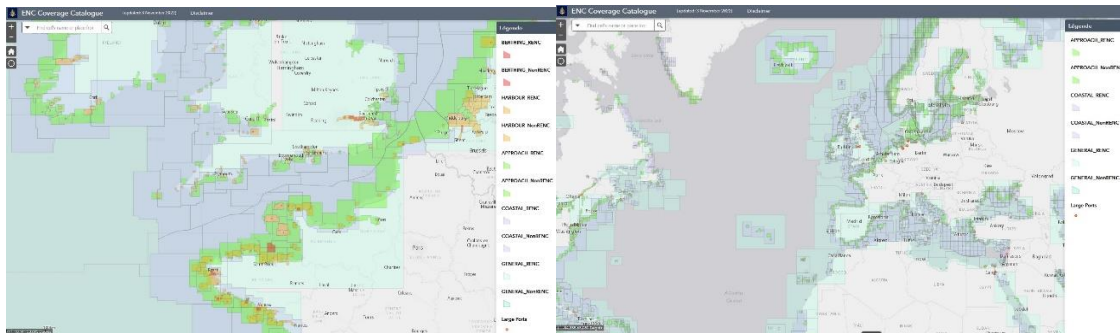
3. Through its active technical and capacity-building programmes conducted in close liaison with other international organizations, notably the International Maritime Organization and the Intergovernmental Oceanographic Commission of UNESCO, the IHO supports the development and improvement of hydrographic and nautical charting standards, products and services, especially in digital formats. These capabilities contribute directly to safe navigation, informed marine spatial planning and coastal management as well as the mitigation of and recovery from natural disasters. They also provide a technical basis for the implementation of the UN Convention on the Law of the Sea.

The digital age comes to Nautical charting

4. A changing technological world in the 1980's ushered in a vision of a versatile software application that digitally integrated a number of functions into a partially interactive navigational

tool. The IHO and the IMO worked together to make this vision a reality by providing specifications and performance requirements for such an application. In 1989 the IMO coined the name “Electronic Chart Display and Information System – ECDIS” for this innovative class of computer based shipborne navigation device. In order to facilitate ECDIS with official nautical data, the IHO created the first standards for digital nautical maps in the mid Nineties which have since been called “Electronic Nautical Chart – ENC.” It took almost two more decades before Hydrographic Offices were capable of setting up a regular provision of ENCs equivalent to paper charts in terms of quality and coverage for their respective sea area of responsibility. Today, effectively all navigable waters are covered with ENCs of which there are approximately **16,000 in total**. Thanks to the application of quality assurance systems (ISO 9000) Hydrographic Offices accept legal liability for ENCs on the same degree as they do for paper charts.

5. There are mature distribution systems for ENCs in place which also facilitate regular updates via satellite communication. Those systems are operated in collaboration with private industry. The world’s fleet of commercial ships on international voyages has been mandated to carry ECDIS devices since 2018. But navigation based on digital maps is also in predominant use by pilots and is popular on smaller boats in the fishing, local traffic and leisure sectors.



Images of ENC coverage of the Channel

6. The shipping industry was an eager adopter of navigation concepts based on digital maps. As a result, the sales of official nautical paper charts decreased to a tenth within one decade. Leading charting nations such as USA and UK have announced a significant reduction if not the full cessation of the respective paper chart portfolio by end of 2025.

7. In the 2000s, user demand for real-time depth information services, which resulted in the development of electronic navigation in conjunction with the availability of high-resolution bathymetric data, prompted a key area of work: the implementation of dynamic tides in the digital environment associated with Electronic Chart Display and Information Systems (ECDIS). The IHO continues to encourage the use of tidal data and the recovery of historical tide gauge records for the study of long-term sea level change.

e-navigation: Next level in digital navigation support

8. The provision of hydrographic information has widened from feeding solely nautical charts and services to other activities in the seas, oceans, and coastal zones. The digitalisation of this information allows hydrographers to provide marine geospatial data which can be both mapped and analysed. Geospatial data in the marine domain had been successfully standardized for navigational purposes using the IHO standards and guidelines for charts and nautical publications. This was achieved in particular through the IHO data exchange standard S-57 for electronic chart data and IHO INT 1 for the standardization of nautical paper charts. However, the

growing importance and expansion of economic and environmental sea-related issues and the need to manage them requires close attention. The underlying hydrographic data, only some of which is shown in charts, is therefore in great demand for a much wider range of applications and as such, interoperability of this data is more important than ever before.

