IHO Input to the Report of the UN Secretary General on Oceans and Law of the Sea

This contribution is provided in response to your letter dated 11 April 2022 as the input from the International Hydrographic Organization to the report of the UN Secretary General on Oceans and Law of the Sea. It addresses developments and issues relating to ocean affairs and the law of the sea, including the implementation of resolution A/RES/75/239.

Executive Summary

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.

Although safety of navigation remains a major driver for the IHO, hydrographic products and services are meant to support all activities associated with the oceans, seas and navigable waters. As every human activity conducted in, on or under the sea depends on knowing the depth and the nature of the seafloor and an understanding of the tides and the currents, hydrography is an essential enabler to the development of the Blue Economy. Yet, mankind has higher resolution maps of the Moon, Venus and Mars than for most of the seas and oceans. This has a significant impact on what mankind can do at sea today in a safe, economical and sustainable manner. It is impeding progress and economic development in many, if not most, coastal States and has a major impact on the effective management, sustainable exploitation, and well-informed governance of the seas and oceans. This situation results notably from the fact that only about half of the States Parties to the SOLAS Convention have arrangements in place to provide adequate hydrographic surveying and nautical charting services. In this context, it is important to continue to call upon States that have not yet done so to consider becoming Member States and actively contributing to the work of the IHO, and urge all States to work with the IHO to increase the coverage of hydrographic information on a global basis.

All coastal States should be encouraged to ensure that their seas and coastal areas are properly surveyed and charted. This will directly support safety of navigation and protection of the marine environment. There are currently 165 States Party to SOLAS, 168 States Party to the UN Convention on the Law of the Sea and more than 150 States that have a recognisable coastline. Perversely, there are only 98 States that are Members of the IHO.

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 limitation of and recovery from natural disasters. They provide also a technical basis for the implementation of the UN Convention on the Law of the Sea.

General

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, through the coordinated endeavours of national Hydrographic Offices that also contribute to the promulgation of Maritime Safety Information (MSI). The requirement to provide these services is set out in Regulation 9 of Chapter V of the International Convention for the Safety of Life at Sea (SOLAS) and is therefore an obligation placed on all contracting governments. Regulation 9 requires, among other things that States: "*… ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation*". Regulation 4 of Chapter V places an obligation on Contracting Governments to ensure that appropriate navigational warnings are issued as part of the MSI services. The IHO has been hosted by the Government of Monaco since its creation in 1921 and its current membership stands at 98 Member States.

2. The reference to "navigable waters" does not mean that the IHO is concerned only with safety of navigation. Although supporting safety of navigation is a major priority for all national Hydrographic Offices, their products and services, in some way or another, support all activities that take place on, in or under the sea. This has been highlighted in the five most recent themes for World Hydrography Day: "*Hydrography - the Key to well managed seas and waterways*" in 2016, "*Mapping our seas, oceans and waterways - more important than ever*" in 2017, "*Bathymetry - the Foundation for Sustainable Seas, Oceans and Waterways*" in 2018, "*Hydrographic Information driving Marine Knowledge*" in 2019 and "*Hydrography – enabling autonomous technologies*" in 2020. The theme of 2021 "One hundred years of international collaboration in hydrography" was highlighting the anniversary of the organization.

3. Hydrography involves measuring the depth of the water (bathymetry), describing the physical features of the seafloor and fixing the position of all the navigational hazards that lie on the seafloor, such as wrecks and rocks. This is done mainly with specialized ships and boats operating echo sounders and sonars, but also using survey aircraft fitted with lasers. Useful information is increasingly being derived from satellite observations. Hydrography also involves measuring the physical features of the water column such as tide and the currents.

4. Hydrographic information is essential for the safe, efficient and sustainable conduct of every human activity that takes place in, on or under the sea. Without hydrography, no ship sails; without hydrography, no port is built; without hydrography; no offshore infrastructure is developed; without hydrography, no marine environmental plan is implemented; without hydrography, no shore is defended, no island protected; without hydrography, no search and rescue operation is attempted, without hydrography, no maritime boundary is delimited. Thus, hydrography is inherent to the three dimensions of the sustainable development of the oceans, ensuring that the marine environment is respected and that no adverse economic or social impact is incurred.

