IOC Manuals and Guides 5

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Guide for Establishing an IODE National Oceanographic Data Centre, IODE Associate Data Unit or IODE Associate Information Unit

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3rd revised edition **UNESCO 2022**

IOC Manuals and Guides 5 rev. 3
September 2022
English only

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For bibliographic purposes this document should be cited as follows:

Intergovernmental Oceanographic Commission of UNESCO. 2022. *Guide for Establishing an IODE National Oceanographic Data Centre, IODE Associate Data Unit or IODE Associate Information Unit (3rd revised edition)*. Paris, UNESCO, 26 pp. (IOC Manuals and Guides, 5, 3rd revised edition) (English)

This version revises and replaces 'Guide for establishing a national oceanographic data centre' published by IOC-UNESCO in 2008.

(IOC/2022/MG/5 Rev.3)

TABLE OF CONTENTS

Acknowledgement

The authors wish to thank the large community of data and information providers who collaborate through the IODE programme and make huge amounts of ocean data and information available free of charge to millions of users.

1 INTRODUCTION

This document supersedes IOC Manuals and Guides No. 5 Rev. 2 (2008) (http://www.iode.org/mg5) which was entitled "Guide for Establishing a National Oceanographic Data Centre". Taking into account the substantive evolution in information technology, capabilities of organizations other than existing IODE National Oceanographic Data Centres to manage and make available ocean data, information, products and services, the IODE Committee, at its 25th Session (2019) recommended the updating of IOC Manuals and Guides. This document is the result of that revision.

2 IMPORTANCE OF DATA MANAGEMENT

2.1 OVERVIEW

Ocean, or marine, data underpin many of the activities we undertake encompassing scientific research, modelling, monitoring and assessment. These data are precious; they are fundamental to the understanding of the processes that control our natural environment. The data help provide answers to both local questions (such as the likelihood of coastal flooding) and global issues (such as the prediction of the impact of global warming). Over the last 20 years or more there has been an increasing requirement for near-real-time data for a variety of purposes including forecasting marine conditions, weather prediction and tsunami warning. This has led to near-real-time data collection, in many cases, becoming routine. The better we can predict events, the better we can protect ourselves into the future. This not only affects us, but the quality of the lives of future generations.

Additionally, whilst the data collected will be used operationally or processed by the scientist or researcher to provide material for scientific publications, the data are a resource in their own right. Properly managed and preserved, they can be used and re-used by future researchers, exploited commercially or used by educators and the general public. Such further uses, often not envisaged in the first instance, will make an additional contribution to scientific advance and knowledge.

Oceanographic data are obtained by diverse means: nets are dragged; traps are set; instruments are lowered from ships, set adrift, or moored on cables and platforms; satellites scan the oceans from space; and laboratories are constructed on the seafloor. Increasingly autonomous vehicles are being used both at the surface and in the water column to measure a wide range of parameters. They may be launched from vessels or from the shore and are controlled remotely by pilots on land. Measurements are made for a wide variety of purposes by individuals and sensors supported by many different kinds of institutions, including governments, private industry and non-governmental organizations. These data come in many different forms, from a single variable measured at a single point (e.g., a species observation) to multivariate, four-dimensional collections of data that may be millions of gigabytes in size. The volume of data being collected is increasing as is the diversity of measurements.

These data are often irreplaceable; they are always unique, if only in the timing of collection. Even when considering all of the data collected, spatial and temporal coverage of the global ocean remains quite sparse. Marine data can also be extremely expensive to collect. Over many years a variety of databases have been compiled bringing together data from many different sources. More recently there has been a need for access to more multidisciplinary and integrated data sets to further our knowledge and understanding and to better manage the marine environment, including taking an ecosystem approach to sustainable use of (living) marine resources.

Within the context of this document we use the following definitions for data and information:

- **Data**: Data is a set of values, symbols or signs (recorded on any type of medium) that represent one or more properties of an entity (*source: Implementation Plan Ocean Decade*).
- **Information**: Information is the results obtained after processing, interpreting, and organizing facts/data (recorded on any type of medium). Examples are publications, videos, graphs, maps, databases (directory of scientists or organizations), etc.

2.2 IMPORTANCE OF DATA AND INFORMATION MANAGEMENT WITHIN THE CONTEXT OF THE UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

The United Nations (UN) General Assembly has declared the UN Decade of Ocean Science for Sustainable Development (2021-2030) ('the Ocean Decade'). The vision of the Ocean Decade is for the "science we need for the ocean we want". The UN General Assembly mandated the Intergovernmental Oceanographic Commission of UNESCO (IOC) to coordinate the preparation and implementation of the Ocean Decade. The Ocean Decade is a convening framework for diverse stakeholders to co-design and co-deliver solution-oriented research needed for a well-functioning ocean in support of the 2030 Agenda. Capacity development, ocean literacy and the removal of barriers to full gender, generational, and geographic diversity are essential elements of the Decade.

The social relevance of measurement and sampling at sea, and the need to disseminate the results as widely, and for some applications, rapidly, and in as user-friendly a manner as possible, cannot be overestimated. More services and products useful to industry, the general public and policy makers, could, and should, be extracted from databases. The oceans cover about 72% of the Earth's surface, and about half of the world's population live in coastal areas, so monitoring the health, resources and natural hazards of the global ocean is no luxury. There are many applications of data management that relate to climate and weather, safety at sea and along the coast, fisheries, offshore activities, management of the seas, etc.

The ambition of the Ocean Decade in relation to data, information and knowledge management includes significant enhancement of infrastructure, common approaches that enable interoperable data sharing and stewardship, and enhanced collaboration between data providers and users. Implementing a "digital ocean ecosystem" to support the Decade will be a dynamic, collective, and continuous process, incorporating established approaches and technologies as well as those that are only just emerging.

From all the above it is abundantly clear that oceanographic data need to be professionally managed at the national and international level.

3 COORDINATION OF DATA AND INFORMATION MANAGEMENT AT THE NATIONAL LEVEL

3.1 HISTORICAL OVERVIEW

Until the late 1980s oceanographic data were mostly managed in a centralized national facility, i.e. a National Oceanographic Data Centre (NODC). Data consisted mostly of research cruise data or research projects, provided by research scientists to the data centres in delayed-mode. The delay between the observation and the submission to the data centre could be days to years depending on the data type. Often data would be submitted to the data centre only when the scientist had finished with it, generally when a scientific paper was published.

The task of the data centre, once the data were received, was to assess the quality of the data through a number of tests and procedures (e.g. valid temperature readings). Data were then archived for use by other “secondary users” (see also 3.2.1).

Sometimes research projects would be organized at a regional level, involving several countries. In such a case one national centre would carry out data management tasks for the entire project or, alternatively, a dedicated data centre was established.

Since the development of operational oceanography and the establishment of the Global Ocean Observing System (GOOS) in 1991, the number of data types and volumes of data have grown greatly. In addition, many projects and programmes have developed their own data management systems, often without coordinating with existing NODCs. The national data centres may be unaware of new data streams and these are often not included in the NODC data systems. In some cases when a project ended, large volumes of data were simply left unattended and have been lost.

3.2 NODC: IODE NATIONAL OCEANOGRAPHIC DATA CENTRE

3.2.1 Tasks of an IODE National Oceanographic Data Centre

The mission of a National Oceanographic Data Centre is to provide access and stewardship for the national resource of oceanographic and marine data. This effort requires the gathering, quality control, processing, summarization, dissemination, and preservation of data generated by national and international agencies.

The full range of data management tasks to be carried out by a national oceanographic data management “system” can be summarized as follows:

- receiving data and metadata from institutional, national, regional and international programmes collecting oceanographic data;
- verifying the quality of the data and metadata (using agreed upon standards);
- ensuring the long-term preservation of the data and associated information required for correct interpretation of the data; and
- making data available, nationally and internationally.