9. For this reason, based on the ECDIS/ENC experience, the IHO continues to develop and set standards, and issues guidance which ensure that hydrographic information is available and can be delivered to users through appropriate harmonized and interoperable products and services on the next level of digitalization. The development of these new standards is driven by the need to continue to satisfy the SOLAS requirements of enhancing safety of navigation, and more recently, supporting the implementation of “e-navigation”, which is led by the International Maritime Organization (IMO). Both elements require easy access to standardized high quality digital geospatial information that can support marine spatial management. Accordingly, the IHO continued to work on its S-100 framework to support the creation and maintenance of interoperable maritime data product specifications compliant with the ISO-19100 series of geographic information standards. S-100 based products including S-101 – next generation of Electronic Navigational Chart, S-102 Bathymetric Surface, S-111 - Surface Currents and S-129 - Under Keel Clearance are under initial implementation, testing and evaluation for vessel navigation in IHO testbed programmes. The series also includes a product specification for maritime limits and boundaries (S-121) and Marine Protected Areas (S-122).

10. The purpose of S-121 is to provide UN DOALOS with a suitable format for the exchange of digital vector data pertaining to the maritime boundaries, limits and zones of States to meet their respective UNCLOS deposit obligations. It will provide the clarity necessary for good governance by: (I) providing coordinate-based spatial representations of MLBs that are accurate, reliable and easy to interpret, (II) facilitating States Parties’ obligation to UNCLOS, to deposit their outer limits of maritime zones, together with the lines of delimitations (marine boundaries) with the Secretary-General of the UN through the Division of Ocean Affairs and the Law of the Sea (DOALOS) of the Office of Legal Affairs of the United Nations. Thus S-121 supports ocean governance in the context of sea-level rise by supporting legal procedures through the provision of output that is legally readable, targeted to the issues and provides historical information and source validation.



Illustration of the next generation datasets supporting ships navigation:
Combination of S-101 ENC and S-102 Bathymetric surface

General Bathymetric Map of the Ocean

11. The IHO strives, together with IOC, to get a complete map of the seafloor with accurate ocean depth through a programme initiated by Prince Albert I of Monaco in 1903, the General Bathymetric Chart of the Oceans (GEBCO). To store the data that is gathered, an IHO Data Centre for Digital Bathymetry (DCDB) was created in 1990. Hosted by NOAA's National Center for Environmental Information (NCEI) in Boulder, Colorado (USA), the DCDB's bathymetric data bank increases by multiple terabytes each year. The resulting freely available GEBCO grid – now updated annually – has evolved to become an interactive mapping tool with query capabilities. The coverage and the quality of the grid is however dependent on the incoming survey data describing the ocean topography.

12. Beside the S-100 standardization framework, the GEBCO grid is the most important contribution of hydrography to the UN Decade of Ocean Science for Sustainable Development. The topography of the seabed influences the physical, chemical and biological processes in the marine environment. In addition to providing baseline data to monitor changes, better data feeds more accurate models for sea level rise. The accuracy of prediction models for the impact of rising waters in coastal areas is highly dependent on the geometry and texture of the seabed. Hydrography as an applied science is the only discipline to deliver this ocean knowledge.

13. The percentage of the global ocean which has been mapped in high resolution by means of the GEBCO grid has increased from 6% in 2017 to 25% in 2022. There is however a significant gap in full high quality coverage. The GEBCO programme addresses this through various activities. The most prominent one is the joint Nippon Foundation GEBCO Seabed 2030 project which aims to map 100% of the ocean in high definition by the end of this decade. Seabed 2030 works to discover existing datasets not yet ingested into the DCDB, supports the IHO's citizen science project to gather depth data ("Crowd Sourced Bathymetry") and plans to sponsor the development of new survey technology. Recognizing its contribution to increased knowledge of the ocean, Seabed 2030 has been endorsed as a UN Ocean Decade Action.

14. Initiated at the Forum for Future Ocean Floor Mapping by Mr Sasakawa, chairman of the Nippon Foundation, in Monaco in June 2016, the Nippon Foundation-GEBCO Seabed 2030 project commenced its operational phase at the beginning of February 2018. The project stood up the four regional centres (North Pacific-Arctic Oceans, South and West Pacific Ocean, Atlantic-Indian Oceans, and Southern Ocean) and the Global Center based at the British Oceanographic Data Centre (BODC) of the National Oceanographic Centre (NOC) in the United Kingdom (UK). A number of regional meetings have been held with a focus on data discovery, making data publically available and gap assessment. The Seabed 2030 project has a goal of completing the GEBCO grid by 2030, such that each grid cell at the defined target resolutions that varies by depth, will contain at least one depth sounding. The new GEBCO grid released in June 2022, contained significantly more data, particularly in the Arctic and Antarctic regions, where the coverage has increased to approximately 15%. Work continues on making additional datasets available and encouraging the IHO Crowd Sourced Bathymetry (CSB) initiative to help increase the publicly available bathymetric data. The Seabed 2030 regional and global centers continue to work closely with the Crowd Sourced Bathymetry Working Group (CSBWG). While gathering bathymetric data from vulnerable or isolated areas presents challenges, it is believed that these barriers will disappear as more data is contributed to Seabed 2030 and its products become

accessible and its benefits are recognized. In addition, the project plans to address this challenge through capacity building. The Nippon Foundation-GEBCO postgraduate programme on ocean bathymetry which is hosted by the University of New Hampshire, USA came into being in 2004. The programme's aim is to create a network of students from around the globe who will act as advocates as they progress in their careers and move into senior roles. Seabed 2030 will help them by providing outreach materials and clear messaging. Another key will be to attract early adopters who, through their own systems, processes, and messaging, will convince others will follow.