5. The activities of the IHO in 2021 which addressed specifically the implementation of resolution A/RES/75/239 concerned four areas: developing standards, guidance, products and services; building capacities; raising awareness on the role of hydrography; and contributing to the promotion of the marine dimension in global agendas. As in all domains, the work programme of the IHO was impacted by the constraints coursed from the global COVID pandemic.

6. The second Assembly of the IHO in November 2020 adopted a new strategy to foster the IHO vision, mission, and objects for the years 2021 to 2026. The strategy is focused on three main goals:

a. Evolving the hydrographic support for safety and efficiency of maritime navigation, undergoing profound transformation;

b. Increasing the use of hydrographic data for the benefit of society;

c. Participating actively in international initiatives related to the knowledge and the sustainable use of the Ocean.

Developing standards, guidance, products and services

7. The IHO develops and sets 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. The current maintenance of existing standards and the development of new ones are driven by the need to continue to satisfy the SOLAS requirements of enhancing safety of navigational, and more recently, supporting the implementation of "e-navigation", which is being led by the UN's 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 of S-101 - 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). 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.

8. IHO also approved a new project S1OOP - S-100 Open Online Platform that is aimed to be the foundation for a digital ocean and accelerate the wide adoption of the S-100 hydrographic framework by jointly developing and making available the technical requirements needed to overcome any S-100 implementation barriers.

9. Numerous IHO Member States currently engage in significant efforts to establish regular and frequent services utilizing such datasets with national and regional coverage. Since the S-100 framework and the associated web based infrastructure is not limited to host data product specifications native to the hydrographic domain, the IHO is proactively supporting the expansion of the S-100 concept to related domains such as maintenance of fixed and floating aids to navigation (IALA), weather and sea ice coverage (WMO), route plan exchange format (IEC), inland electronic charting (IEHG) and oceanography (IOC).

10. The IHO has deployed a questionnaire to assess the status of Marine Spatial Data Infrastructure (MSDI) and Marine Spatial Planning (MSP) in their respective Member States and developed a template to assess the status of maturity of MSDI and MSP in their respective Member States. IHO is working on an online publication of the IHO publication C-17 Spatial Data Infrastructures: "The Marine Dimension" - Guidance for Hydrographic Offices, which will be continuously updated in a decentralized approach. An important undertaking is the IHO-OGC MSDI Concept Development Study (CDS), funded by the USA/NGA. The goal of the CDS was to demonstrate to stakeholders the diversity, richness and value of a Marine SDI, specifically data, analysis, interoperability and associated IT services -including web services -in addressing the needs of the marine domain. The study is also available at https://iho.int/en/body-of-knowledge. As recommended by the successful OGC-IHO MSDI Concept Development Study (CDS), a full-scale Pilot to demonstrate a multi-country, federated MSDI under a land/sea boundary use case is now under development. The goal of the Pilot is to show how the value of MSDI can unlock data and information for use beyond traditional providers and consumers of hydrographic data, across borders, and across domains inclusive of improved connections between the terrestrial and marine foundational communities.

11. The IHO is also developing and maintaining guidelines to assist stakeholders in implementing the requirement of international instruments such as UNCLOS and SOLAS. An example is the Manual on Technical Aspects of the UN Convention on the Law of the Sea (TALOS Manual - IHO Publication C-51). The TALOS Manual is maintained jointly by the IHO and the International Association of Geodesy (IAG). Its purpose is to provide guidance in order to ensure maximum international standardization of the technical aspects of UNCLOS. The Manual can be downloaded free of charge from the IHO website at www.iho.int.

12. IHO standards and guidelines, intended to assist coastal States meet their obligations and requirements, fall under three main themes:

- nautical charts, issued on paper or in digital format (Electronic Navigational Charts), which are produced by national Hydrographic Offices to support safe navigation in accordance with the requirements of SOLAS;
- the maritime component of spatial data infrastructures being developed at the national and regional levels, which includes in particular high resolution bathymetry (depth data) compiled by national Hydrographic Offices;
- the global reference bathymetric data sets developed and made available through the GEBCO programme (General Bathymetric Chart of the Oceans) operated jointly by the IHO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

13. The current worldwide coverage of Electronic Navigational Charts is now effectively corresponding with paper chart coverage. However numerous areas remote from the highly frequented shipping routes are still not sufficiently covered by modern up to date nautical chart information. Further progress is hindered by the lack of reliable survey data and the allocation of appropriate resources and priority by the governments of many coastal States. While most of the world's established shipping routes are relatively safe navigationally because of widespread use by many ships over many years, the advent of larger vessels and the need for vessels to travel to new destinations, in particular with regard to the expansion of the cruise industry, are not being supported by adequate surveys and charts.