National Responsibilities include:

1. Receiving data from researchers, performing quality control, and archiving;
2. Receiving data from buoys, ships, autonomous vehicles and satellites on a daily basis, processing the data in a timely way, and providing outputs to various research and engineering users, forecasters, experiment managers, or to other centres participating in the data management plan for the data in question;
3. Reporting the results of quality control directly to data collectors as part of the quality assurance module for the system;
4. Participating in the development of data management plans and establishing systems to support major experiments, monitoring systems, fisheries advisory systems;
5. Disseminating data on the internet through dedicated (cloud) servers and other means;

6. Publishing statistical studies and atlases of oceanographic and other marine variables;
7. Providing indicators for the different types of data being exchanged in order to track the progress.

International Responsibilities include:

1. Participating in the development of international standards and methods for data management through the IODE and other relevant international bodies;
2. Participating in international oceanographic data and information exchange through the IODE and other relevant international bodies;
3. Assisting with data management aspects of global or regional programmes or pilot projects through IODE and other relevant international bodies in the framework of, inter alia, the IOC's Strategic Plan for Oceanographic Data and Information Management;
4. Operating as a data assembly and quality control centre for part of an international science experiment or programme;
5. Operating regional, specialized or ISC World Data System (WDS) centre on behalf of the international science community;
6. Contributing to IODE projects, for example, World Ocean Database (WOD), Ocean Biodiversity Information System (OBIS), International Coastal Atlas Network (ICAN), Ocean Data and Information System (ODIS).

In order to coordinate the international tasks each IOC Member State is invited to designate an IODE National Coordinator for Data Management and IODE National Coordinator for Marine Information Management, even if no IODE data centres have been established yet.

3.2.2 Establishment of an IODE National Oceanographic Data Centre

The most important requirement in establishing an NODC is to secure the support and cooperation of the oceanographic and in some cases meteorological or other marine organizations that collect and use oceanographic data. Without this cooperation the new centre will have great difficulties in acquiring data for its databases and will lose its first and most natural group of clients, i.e. the ones who supply the data. A centre that is designed with the collaboration of the collectors of the data will be off to a much better start. This also ensures that the data centre knows where expertise lies when new or unfamiliar data types are sent to the data centre and guidance may be needed.

There is always a danger that the new centre will be seen as an additional burden on the data collectors. They may not see benefits for themselves while having to do additional work to supply the centre with data. There is no universal solution to this problem. There are, however, some initiatives that can be taken to show mutual benefits:

- The centre should plan and demonstrate that it will have data management and other related expertise that is more specialized and focussed than that available to the data collectors. Thus, the data collectors can expect to receive benefits from working with the centre. The centre must then establish this expertise by recruitment or training (e.g. through IODE's OceanTeacher Global Academy (OTGA)) and maintain it;
- The centre must also relieve the collecting organizations of some existing responsibilities. For example, if a collecting organization has to deal with the

international community as well as local requests for data, the centre can take on that work for them;

- The centre will also take on the responsibility for long-term stewardship of the data including transferring the data to any medium or format for the purpose of future preservation and accessibility and ensuring plans for disaster recovery;
- The centre must demonstrate that it can provide information on standards (e.g. by utilising the Ocean Best Practices System) and on hardware and software technologies that will be useful to the collectors in improving their own data management;
- The centre must demonstrate that it will not be a roadblock in the data flow, but will improve efficiency.
- The centre may be able to mint Digital Object Identifiers (DOI) enabling citation of datasets in journal papers. Further information is in IOC Manuals and Guides No 64, Ocean Data Publication Cookbook.

Once the centre is well established and running operationally, it should consider becoming accredited as an NODC. This, together with the development of a Quality Management Framework, is described in more detail in section 5.2 (see also IOC Manuals and Guides No 67, IODE Quality Management Framework for National Oceanographic Data Centres and Associate Data Units (Revised edition)). This gives data providers and users the assurance that the NODC is operating to defined principles and standards and can provide data of known quality to meet the requirements of a broad community of users.

An important step in the process is to build confidence that the centre will be established to serve, that it will have the expertise to fill a leading role in national oceanographic data management, and that it will work in a co-operative manner to ensure that the organizations that supply data will receive commensurate benefits for the work involved in supplying data to the centre.

Given the above ideas and principles the following steps are suggested as an outline on proceeding to establish an NODC.

Step 1. Recruit a team of interested parties (including potential clients and partners) to propose a mission and organizational model for the centre. This team should examine the missions of the organizations in the Member State or region that collect or use oceanographic and other marine data. Some of these organizations may be examined as a class (e.g., coastal engineering firms designing shore-based facilities of various sorts). This examination will also provide information on the potential client base. At this stage it is important to ensure that effective consultation occurs with all potential stakeholders including all levels of government (local, state and federal), industry, the science community, community interest groups, Non-Governmental Organizations (NGOs), etc. Workshops may provide a suitable forum for the generation of ideas and directions. These also may suggest products that might be useful to the community (e.g. distribution maps of parameters or species, real-time data display, atlas for the country's seas, etc.).

Step 2. From this study construct a draft mission for the centre and review the opportunities for useful partnerships with existing organizations. Also review the needs of the centre for specific types of expertise and make a first attempt at defining a client base. This document should basically be a preliminary proposal for a national centre including a draft cost proposal. Considering the cost of the centre and likely sources of funding is important at this early stage. It may be possible to obtain funding from a government ministry with some responsibility for marine affairs, the funder of the organization hosting the proposed NODC or perhaps a

consortium of organizations will agree to provide funding. Some negotiation is likely to be required. If possible aim for funding for 3-5 years initially, maybe with a review a year before that phase of the funding ends.

Step 3. It is important to consider the number (and expertise) of staff required. This will partly depend on the volume and diversity of data expected to be provided to the centre. A possible initial model could be perhaps for 5 to 10 staff; this would include a data centre manager, with some administrative support, 2-3 data managers (ideally with a marine science background), 2-3 software developers and a communications person to promote the data centre, respond to data requests and provide advice to data centre users. This can be refined as necessary in the planning stages and again as the centres become established when the workload may increase. Assuming the data centre is located within an existing marine research centre, then administrative support and IT infrastructure could be shared, although further equipment will probably be required (e.g. computers, data storage). If possible look for some sort of governmental approval in principle pending a final formal proposal for the centre so that meaningful negotiations can be taken under Step 4 below.

Step 4. Conduct negotiations with the potential partners as to the possibilities for mutually beneficial partnerships or at least support for the establishment of the centre. During these negotiations the mission can be revised to reflect the partnerships. The expertise proposed for the centre can be modified as well.

Step 5. Do a study of the computer and communications hardware required: The host institution may be able to provide assistance with this. A final plan for the staff will be needed. Recruiting the right staff is crucial to the operation of the centre and needs to be undertaken with great care. A range of skills and experience will be required and importantly excellent leadership. Consider discussing the options with existing NODCs. Prepare a draft administrative organization. It will probably be necessary to have assistance from appropriate specialists for this step. Contracting for some of the experts is an option.

Step 6. Having a more final version of the mission and information on partnerships, prepare a final proposal for the centre for final approval. This proposal should include a high-level national data management plan for ocean and other marine data. Recruit the appropriate team to prepare it. Include a more detailed budget.

Step 7. Develop in consultation with the partners clear written agreements on the responsibilities of both sides, for example, data deposit conditions which describe the rights of the data centre in relation to the data. This could specify any licences (i.e. to use, translate the data, without changing the content to any medium or format, and disseminate the data for all uses and re-uses), privacy policies, and responsibilities of the data centre. This will ensure that expectations are met in the future. If expectations are not met due to misunderstandings there will be difficulties in maintaining productive partnerships.

These steps and principles are suggestions for guidance only. Depending on the circumstances and administrative arrangements in the organization establishing the NODC, modifications may have to be made, or a completely different approach taken. Directors of NODCs in other countries could help with this process based on their experiences. Member States should not hesitate to contact NODCs in other countries or the IOC/IODE Secretariat for advice in developing their NODC.

After the centre is approved and staffing is complete there will be an appreciable time before routine operation is achieved. There should be two main thrusts. The first will be to acquire and implement the computer and communications hardware and software. The second will be to make the centre visible to the client community.