Using hydrographic data to mitigate impacts of rising sea level

15. Sea level rise can have a major impact on countries, by altering access to food and resources, increasing the impact of storms and storm surges, displacing populations etc. Data on physical features of the ocean such as the shape and texture of the seabed, tides and currents, ocean depth, all of which are gathered as part of hydrographic surveys, can be used to improve models of climate change impacts and feed the digital twin of the ocean. Such knowledge can be used by countries to mitigate and adapt to any negative impacts of sea level rise.

16. Recognizing the importance of this information, IHO Member States approved during the Assembly in 2020 a new Strategic Plan which laid out the organization's priorities. The inclusion of Goal No. 2, targeting the increased use of hydrographic data beyond the traditional charts and Goal No. 3 related to participation in international initiatives on the sustainable use of the oceans are a sign the IHO is now also clearly committed to cooperating with the broader community of ocean data stakeholders.

Building capacity

17. Capacity-building has become an important component of the IHO Work Programme since 2003. The IHO defines capacity-building as the process by which the Organization assesses the status of current capacity and assists States to achieve sustainable development and improvement in their ability to meet hydrographic, cartographic and maritime safety obligations with particular reference to recommendations in UNCLOS, SOLAS, and other international instruments. The scope encompasses all hydrographic needs as they underpin every activity associated with the sea, including safety of navigation, protection of the marine environment, mitigation and adaptation to the impacts of climate change, national infrastructure development, coastal zone management, marine exploration, marine resource exploitation (minerals, fishing, etc.), maritime boundary delimitation, maritime defence and security, and coastal disaster management. The IHO Capacity-Building Strategy stipulates that the focus should be on achieving enduring output which will benefit safe navigation, safety of life at sea, protection of the marine environment and economic development, rather than on creating enabling infrastructure per se.

18. More than 1500 participants from 143 States have benefited from the Capacity Building programme's financed activities since 2005. The range of activities supported by the IHO Capacity Building programme covers a wide spectrum not only in terms of the type of activities but also in terms of their duration in time. Short term activities are normally comprised of Technical Visits, workshops, seminars and short courses. Technical Visits aim to raise awareness of the importance of having hydrographic services that can provide the services required to meet the obligations specified in the International Convention for the Safety of Life at Sea. Workshops, seminars and short courses are dedicated to specific aspects of the obligations such as those

related to Marine Safety Information, specific parts of hydrographic surveying, data processing and management, and the production of nautical charts.

19. The IHO has set up and maintains a system of funded education courses with a duration of up to one year. The courses are conducted by certified training institutions. The certification process is coordinated by the International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (IBSC) that is composed of members of the International Hydrographic Organization, the International Federation of Surveyors (FIG) and the International Cartographic Association (ICA) which is also in charge of the maintenance of the standardised education & training syllabi. The Capacity Building long duration courses consist of complete education courses containing the minimum degree of knowledge considered necessary to form hydrographic surveyors and nautical cartographers. Since 2009, 27 courses have been made available and completed by 137 students from 56 Member States and have provided an important contribution to the hydrographic capacity of the respective countries.

20. Marine Spatial Data Infrastructure (MSDI) has been highlighted as an important component of the future development of hydrographic offices for the purpose of national and regional acquisition, processing, management and distribution of marine geoinformation. As it has been concluded that there is either no, or very little, basic teaching material available for MSDI training that is accessible for IHO Member States, the IHO has developed materials to enable the conduct of basic MSDI education/training. A collection of these materials, including e-learning programmes, is freely available on the IHO webpage under MSDIWG Body of knowledge <https://iho.int/en/body-ofknowledge> and on the IHO e-Learning Center at <https://elearning.iho.int/>.

21. The IHO Capacity-Building programme is funded from the IHO budget and is supplemented by contributions from Member States and partners. Currently, in addition to the funds from the IHO budget, ongoing financial support is provided by the Nippon Foundation of Japan and the Republic of Korea, with ad-hoc in-kind support from Member States and industry. The Secretariat is continuing its campaign to find additional donor States and funding organizations.

22. Taking into account the growing demands for IHO CB activities, more funds and contributions are required. For this reason, the IHO representatives continuously engage with external stakeholders such as the United Nations, IMO, IALA, the European Commission, funding agencies, academia and industry in general, with priority for the Caribbean, West Africa and South West Pacific regions.

23. While non IHO Member States can participate in some initiatives, the benefit of the full range of IHO capacity-building activities is accessible only to IHO Member States.