Building capacities

14. Capacity building continues to be an important component of the IHO Work Programme. The IHO defines capacity building as the process by which the Organization assesses the status of current arrangements 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 it underpins every other activity associated with the sea, including safety of navigation, protection of the marine environment, 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.

15. The IHO Capacity Building programme is funded from the IHO budget and is supplemented by additional support from Member States. Thanks to the impact of the global pandemic, the level of activity of the IHO Capacity Building (CB) Programme in 2021 was significantly lower compared to the level of the preceding years. Expenditure in the IHO 2021 CB Work Programme (CBWP) was 339,493 Euros, approximately 50% smaller than the usual expenditure in the years before COVID. Ongoing financial support is provided by the Nippon Foundation of Japan, the Republic of Korea and by a contribution from the IHO budget with in-kind support from Member States and from industry. The Secretariat is continuing its campaign to find additional donor States and funding organizations. 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.

16. Benefit of the full range of IHO Capacity Building activities is accessible only to IHO Member States.

Raising awareness on the role of hydrography

17. The theme for the celebration of World Hydrography Day (WHD) 2021 was "*One hundred years of international cooperation in hydrography*". The theme is designed to showcase progress in knowledge and technology over the past 100 years, while celebrating the ground-breaking work which was done during this period. The goal is to highlight the past, present, and future of

hydrography by showing the important work of early hydrographers, progress in technology, and state of the art in technology.

18. The IHO is one of the important actors underpinning the sustainable development of the oceans. This ambition is expressed by the theme for the celebration of World Hydrography Day (WHD) 2022 “Hydrography – contributing to the Ocean Decade”. The theme is designed to highlight the relevant contribution of hydrography as a discipline of applied sciences to the United Nations Decade of Ocean Science for Sustainable Development (2021– 2030). The suggested theme offers the opportunity to emphasize the ability of hydrographers to gather and manage marine data and their strengths in technical collaboration on a global scale. It also underlines the strategic evolution of national, inter-regional and global activities to support an expanding group of stakeholders with hydrographic information and services.

Promoting the marine dimension in global agendas

19. The IHO Secretariat has continued to contribute directly to the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM). At its 11th session in August 2021 the report on the *Implementation and adoption of standards for the global geospatial information community* (Agenda Item 13), was brought to the attention of the Committee by the three Standard Developing Organizations ISO, OGC and IHO Group. This group being integral part of the global geospatial information management community agreed to continue the strong liaison on all levels to support the UN-GGIM process further.

20. The Working Group on Marine Geospatial Information under the leadership of John Nyberg (USA), established by UN-GGIM 7 in 2017, reported to the Committee of Experts for the fourth time. The Committee welcomed the report of the Working Group on Marine Geospatial Information, and noted its progress, including the successful completion of its use case exercise on data availability and interoperability, the associated white paper on readily available and accessible marine geospatial information, and the ongoing efforts of the working group to implement the Integrated Geospatial Information Framework in the marine domain, where water is the dominant geographical feature. The Committee also noted that the working group was considering integrated ecosystem-based data management practices that would require collaboration across multiple disciplines and institutions, including users and stakeholders, and that the Integrated Geospatial Information Framework provided a coherent mechanism for effective and integrated marine geospatial information management, as well as the means to raise awareness and advocacy and facilitate communication and collaboration between the maritime, terrestrial and cadastral domains. Furthermore, the Committee encouraged the working group to strengthen collaboration with the International Hydrographic Organization, in particular in the areas of capacity development and the application of standards, including the S-121 standard for maritime limits and boundaries, and to consider engaging other international organizations focusing on ocean sciences and observations.