In implementing the systems it is important to choose some goals that can be achieved earlier rather than later. There will be significant expectations within a broad community. It is not a good idea to implement a new centre and then not see anything produced for two years or more. It is important that visible progress becomes evident quickly. Even small steps that nevertheless show distinct progress will keep up interest in the centre. It is important not to promise more than can be delivered. This will maintain confidence in the client community and among partners.

When the NODC has become established it should consider participating in IODE programmes and projects. A list of IODE projects is available from the IODE web site (https://www.iode.org).

3.2.3 Formal Steps to Establish a Data Centre as an IODE NODC

Once the data centre has been established at the national level as an NODC an official communication should be sent by the official focal point of the IOC Member State concerned to the IOC Executive Secretary informing IOC of the official establishment of the data centre as an IODE National Oceanographic Data Centre (NODC). The communication should include the name and full address of the organization that will host the NODC. In addition as mentioned previously an IODE national coordinator for data management should be designated as well in this communication, if not designated before. It is important that the head of the NODC is also the IODE national coordinator for data management as this will greatly facilitate cooperation of the data centre in the IODE network.

Once IOC has received official notification of the NODC establishment the IODE Secretariat will inform the IODE community of the new NODC that has joined the network.

Relevant Addresses:

IOC Executive Secretary
Intergovernmental Oceanographic Commission (IOC) of UNESCO
7 Place de Fontenoy,
75352 Paris Cedex 07 SP
France

IODE Technical Secretary
IOC Project Office for IODE
Jacobsenstraat 1
8400 Oostende
Belgium
Email: info@iode.org

The List of Action Addresses can be obtained from the IOC Secretariat. It is also available from the IOC web site (http://ioc.unesco.org)

3.2.4 Obtaining the Accredited NODC Status

NODCs seeking formal accreditation will need to meet a minimum set of requirements to ensure compliance with IODE standards and to establish a mechanism to regularly monitor and assess the quality of data and service. NODCs will need to demonstrate their ability to provide secure long-term storage of and access to marine data.

The IODE committee has established accreditation criteria to ensure NODCs meet these requirements. Submissions for accreditation should address all the accreditation criteria which

can be found in IODE Quality Management Framework for National Oceanographic Data Centres (IOC Manuals and Guides 67). See also section 5.2 The IODE Quality Management Framework (IODE QMF) for further information.

3.3 ADU: IODE ASSOCIATE DATA UNIT

Recognising the growth in the number of data types and volumes of data, and projects or programmes developing their own data management systems, the IOC's International Oceanographic Data and Information Exchange (IODE) Committee, at its 22nd Session (2013) (Recommendation IODE-XXII.16) established a new structural element "The IODE Associate Data Unit (ADU)".

The IODE Associate Data Unit is intended to bring in the wider ocean research and observation communities as key stakeholders of the IODE network, taking into account the growth of ocean research and observation programmes and projects, and the ability of these projects to establish data systems.

It is important for these communities to share, provide access to and preserve all ocean research and observation data. In addition, it was recommended that OBIS nodes become either NODCs or ADUs.

The global community, through the NODCs, will benefit from the ADUs as these will be invited to share their data and information on their data collection (metadata catalogue), and this should be through their NODC (in the case of national projects, programmes, institutions or organizations), or through another IODE data facility (in the case of regional or international projects, programmes, institutions or organizations) or, in the case of biodiversity data, through international OBIS.

3.3.1 Tasks of an IODE Associate Data Unit And Benefits to their Host Organization

Tasks

ADUs do not replace NODCs but should contribute to the objectives of NODCs by:

(i) improving the completeness of data coverage of NODCs;

(ii) ensuring the long-term archival and preservation of ADU data by NODCs; and

(iii) increasing awareness amongst the ocean research and observation community of the importance of professional data management through NODCs. ADUs shall agree to apply the IOC Oceanographic Data Exchange Policy for the data shared with IODE.

The global community (the network of IODE data centres and their associated user communities) will benefit from the ADUs as these will be invited to share their data and information on their data collection (metadata catalogue).

They will be expected to coordinate with their NODC (in the case of national projects, programmes, institutions or organizations), or through another IODE data facility (in the case of regional or international projects, programmes, institutions or organizations) or, in the case of biodiversity data, through OBIS.

Benefits

By joining IODE as an ADU, projects, programmes, institutions or organizations will get the following benefits:

(i) Receive information on, and contribute to, IODE standards and best practices related to ocean data management,

(ii) Be welcomed to participate in ocean data and information management training, organized within the framework of the IODE OceanTeacher global academy,

(iii) Receive assistance, upon request, from IODE, on matters related to ocean data management,

(iv) Be invited, as observers, to participate in Sessions of the IODE Committee,

(v) Participate in IODE workshops and projects,

(vi) Share expertise with other ADUs and NODCs.

3.3.2 Establishment of an IODE Associate Data Unit

Any project, programme, institution or organization that wishes to join IODE as an IODE Associate Data Unit should contact the IOC Project Office for IODE (email to info@iode.org) and provide the following information:

(i) name and contact information of the ADU contact point(s);

(ii) name and contact point of the head of the applicant entity;

(iii) description of the national, regional or international project, programme, institution or organization;

(iv) brief description of data services/products provided by the entity;

(v) for projects: expected lifespan of the project and indication of plan for the archival/preservation of the data, data management plan;

(vi) letters of support;

(vii) required expertise, training that IODE could contribute;

(viii) data policy (if identified) of the applicant entity;

(ix) information on the existing relationship with a NODC.

An application form can be downloaded from the IODE web site or obtained from the IODE Secretariat. It should be filled and signed. When submitting please send us the MS-Word version (without signature) as well as a scanned version (with signature). Please also discuss your application with your NODC (if existing) as well as with your IOC national contact as the ADUs should work closely with the NODCs (if existing).

Applications shall be reviewed by the IODE Management Group (by email or during IODE Management Group meetings) in consultation with – and in the case of national projects, programmes, institutions or organization, subject to approval by the relevant NODC (if existing) – SG-OBIS (for biodiversity data) or other relevant recognized international programme.

3.3.3 Obtaining the Accredited ADU Status

The procedure to apply for accreditation of an ADU is the same as from NODCs (see- section 5.2 The IODE Quality Management Framework (IODE QMF) for further information)

3.4 AIU: IODE ASSOCIATE INFORMATION UNIT

Associate Information Units (AIUs) providing recognition and accreditation for marine science libraries and information centres are complementary to the Associate Data Unit structure for the IODE Data Management programme. Information (as usually managed by librarians and information managers) is as essential in the research process as data.

AIUs provide research support and host and maintain open access repositories of all ocean and aquatic related documents and other object types. Working alongside data centres they are also central in disseminating the information products resulting from processing, interpreting, and organizing facts/data.

AIUs were the final recommendation (Recommendation IODE-XXIV.5) (IODE ASSOCIATE INFORMATION UNIT) of the Group of Experts on Marine Information Management (GE-MIM) which had existed since 1984 and initiated many of the IODE information products. GE-MIM was disbanded along with other Groups of Experts by IODE-XXIV following IODE project-based restructuring. IODE National Coordinators for Marine Information Management continue to exist and along with AIUs are the main communication channel for MIM discussions.

Global marine science libraries and information centres are **encouraged** to become **Associate Information Units**

Regarding marine information management, the IODE works closely with the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC).

3.4.1 Tasks of an IODE Associate Information Unit

IODE Associate Information Units (AIUs) shall (updated September 2021):

(i) Be national projects, programmes, institutions or organizations, or regional or international projects, programmes, institutions or organizations (including academia) that carry out marine information management functions, and/or provide marine information services/products;

(ii) Be staffed by at least one marine information professional (by qualification or experience);

(iii) Demonstrate active digital development: online information services and products;

(iv) Promote Open Access to information. In this context “Open Access” is defined as “unrestricted access and unrestricted reuse” to/of information;

(v) Display a collaborative and networking ethos through:

a) Membership/partnership of professional library/information networks to

b) enrich their own as well as the entire IODE community;

c) Sharing expertise and experience with other AIUs, and IODE National

d) Coordinators for Marine Information Management;

e) Sharing information on new digital initiatives implemented within the

f) AIU, with the IODE community;

g) Encourage organization staff to submit records to OceanExpert

(vi) Receive information on, and contribute to, IODE standards and best practices related to marine information management;

(vii) Be welcomed to participate in training activities, organized within the framework of the IODE OceanTeacher Global Academy;

(viii) Be welcomed to participate in IODE workshops and projects;

(ix) Agree to display the IODE logo on your webpage and on marine information products developed in collaboration with IODE;

(x) Agree to make available information management documentation (standards, practices, guides…) used by the AIU for the wider marine science library and information community.

3.4.2 Establishment of an IODE Associate Information Unit

Information that should be provided includes:

1. name and description of the national, regional or international institution, organization, project or programme, include URL;
2. name of the applicant AIU (if different from (1));
3. URL of web presence of the applicant AIU;
4. URL of database where AIU collection holdings are recorded;
5. URL of Open Access document repository;
6. brief description of information services/products/digital initiatives provided by the
   entity including any separate URLs;
7. name and contact information of the AIU contact point(s);
   (note that this name can be different from the person signing the application. The AIU contact point will be contacted for all practical, technical and scientific communications);
8. name and contact information of the head of the applicant entity:
   (Director of institution, project coordinator, etc. This may be the name of the person signing the application);
9. description of staff and skills/expertise (include IT support);
10. opportunities provided to staff for professional development (in-house training/external training/participation in conferences…);
11. metrics (e.g. number of journal subscriptions, number of holdings, number of records in repositories and other databases etc.);
12. demonstrated involvement in a professional network or partnership (e.g. active member of library network, partner in funded collaborative project at regional, national, international level etc.)
13. involvement in research data management activities (e.g. RDM resources webpage or assisting with creation of a Data Management Plan (DMP))
14. for projects: expected lifespan of the project and indication of plans for the archival/preservation of the information output;
15. please attach letter of support from organization management;
16. required capacity building, training that IODE should provide;

17. information on the existing relationship with IODE (if applicable).

The application form is available from the IODE web site or from the IODE Secretariat.

Applications for AIUs shall be reviewed and approved by the IODE-Management Group (by email or during IODE-MG meetings). The Group will use *APPLICATION CRITERIA* documented in which can be obtained from the IODE Secretariat.

4 COORDINATION OF DATA AND INFORMATION MANAGEMENT AT THE INTERNATIONAL LEVEL: THE IOC COMMITTEE ON INTERNATIONAL OCEANOGRAPHIC DATA AND INFORMATION EXCHANGE (IODE)

4.1 ESTABLISHMENT AND OBJECTIVES OF THE IODE PROGRAMME

The IOC's International Oceanographic Data and Information Exchange (IODE) was established in 1961 to "enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products". Formally the IODE started out as a Working Group on Oceanographic Data Exchange which was created by the First IOC Assembly (19-27 October 1961) through Resolution I-9. The Working Group became a Working Committee in 1973 through Resolution VIII-31, adopted by the 8th Session of the IOC Assembly (5-17 November 1973).

The main objectives of the IODE Programme are (revision IODE-XXII, March 2013)

(i) To facilitate and promote the discovery, exchange of, and access to, marine data and information including metadata, products and information in real-time, near real time and delayed mode, through the use of international standards, and in compliance with the IOC Oceanographic Data Exchange Policy for the ocean research and observation community and other stakeholders;

(ii) To encourage the long term archival, preservation, documentation, management and services of all marine data, data products, and information;

(iii) To develop or use existing best practices for the discovery, management, exchange of, and access to marine data and information, including international standards, quality control and appropriate information technology;

(iv) To assist Member States to acquire the necessary capacity to manage marine research and observation data and information and become partners in the IODE network;

(v) To support international scientific and operational marine programmes, including the Framework for Ocean Observing for the benefit of a wide range of users.

The IODE network has been able to collect, control the quality of, and archive millions of ocean observations, and makes these available to Member States. Whereas in the past IODE data centres focused mainly on physical oceanography data, the IODE Programme now gives attention to all ocean related data including physical oceanography, chemical, biological, etc.

IODE closely collaborates with, and services the needs of, the other IOC and related programmes such as Ocean Sciences, GOOS and other international organizations. IODE provides the data dissemination and archiving functions required to build an integrated ocean observing system.

Another major and long-term commitment of the IODE Programme is the long-term accessibility and archival of oceanographic data, metadata and information to safeguard present and future holdings against loss or degradation.

4.2 OPERATIONAL STRUCTURE OF THE IODE PROGRAMME

The IODE system forms a worldwide service-oriented network consisting of:

- IODE national coordinators for data management
- IODE national coordinators for marine information management
- IODE National Oceanographic Data Centres (NODCs)
- IODE Associate Data Units (ADUs) (and their contact points)
- IODE Associate Information Units (AIUs) (and their contact points)
- The IODE Secretariat
- Invited experts (who collaborate with and contribute IODE activities such as projects)

4.3 MANAGEMENT OF THE IODE PROGRAMME

The IODE programme coordinates the IODE system within the IOC. The IODE Programme is governed by the IODE Committee, which is governed by the IOC Assembly, the main governing body of the IOC. The IODE Committee is composed of IODE national coordinators for data management, IODE national coordinators for marine information management, IODE Associate Data Unit contact points, IODE Associate Information Unit contact points.

The IODE Committee meets every two years. During these Sessions the Committee reviews the implementation of its past work plan and decides on a work plan for the next inter-sessional period. The IODE Committee is chaired by two Co-Chairs who are elected by the IODE Committee for the next inter-sessional period. They can be re-elected for a second term only once (unless there are special circumstances that call for a third term).

Between two Sessions of the Committee, the work of the Committee is overseen by the IODE Management Group.

The IODE management structure was revised by IODE-XXV through Decision IODE-XXV.5.1 (The IODE Management Structure). The **objectives** of the IODE-MG have been defined as follows:

(i) Be responsible for reviewing progress of the work plan and budget approved by the IODE Committee and adjusting them as required;

(ii) Oversee the assessment of IODE projects and activities and recommend their endorsements when these meet the agreed evaluation criteria;

(iii) Evaluate for efficacy any existing IODE groups formed by the IODE Committee.

The **membership** of IODE-MG comprises the following Executive and Non-executive members, bearing in mind that, ideally, both data and marine information management should be represented:

Executive members

- The current two IODE Co-Chairs,

- One or both past IODE Co-Chairs (to be agreed by past Co-chairs), (1)
- IODE Secretariat members (non-voting member) (2)

Non-executive members

- Current (Co-)Chair(s) of IODE (data and information) project steering groups or their designee, or IODE project leaders where no SG exists,
- Additional experts as needed (3)

1. The inclusion of one or both the past IODE co-chairs will provide continuity from the preceding intersessional period.
2. Members of the Secretariat are responsible for the administrative and financial implementation of projects and the MG will require their guidance and support on these matters.
3. The IODE-MG may seek the advice of subject matter experts and others as appropriate to help formulate its decisions and recommendations.

The IODE-MG reaches decisions by consensus of its voting members (executive + non-executive). IODE-MG members should not participate in decisions that relate to a project on which there may be a perceived conflict of interest.

The Executive members of the IODE-MG should meet face-to-face once during the intersessional period to review the status of the approved workplan and budget.

4.4 IODE ACTIVITIES

While each IODE data and information centre has its own day-to-day tasks, carried out as part of its national responsibilities, many of the IODE programme activities are implemented as **projects**. Projects are established by the IODE Committee (as a Recommendation to the IOC Assembly). Each project is managed by a Steering Group, composed of experts that collaborate on the implementation of the project. In some cases a Project Manager is recruited to manage the project while in other cases one of the members of the Steering Group volunteers to be the project manager. Some projects are funded from UNESCO regular programme funding (mostly for covering costs of meetings), whereas others are supported from extra-budgetary (donor) funding.