Ocean bathymetry

21. The General Bathymetric Chart of the Ocean (GEBCO) programme is a joint programme that is executed under the governance of the IHO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. GEBCO is directed by a Guiding Committee made up of representatives from both IHO and IOC and is supported by a Technical Sub-Committee on Ocean Mapping (TSCOM), a Sub-Committee on Undersea Feature Names (SCUFN), a Sub-Committee on Regional Undersea Mapping (SCRUM), a Sub-Committee on Communications, Outreach and Public Engagement (SCOPE) and a Nippon Foundation/GEBCO Training Project Management Committee. SCUFN maintains close liaison with the UN Group of Experts on Geographical Names (UN-GEGN), and with international or national authorities concerned with the naming of undersea features.

22. Through the work of its organs, GEBCO produces and makes available a range of bathymetric data sets and products, including the GEBCO Gazetteer of Undersea Feature Names; the GEBCO world map; GEBCO Cook Book; Web Map Services and its lead bathymetric product: a global gridded bathymetric data set.

23. A significant source of data for these products is the IHO Data Centre for Digital Bathymetry (DCDB). One of the primary objectives of the IHO DCDB is to provide an authoritative source of

bathymetry for ocean mapping requirements. In order to achieve this, 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 appointed representatives to participate in selected meetings of Regional Hydrographic Commissions that operate under the umbrella of the IHO. Traditionally GEBCO has focused on waters deeper than about 200 m; however, it is now actively collecting data in shallow water areas to support activities such as coastal zone management and development, and the mitigation of marine disasters such as storm 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.

24. A new GEBCO 15 arc-second global grid, GEBCO_2021, was published in June 2021. This is the third GEBCO grid produced in cooperation with the Nippon Foundation-GEBCO Seabed 2030 Project. The grid uses as a 'base' Version 1 of the SRTM15+ data set (Olson et al, 2014) - a fusion of land topography with measured and estimated seafloor topography. This base grid is augmented with the gridded bathymetric data sets developed by the four Seabed 2030 Regional Centers and compiled into a global bathymetric grid at the Seabed 2030 Global Center. Information on how to access the grid and the data sets included can be found on the GEBCO web site: www.gebco.net/data_and_products/gridded_bathymetry_data/.

25. 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. Under the Directorship of Mr Jamie McMichael-Phillips, the project has established 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). 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 2021, contains significantly more data, and the overall coverage has increased to approximately 21%. Work continues on making additional datasets available and encouraging the IHO Crowdsourced Bathymetry (CSB) initiative to help increase the publicly available bathymetric data. The Seabed 2030 regional and global centers continue to work closely with the CSBWG.

26. The IHO established a Crowdsourced Bathymetry Working Group (CSBWG) in 2015 to examine how best to incorporate, manage and use bathymetric data acquired by other than conventional means and develop principles and guidelines to enable the appropriate collection and use of crowdsourced bathymetry for the benefit of all stakeholders interested in knowing the shape and nature of the seafloor and its depths. In 2019, the CSBWG, comprising representatives from national Hydrographic Offices, academia, and industry finalised the first Edition of a guidance document that sets out the key issues regarding crowdsourcing - both from a collector's and a user's perspective. The guidance document provides general advice and information for those considering collecting or using crowdsourced bathymetry. It is not intended to be either prescriptive or authoritative, but rather to alert those with an interest in crowdsourcing of the relevant considerations to take into account. The updated guidance document named IHO B-12 "*Crowdsourced Bathymetry Guidance Document*", Edition 2.0.3 was approved by the IHO Member States in December 2019 and is now publicly available for application. The IHO is maintaining a positive list of Coastal States which accept crowdsourced bathymetry activities and the provision of resultant datasets in national waters of jurisdiction: https://iho.int/en/csbwg

Awareness of hydrography and the future

27. Increased IHO involvement in the United Nations initiative on Global Geospatial Information Management (UN-GGIM) and the steady support of UN´s Decade of Ocean Science for sustainable development indicates that there is a growing acknowledgement and awareness of the relevance and the underpinning contribution that hydrographic information can make in the context of the 2030 Agenda for Sustainable Development and in particular in support of its Sustainable Development Goal 14 - Conserve and sustainably use the oceans, seas and marine resources for sustainable development. The IHO will not stop to underpin the vital importance of the digital mapping of the oceans presenting seabed topography as the basic information and to advertise for IHO´s S-100 approach to be potentially applicable to all sorts of marine information including

chemistry and biology of the oceans resulting in interoperable datasets to form “the digital twin of the Ocean”.