4.5 IODE AND CAPACITY DEVELOPMENT

The IODE programme aims to assist Member States to acquire the necessary capacity to manage marine data and information and become active partners in the IODE network and capacity development has been a cornerstone of the IODE since the programme's inception in 1961.

The OceanTeacher Global Academy (OTGA) provides specialized training related to ocean science, observation and data/information management. OTGA contributes to the implementation of the IOC Capacity Development Strategy, addressing key outputs identified in the strategy through increased support of training activities of all IOC programmes. This includes the Tsunami Unit, Ocean Literacy, Harmful Algal Bloom programme, IODE, and Ocean Sciences, amongst others. OTGA is an endorsed action under the Ocean Decade. **It provides a comprehensive web-based training platform that supports classroom training (face-to-face), blended training (combining classroom and distance learning), and online (distance) learning.** With greater involvement by the IOC Regional Sub-Commissions and Regional Committees, these regional bodies ensure the capacity development needs of the regions are being met by supporting a network of Regional and

Specialized (topic focused) Training Centres. This enables sharing of training materials and translation into other languages and promotes community building. The Training Centres deliver customised training for ocean experts and professionals to increase national and regional capacity in coastal and marine sciences, services and management. For an overview of courses visit: http://oceanteacher.org.

5 COLLABORATION OF IODE NODCS, ADUS AND AIUS IN GLOBAL DATA AND INFORMATION SHARING

5.1 IOC DATA POLICY AND TERMS OF USE

The sharing of oceanographic data is central to the mission of IODE and the free and unrestricted exchange of oceanographic data will ensure the maximum use is made of all available data. Open access to data and derived products can contribute to the beneficial public use and protection of the ocean environment, resources, protection of life and property and for the prediction of weather and climate.

The IOC Oceanographic Data Exchange policy, which was adopted as Resolution IOC-XXII-6 at the 22nd Session of the IOC Assembly in 2003, and slightly revised by the 30th Session of the IOC Assembly in 2019, promotes the free and open access to data, metadata and products, and aims to maximize the amount of data exchanged without infringing the rights of data originators.

The IOC Oceanographic Data Exchange Policy has been revised in 2022 and the new policy has been submitted for adoption to the IOC Assembly in 2023. It is available from the IODE web site.

5.2 THE IODE QUALITY MANAGEMENT FRAMEWORK (IODE QMF)

The IODE Quality Management Framework (IODE-QMF) provides the overall strategy, advice and guidance for NODCs to design and implement a quality management system for the successful delivery of oceanographic and related data, products and services. The IODE-QMF project was established through Recommendation IODE-XXII.18.

The main objectives of the IODE QMF are to:

- Promote accreditation of NODCs and ADUs according to agreed criteria
- Provide assistance to NODCs and ADUs to establish organizational quality management systems
- Initiate and review existing standards and Manuals and Guides with respect to the inclusion of quality management procedures and practices
- Provide regular feedback to the IODE Committee.

The IODE-QMF addresses the implementation of a quality management system to assist the NODCs and ADUs in the provision of good management practices that will ultimately enhance confidence in the quality of the data, products and services delivered to the community.

The IODE encourages all NODCs and ADUs to implement a quality management system and seek accreditation of their data centre. Accreditation is based on relevant criteria that can be translated into quantitative indicators, to ensure data centres are able to provide data of known quality to meet the requirements of a broad community of users. The accreditation requirements are divided into four broad sections covering:

- Organizational framework
- Quality control and maintenance
- User access and communication
- Technical infrastructure

For more information on the IODE QMF, refer to IOC Manuals and Guides 67 (*IODE Quality Management Framework for National Oceanographic Data Centres and Associate Data Units (Revised edition)*).

5.3 IOC STRATEGIC PLAN FOR OCEANOGRAPHIC DATA AND INFORMATION MANAGEMENT

The "IOC Strategic Plan for Oceanographic Data and Information Management (2023-2029)" has been revised and submitted for adoption to the IOC Assembly in 2023.

The **vision** of the IOC Strategic Plan for Data and Information Management (2023-2029)[1] is to achieve:

> *"**A comprehensive and integrated ocean data and information system, serving the broad and diverse needs of IOC Member States, for management, policy-making and scientific use**".*

This will contribute both to the mission and vision of the IOC. The latter is:

> ***"To bring together governments and the science community in achieving the 'Ocean We Need for the Future We Want.'"***

The IOC Strategic Plan for Data and Information Management describes the implementation of functional and interoperable data and information management practices and frameworks to ensure data and information availability.

It will guide IOC Programmes to effectively share and manage their data and information in a coordinated way and based on widely agreed practices so as to assist in fulfilling not only IOC's objectives but also those of the Ocean Decade.

The **scope** of the IOC Strategic Plan for Data and Information Management is therefore intended to be **comprehensive and cover all disciplines within the mandate of IOC**. All types of data and all time scales for data delivery (e.g. real-time versus delayed mode) as well as synthesis products and model output are included. Different strategies might be employed to satisfy global, regional and local requirements, and to meet timeliness needs. We must move towards a coherent data and information management communications strategy to enable us to integrate the wide variety of complex marine environmental measurements and observations across disciplines, institutions, and temporal and spatial scales.

The **aim** is to ensure the establishment of ***a comprehensive and integrated ocean data and information ecosystem*** for all ocean activities. It is essential that the existing and operational national, regional, and international systems can connect to the integrated global system.

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[1] IOC/INF-1412 (IOC Medium-Term Strategy, 2022–2029. UNESCO, 2022); https://unesdoc.unesco.org/ark:/48223/pf0000381388.locale=en

The **objectives** of the Strategic Plan are to deliver:

(i) interoperable, quality-controlled data on a diverse range of variables, (1) generated according to scientifically and operationally sound methods and (2) persistently archived in well-documented, globally applicable standards and formats,

(ii) timely dissemination of data on a diverse range of variables (generated from observations and model outputs) both in real-time and delayed modes depending on the needs of user groups and their technical capabilities ("on demand" as well as automatically scheduled), and

(iii) easy discovery and access to data and information about a diverse range of variables and derived products (including forecasts, alerts and warnings) in a way that is user friendly for a wide variety of users..

The implementation of the Strategic Plan should take into account:

1) Developments within the IOC/IODE Ocean Data and Information System (ODIS) and the ODIScat catalogue of online data and information services as an interoperability framework to interlink international, regional and national digital resources (see also 4.1);

2) Developments within the IOC/GOOS Observations Coordination Group (OCG) to map the data flows of the global in situ networks and develop a data implementation plan;

3) Developments within the IODE/GOOS Ocean Best Practices System (OBPS), noting that currently not all methods and best practices relevant to the IOC Strategic Plan for Data and Information Management are included;

4) The IOC Capacity Development Strategy (2023) and IOC Data Policy and Terms of Use (2023);

5) The need to support the data and information requirements for marine services, transportation, ocean forecasts, climate change and variability studies and scientific research;

6) The need to support IOC's efforts related to its custodian responsibility for indicators for SDG target 14.3 on ocean acidification and SDG target 14.a on marine scientific research;

7) The recognition and inclusion of Indigenous and Local Knowledge (ILK) to ensure this knowledge is appropriately integrated;

8) The support of community data principles such as FAIR (Findable, Accessible, Interoperable and Reusable), CARE (Collective benefit, Authority to control, Responsibility, Ethics), and TRUST (Transparency, Responsibility, User Focus, Sustainability, Technology); and 'Trusted Repository' protocols;

9) The need to undertake marine assessments and routinely provide indices on the "health" of the marine environment, such as assessments under the UN Regular Process (World Ocean Assessment) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES);

10) The call from the Convention on Biological Diversity (CBD) to IOC and its OBIS to provide data and information for the identification of Ecologically or Biologically Significant Areas (EBSAs), and to support the CBD's post-2020 Global Biodiversity Framework through GOOS and OBIS.

5.4 IODE GLOBAL DATA AND INFORMATION SYSTEMS AND REPOSITORIES

5.4.1 OBIS: Ocean Biodiversity Information System: https://www.obis.org

Playing a central role in fostering data sharing of marine species occurrence data since 2000, the Ocean Biodiversity (formerly Biogeographic) Information System (OBIS) has built the world's most comprehensive database on the diversity, distribution, and abundance of life in the ocean in time and space. OBIS was initiated under the Census of Marine Life (a 65 million USD decade-long private funded programme) and was adopted by IOC-XXV-4 in 2009 and formally established as a project under IODE with a formal Steering Group in 2011 (IODE-XXI.2). The +30 national, regional and thematic OBIS nodes participate in IODE as NODCs or ADUs following recommendation IODE-XXII.4 (2013), and as such OBIS nodes are official structural elements under IODE.

The IODE Steering Group for OBIS (SG-OBIS) is composed of the managers of the OBIS nodes and meets once per year. The SG-OBIS has an advising role to the IODE Committee on OBIS's vision and mission, and its strategy for sustainability and further development (including assisting with seeking funding). The SG-OBIS prepares, for submission to the IODE committee, OBIS' workplan, reviews progress and guides and identifies any technical or scientific issues as relevant to the implementation of the work plan. The SG-OBIS has established several (long-term) Task Teams and (shorter-term ad-hoc) Project Teams to share responsibilities between members of the OBIS community. These are currently:

- OBIS Strategic Advisory Task Team (SATT)
- OBIS Taxonomy Task Team (TaxTT)
- OBIS Capacity Development Task Team (CDTT)
- OBIS Communication and Outreach Task Team (COTT)
- OBIS Vocabulary Infrastructure Project Team (VIPT)
- OBIS Data Quality Assessment and Enhancement Project Team (QCTT)
- OBIS Historical Data Project Team (HDPT)
- OBIS Grand Unified Data Model Project Team (GUMPT)

The OBIS secretariat, hosted at the UNESCO/IOC project office for IODE in Oostende (Belgium), provides training and technical assistance to its OBIS nodes, guides new data standards and technical developments, and encourages international cooperation to foster the group benefits of the network. The OBIS project manager monitors the implementation, and reports on the progress with the implementation of the work plan, and organizes and implements sessions of the SG-OBIS, any Task Team meetings and other relevant OBIS meetings. The project manager is also responsible for the smooth operation of the OBIS data portal, in close collaboration with the OBIS data manager.

OBIS Nodes are either national projects, programmes, institutes or organizations, National Oceanographic Data Centers or regional or international projects, programmes and institutions or organizations that carry out data management functions. OBIS nodes are responsible for representing all aspects of OBIS within a particular region or taxonomic domain. The node is intended to establish relationships with key data providers within their geographical (or taxonomic) area of responsibility and bring data and corresponding metadata into the global OBIS database. Nodes are responsible for all aspects of the data from gaining permission to provide access to the data, to ensuring a certain level of data quality and for the transfer of these datasets to the global OBIS database. In addition, Nodes provide support for the full implementation of OBIS worldwide by serving on the SG-OBIS and any relevant OBIS

Task Teams and Project Teams. Each node may also maintain a data presence on the Internet representing their specific area of responsibility.

The OBIS secretariat runs the global database and is responsible for providing data access, web services, statistics and data products, and reports on data quality issues back to the OBIS nodes.

OBIS is a collective effort of thousands of scientists and data managers employed by hundreds of institutions around the world, who ensured that the scientifically researched, collated and published data adheres to the highest internationally recognized standards and protocols. OBIS has built the technology and methodology for robust near real-time data integration and curation. It also provides powerful data access and analytical services that streamline the feeding of integrated and quality-controlled datasets into models and forecasts. Since 2017, OBIS has championed a solution for managing combined biological and environmental data, including details about sampling effort and methods. This step of OBIS going beyond species occurrence data and embracing biological and ecosystem Essential Ocean Variables has been a crucial step in supporting the Global Ocean Observing System (GOOS), the Marine Biodiversity Observation Network (MBON) and the UN Decade of Ocean Science for Sustainable Development.

The success of bringing >100 millions of marine species observations into the public domain is a major achievement. Through open-access to data, OBIS provides equitable access and benefits to research, biodiversity conservation management and policy making, and also enhances international collaboration, for which OBIS is recognized by many global organizations, including the UN General Assembly.

5.4.2 WOD: World Ocean Database: https://www.ncei.noaa.gov/products/world-ocean-database

The World Ocean Database (WOD) is the world's largest collection of uniformly formatted, quality controlled, publicly and openly available oceanographic profile data. WOD is an IODE project and a NCEI product. At present, the database contains over 17.5 million oceanographic casts with Essential Ocean Variables (i.e., temperature, salinity, nutrients, oxygen, carbon, transient tracers, chlorophyll) and plankton. The database is quarterly updated with new data and data corrections and made available online.

WOD is a powerful tool for oceanographic, climatic, and environmental research at different spatial and temporal scales. It is the result of more than 20 years of sustained coordinated efforts to incorporate worldwide data from NODCs, GDACS, institutions, agencies, individual researchers, and data recovery initiatives into a single database for international use. WOD data spans from Captain Cook's 1772 voyage to the present including Argo.

All or subsets of the data in WOD can openly be findable and accessible through the World Ocean Database Select (WODSelect) at NCEI or its mirror at the UNESCO/IOC Project Office for IODE. WOD includes extensive documentation and metadata. Data users can also find and access the exact original data added to WOD through the NOAA NCEI archives.

5.4.3 Aquadocs: https://aquadocs.org/

AquaDocs is the open access global repository of the UNESCO/IOC International Oceanographic Data and Information Exchange (IODE) and the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) with support from the FAO Aquatic Sciences and Fisheries Abstracts. It is a thematic repository of publications covering the natural marine, coastal, estuarine /brackish and fresh water environments and

includes all aspects of the science, technology, management and conservation of these environments, their organisms and resources, and the economic, sociological and legal aspects.

AquaDocs objectives are:

- To make aquatic and marine science information FAIR (**F**indable, **A**ccessible, **I**nteroperable, **R**eusable) for all;
- To offer an open access repository platform to those organizations and individuals without the infrastructure to support their own;
- To provide a capacity development opportunity for the IODE and IAMSLIC Communities.

The structure of the repository reflects the global community that uses AquaDocs. The AquaDocs repository is free to search and download full text documents; publications are also findable through major search engines.To deposit items into AquaDocs, a registration process is required. The digital full text of a document is required to be deposited along with each document metadata. AquaDocs Editors review the metadata for accuracy and completeness, and the document for accessibility, prior to making the publication live in AquaDocs.

5.4.4 Ocean Best Practices: https://www.oceanbestpractices.org/

A main component of the Ocean Best Practices System (OBPS) is an open access sustained digital repository of global community methodologies in **all ocean-related sciences, operations and applications**. It is hosted and maintained by the International Oceanographic Data and Information Exchange (IODE) of the UNESCO-IOC as an IOC (IODE, GOOS) supported activity. The OBPS Repository provides an array of services in publication, discovery, access and training of methods and best practices in multiple languages, working with the communities that create and use best practices. The OBPS Repository offers the ocean observing community consistent access to methods and best practices, where community practices can be shared.

The Repository has two separate access interfaces :

1. **For Submission**: available through https://www.oceanbestpractices.org/ or https://repository.oceanbestpractices.org/. To deposit items into OBPS, a registration process is required. The digital full text of a method document is required to be deposited along with related metadata. Record curation of the metadata for accuracy and completeness, and the document for accessibility, is carried out prior to making the publication freely available in the OBPS Repository. In addition to bibliographic metadata, special metadata is collected on the documented method such as relevant EOV, EBV, ECV, SDG, Method Maturity Level, Adoption and Endorsement. Any document without a Digital Object Identifier (DOI) will have one issued by the repository. This rich metadata underpins the OBPS search and supports indexing and findability through major search engines.

2. **For Search:** available through http://oceanbestpractices.org or https://search.oceanbestpractices.org/. Provides a sophisticated search interface where the full text and individual metadata fields can be searched and the identified document may be freely downloaded. The full text digital content of documents in the repository is automatically semantically indexed against terminology resources used to annotate data and information across multiple fields and communities. Together, these capacities are improving the discoverability of ocean methods and best practices and gradually building links to the data and information they generate.

5.4.5 OceanExpert: https://www.oceanexpert.org

OceanExpert is a global directory containing information on

- Individuals: contact information, degree, affiliations, links to events, trainings and documents
- Organizations: contact information and affiliations
- Events: organizer information, content,participants, documents
- Training: organizer information, content, participants, documents
- Documents: training information, meeting reports, …

that are related to marine and freshwater knowledge.

It is a free and open database where the information is entered and maintained by its users (users keep full responsibility and ownership of their data). Individual professionals are welcome to contribute (and update) their records to this online database, to add to the already more than 20,000 of records in the directory (https://oceanexpert.org/statistics). While it is an open access product, it can be used only for non-profit purposes. The data is used in many IOC sites (e.g. https://ioc.unesco.org/events, OceanTeacher,…).

to manage information on training, events, experts participating in IOC events. In that regard OceanExpert is an essential IOC communications tool. The database and web interface are developed and maintained by the UNESCO/IOC Project Office for IODE (based in Oostende, Belgium).

5.5 THE IOC OCEAN DATA AND INFORMATION SYSTEM (ODIS): https://odis.org/

The Ocean Data and Information System (ODIS) provides an interoperability layer and supporting technology to allow existing and emerging ocean data and information systems, from any stakeholder, to interoperate with one another.

ODIS links these distributed, independent, systems through a decentralized interoperability architecture (ODIS-Architecture), to form a digital ecosystem. As with natural ecosystems, ODIS will be resilient to the gain or loss of parts, and accommodate a high diversity of products and services, while maintaining its core functions. In this way, ODIS will provide a comprehensive and global e-environment where users can discover data, data products, data services, information, information products and services provided by Member States, projects and other partners.

This will enable and accelerate more effective development and dissemination of digital technology and sharing of ocean data, information, and knowledge. As such, ODIS is not a new portal or centralised system but will provide a collaborative solution to link distributed systems for common goals.

5.5.1 Epilogue

This document will be updated in the future incorporating changes, community needs, as well as adding new emergent products and services.

IOC Manuals and Guides

No.	Title
1 rev. 2	Guide to IGOSS Data Archives and Exchange (BATHY and TESAC). 1993. 27 pp. (English, French, Spanish, Russian)
2	International Catalogue of Ocean Data Station. 1976. *(Out of stock)*
3 rev. 3	Guide to Operational Procedures for the Collection and Exchange of JCOMM Oceanographic Data. Third Revised Edition, 1999. 38 pp. (English, French, Spanish, Russian)
4	Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices. 1975. 54 pp. (English)
5 rev. 3	Guide for Establishing an IODE National Oceanographic Data Centre, IODE Associate Data Unit or IODE Associate Information Unit (3rd revised edition), 2022. 28 pp. (English) *(Electronic only)*
6 rev.	Wave Reporting Procedures for Tide Observers in the Tsunami Warning System. 1968. 30 pp. (English)
7	Guide to Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring. 1976. 50 pp. (French, Spanish)
8	*(Superseded by IOC Manuals and Guides No. 16)*
9 rev.	Manual on International Oceanographic Data Exchange. (Fifth Edition). 1991. 82 pp. (French, Spanish, Russian)
9 Annex I	*(Superseded by IOC Manuals and Guides No. 17)*
9 Annex II	Guide for Responsible National Oceanographic Data Centres. 1982. 29 pp. (English, French, Spanish, Russian)
10	*(Superseded by IOC Manuals and Guides No. 16)*
11	The Determination of Petroleum Hydrocarbons in Sediments. 1982. 38 pp. (French, Spanish, Russian)
12	Chemical Methods for Use in Marine Environment Monitoring. 1983. 53 pp. (English)
13	Manual for Monitoring Oil and Dissolved/Dispersed Petroleum Hydrocarbons in Marine Waters and on Beaches. 1984. 35 pp. (English, French, Spanish, Russian)
14	Manual on Sea-Level Measurements and Interpretation. (English, French, Spanish, Russian)
	Vol. I: Basic Procedure. 1985. 83 pp. (English)
	Vol. II: Emerging Technologies. 1994. 72 pp. (English)
	Vol. III: Reappraisals and Recommendations as of the year 2000. 2002. 55 pp. (English)
	Vol. IV: An Update to 2006. 2006. 78 pp. (English, Arab)
	Vol. V: Radar Gauges. 2016. 100 pp. and Supplement: Practical Experiences. 100 pp. (English, French, Russian, Spanish)
15	Operational Procedures for Sampling the Sea-Surface Microlayer. 1985. 15 pp. (English)
16	Marine Environmental Data Information Referral Catalogue. Third Edition. 1993. 157 pp. (Composite English/French/Spanish/Russian)
17	GF3: A General Formatting System for Geo-referenced Data
	Vol. 1: Introductory Guide to the GF3 Formatting System. 1993. 35 pp. (English, French, Spanish, Russian)
	Vol. 2: Technical Description of the GF3 Format and Code Tables. 1987. 111 pp. (English, French, Spanish, Russian)
	Vol. 3: Standard Subsets of GF3. 1996. 67 pp. (English)
	Vol. 4: User Guide to the GF3-Proc Software. 1989. 23 pp. (English, French, Spanish, Russian)

No.	Title
	Vol. 5: Reference Manual for the GF3-Proc Software. 1992. 67 pp. (English, French, Spanish, Russian)
	Vol. 6: Quick Reference Sheets for GF3 and GF3-Proc. 1989. 22 pp. (English, French, Spanish, Russian)
18	User Guide for the Exchange of Measured Wave Data. 1987. 81 pp. (English, French, Spanish, Russian)
19	Guide to IGOSS Specialized Oceanographic Centres (SOCs). 1988. 17 pp. (English, French, Spanish, Russian)
20	Guide to Drifting Data Buoys. 1988. 71 pp. (English, French, Spanish, Russian)
21	*(Superseded by IOC Manuals and Guides No. 25)*
22 rev.	GTSPP Real-time Quality Control Manual, First revised edition. 2010. 145 pp. (English)
23	Marine Information Centre Development: An Introductory Manual. 1991. 32 pp. (English, French, Spanish, Russian)
24	Guide to Satellite Remote Sensing of the Marine Environment. 1992. 178 pp. (English)
25	Standard and Reference Materials for Marine Science. Revised Edition. 1993. 577 pp. (English)
26	Manual of Quality Control Procedures for Validation of Oceanographic Data. 1993. 436 pp. (English)
27	Chlorinated Biphenyls in Open Ocean Waters: Sampling, Extraction, Clean-up and Instrumental Determination. 1993. 36 pp. (English)
28	Nutrient Analysis in Tropical Marine Waters. 1993. 24 pp. (English)
29	Protocols for the Joint Global Ocean Flux Study (JGOFS) Core Measurements. 1994. 178 pp . (English)
30	MIM Publication Series:
	Vol. 1: Report on Diagnostic Procedures and a Definition of Minimum Requirements for Providing Information Services on a National and/or Regional Level. 1994. 6 pp. (English)
	Vol. 2: Information Networking: The Development of National or Regional Scientific Information Exchange. 1994. 22 pp. (English)
	Vol. 3: Standard Directory Record Structure for Organizations, Individuals and their Research Interests. 1994. 33 pp. (English)
31	HAB Publication Series:
	Vol. 1: Amnesic Shellfish Poisoning. 1995. 18 pp. (English)
32	Oceanographic Survey Techniques and Living Resources Assessment Methods. 1996. 34 pp. (English)
33	Manual on Harmful Marine Microalgae. 1995. (English) [superseded by a sale publication in 2003, 92-3-103871-0. UNESCO Publishing]
34	Environmental Design and Analysis in Marine Environmental Sampling. 1996. 86 pp. (English)
35	IUGG/IOC Time Project. Numerical Method of Tsunami Simulation with the Leap-Frog Scheme. 1997. 122 pp. (English)
36	Methodological Guide to Integrated Coastal Zone Management. 1997. 47 pp. (French, English)
37	International Tsunami Survey Team (ITST) Post-Tsunami Survey Field Guide. 2nd Edition. 2014. 120 pp. (English)
38	Guidelines for Vulnerability Mapping of Coastal Zones in the Indian Ocean. 2000. 40 pp. (French, English)
39	Manual on Aquatic Cyanobacteria – A photo guide and a synopsis of their toxicology. 2006. 106 pp. (English)
40	Guidelines for the Study of Shoreline Change in the Western Indian Ocean Region. 2000. 73 pp. (English)

No.	Title
41	Potentially Harmful Marine Microalgae of the Western Indian Ocean Microalgues potentiellement nuisibles de l'océan Indien occidental. 2001. 104 pp. (English/French)
42	Des outils et des hommes pour une gestion intégrée des zones côtières - Guide méthodologique, vol.II/ Steps and Tools Towards Integrated Coastal Area Management – Methodological Guide, Vol. II. 2001. 64 pp. (French, English; Spanish)
43	Black Sea Data Management Guide *(Cancelled)*
44	Submarine Groundwater Discharge in Coastal Areas – Management implications, measurements and effects. 2004. 35 pp. (English)
45	A Reference Guide on the Use of Indicators for Integrated Coastal Management. 2003. 127 pp. (English). *ICAM Dossier No. 1*
46	A Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management. 2006. iv + 215 pp. (English). *ICAM Dossier No. 2*
47	TsunamiTeacher – An information and resource toolkit building capacity to respond to tsunamis and mitigate their effects. 2006. DVD (English, Bahasa Indonesia, Bangladesh Bangla, French, Spanish, and Thai)
48	Visions for a Sea Change. Report of the first international workshop on marine spatial planning. 2007. 83 pp. (English). *ICAM Dossier No. 4*
49	Tsunami preparedness. Information guide for disaster planners. 2008. (English, French, Spanish)
50	Hazard Awareness and Risk Mitigation in Integrated Coastal Area Management. 2009. 141 pp. (English). *ICAM Dossier No. 5*
51	IOC Strategic Plan for Oceanographic Data and Information Management (2008–2011). 2008. 46 pp. (English)
52	Tsunami risk assessment and mitigation for the Indian Ocean; knowing your tsunami risk – and what to do about it. 2009. 82 pp. (English)
53	Marine Spatial Planning. A Step-by-step Approach. 2009. 96 pp. (English; Spanish). *ICAM Dossier No. 6*
54	Ocean Data Standards Series: Vol. 1: Recommendation to Adopt ISO 3166-1 and 3166-3 Country Codes as the Standard for Identifying Countries in Oceanographic Data Exchange. 2010. 13 pp. (English) Vol. 2: Recommendation to adopt ISO 8601:2004 as the standard for the representation of date and time in oceanographic data exchange. 2011. 17 pp. (English) Vol.3: Recommendation for a Quality Flag Scheme for the Exchange of Oceanographic and Marine Meteorological Data. 2013. 12 pp. (English) Vol. 4: SeaDataNet Controlled Vocabularies for describing Marine and Oceanographic Datasets – A joint Proposal by SeaDataNet and ODIP projects. 2019. 31 pp (English)
55	Microscopic and Molecular Methods for Quantitative Phytoplankton Analysis. 2010. 114 pp. (English)
56	The International Thermodynamic Equation of Seawater—2010: Calculation and Use of Thermodynamic Properties. 2010. 190 pp. (English)
57	Reducing and managing the risk of tsunamis. Guidance for National Civil Protection Agencies and Disaster Management Offices as Part of the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas Region – NEAMTWS. 2011. 74 pp. (English)
58	How to Plan, Conduct, and Evaluate Tsunami Exercises / Directrices para planificar, realizar y evaluar ejercicios sobre tsunamis. 2012. 88 pp. *(*English, Spanish*)*
59	Guide for designing and implementing a plan to monitor toxin-producing microalgae. Second Edition. 2016. 63 pp. (English, Spanish)

No.	Title
60	Global Temperature and Salinity Profile Programme (GTSPP) — Data user's manual, 1st Edition 2012. 2011. 48 pp. (English)
61	Coastal Management Approaches for Sea-level related Hazards: Case-studies and Good Practices. 2012. 45 pp. (English)
62	Guide sur les options d'adaptation en zone côtières à l'attention des décideurs locaux – Aide à la prise de décision pour faire face aux changements côtiers en Afrique de l'Ouest / A Guide on adaptation options for local decision-makers: guidance for decision making to cope with coastal changes in West Africa / Guia de opções de adaptação a atenção dos decisores locais: guia para tomada de decisões de forma a lidar com as mudanças costeiras na Africa Ocidental. 2012. 52 pp. (French, English, Portuguese). *ICAM Dossier No. 7*.
63	The IHO-IOC General Bathymetric Chart of the Oceans (GEBCO) Cook Book. 2012. 221 pp. (English). *Also IHO Publication B-11*
64	Ocean Data Publication Cookbook. 2013. 41 pp. (English)
65	Tsunami Preparedness Civil Protection: Good Practices Guide. 2013. 57 pp. (English)
66	IOC Strategic Plan for Oceanographic data and Information Management (2013-2016). 2013. 54 pp. (English/French/Spanish/Russian)
67	IODE Quality Management Framework for National Oceanographic Data Centres. 2014; revised edition 2019 (English)
68	An Inventory of Toxic and Harmful Microalgae of the World Ocean (in preparation)
69	A Guide to Tsunamis for Hotels: Tsunami Evacuation Procedures (North-eastern Atlantic and the Mediterranean Seas). 2016 (English)
70	A guide to evaluating marine spatial plans. 2014. 96 pp. (English)
71	IOC Communication Strategy for Marine Information Management (2015-2017). 2015
72	How to reduce coastal hazard risk in your community – A step-by-step approach. 2016
73	Guidelines for a Data Management Plan. 2016
74	Standard Guidelines for the Tsunami Ready Recognition Programme. 2022. 60 pp. (English)
75	ICAN (International Coastal Atlas Network) - best practice guide to engage your CWA (Coastal Web Atlas) user community. 2016
76	Plans and Procedures for Tsunami Warning and Emergency Management – Guidance for countries in strengthening tsunami warning and emergency response through the development of Plans and Standard Operating Procedures for their warning and emergency management authorities. 2017
77	IOC Strategic Plan for Data and Information Management (2017-2021). 2017
78	Harmful Algal Blooms (HABs) and Desalination: A Guide to Impacts, Monitoring and Management. 2017
79	IOC Communication and Outreach Strategy for Data and Information Management (2017-2019). 2017
80	Ocean Literacy for All – A toolkit. 2017
81	Procedures for Proposing and Evaluating IODE Projects and Activities. 2018
82	Preparing for community tsunami evacuations: From Inundation to Evacuation Maps, Response Plans, and Exercises (English and Spanish) and Supplement 1 and 2 (English only), 2020.
83	Quality Control of in situ Sea Level Observations: A Review and Progress towards Automated Quality Control, Vol. 1. (English only), 2020
84	Towards a Best Practice for Developing Best Practices in Ocean Observation (BP4BP): Supporting Methodological Evolution through Actionable Documentation. (English only). 2020
85	Vol1.: Workbook: How to Reduce Coastal Hazard Risk in your Community – A step-by-step approach. English only (2021)

No.	Title
	Vol 2: Community Guide for community members interested in risk reduction efforts. How to reduce coastal hazard risk in your community: A step-by-step approach (English, French, Spanish, Russian, Arabic and Portuguese) 2021
86	Multi-Annual Community Tsunami Exercise Programme: Guidelines for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions. 2022. 65 pp. (English)
87	*In preparation*
88	Guidelines for the Study of Climate Change Effects on HABs. 2021. 118 pp. (English)
89	MSPglobal International Guide on Marine/Maritime Spatial Planning. 2021. 150 pp. (English)
90	A New Blue Curriculum – A toolkit for policy-makers. 2022. 128 pp. (English)

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