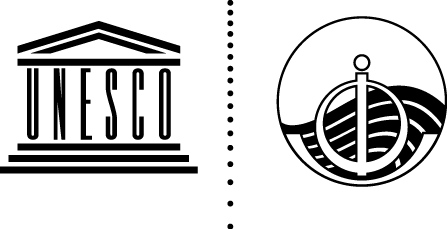
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Oostende, 8 February 2022

Original: English

**INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION**

(of UNESCO)

**First Meeting of the IOC Inter-sessional working group on the revision of the IOC Oceanographic Data Exchange Policy (2003, 2019) (IWG-DATAPOLICY-I)**

**desk study on existing DATA policies (IOC, UN, non-UN)**

(by Greg Reed, Consultant)

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# Background

The 20th Session of the IOC Assembly (Paris, June/July 1999) proposed an ad hoc Intersessional Working Group on Oceanographic Data Exchange Policy to review existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products, with a view to proposing to the next session of the Assembly:

* a restatement of the general IOC principles and policy with regard to oceanographic data exchange; and
* a statement of recommended practices and the required institutional arrangements for the operational exchange of oceanographic data

The Group met (Paris, May 2000[[1]](#footnote-1)) to review existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products . The Group was unable to reach consensus on a new IOC data exchange policy but outlined a general statement of principles and practices for data exchange, with commercialization issues clearly marked for further discussion. The findings of the Group were presented to the 33rd Session of the Executive Council for comments and recommendations for further action. The IOC Executive Council noted that the Group could not reach consensus on a draft text and concluded that this matter needed the attention of an Intergovernmental Working Group, comprising representatives of the Members States of the IOC Executive Council. Resolution EC-XXXIII.4 tasked the IWG to continue detailed discussions on and assessment of existing agreements and practices within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products, with a view to proposing to the IOC Assembly:

1. a statement of the general IOC principles and policy on oceanographic data exchange
2. a statement of recommended practices and associated institutional arrangements for the exchange of oceanographic data
3. a draft resolution for consideration by the Assembly

The IWG met twice (Brussels, May 2001[[2]](#footnote-2); Paris, June 2002[[3]](#footnote-3)). The Second Session of the IWG agreed on a draft policy which was subsequently submitted to IODE-XVII (Paris, March 2003) and to the IOC Assembly (IOC-XXII, June 2003). The IOC Assembly adopted Resolution XXII-6, IOC Oceanographic Data Exchange Policy.

The 25th Session of IODE (February 2019) revised Clause 5 of the policy which was adopted by the 30th Session of the IOC Assembly (June 2019). The IOC Oceanographic Data Exchange Policy (2019) is shown in Annex I.

# Revision of the Policy

At its meeting on 17 February 2021, the Management Group of the International Oceanographic Data and Information Exchange Programme (IODE) agreed that there were enough elements that warrant a revision of the IOC data exchange policy and a new IOC data policy should further promote and support free and open exchange of data in the framework of IOC activities and programmes. The Management Group acknowledged the amount of effort that went into building consensus on the current policy, especially with respect to acknowledging the rights of countries and the non-binding nature of the policy, so any changes should be carefully considered. Suggestions were made to build on other models such as the data policy of WMO that has a main policy with core principles, and modular extensions pertaining to specific data types or applications and products. This way the scope of the policy could be further expanded more easily if needed without opening a debate on the core elements. The ultimate goal of the IOC policy is to increase global cooperation, improved sharing and uptake of data and it is therefore important that data policies should not hamper, but streamline this within commonly agreed terms (e.g., use of a Creative Commons licence). The review of the current policy should ensure better alignment with data policies at national, regional and international level as well as those from other sectors, and should reflect current international principles (such as FAIR), which did not exist in 2003.

The 31st Session of the IOC Assembly (June 2021) recognized that a revision of the 20-year-old IOC data exchange policy was timely and adopted Decision A-31/3.4.2 (International Oceanographic Data and Information Exchange) including part III *Revision of the IOC Oceanographic Data Exchange Policy (2003, 2019)* which established the IOC Intersessional Working Group on the Revision of the IOC Oceanographic Data Exchange Policy (2003, 2019) (IWG-DATAPOLICY) and defined its terms of reference[[4]](#footnote-4). The IWG would reflect on the international, regional and national developments and improvements in data sharing principles and should align with updated policies from other organizations, such as WMO. The revised IOC data exchange policy should also serve and be applicable to the variety of data types and applications under the UN Ocean Decade and should consider the increased interest from philanthropic and private or commercial enterprises in using the ocean data collected by our Member States and recovered and stored by IODE.

# Overview of Data Sharing Principles

In their study of data sharing in the natural sciences, the US National Research Council noted in its report *Bits of Power: Issues in Global Access to Scientific Data[[5]](#footnote-5)*

*“The value of data lies in their use. Full and open access to scientific data should be adopted as the international norm for the exchange of scientific data derived from publicly funded research.”*

It is acknowledged that sharing of data promotes scientific progress and data sharing is now actively promoted by different groups including governments, data centres, researchers and funding agencies:

* Institutional data management policies and procedures address the ownership data, their storage, their retention beyond the end of the project and appropriate access to them by the community
* Data management plans are used to outline what research data will be created during the course of a research project, plans for sharing and preserving the data and any restrictions that may need to be applied.
* Funding agencies have guidelines and requirements relating to research data management that address planning, dissemination and sharing, accessibility and reuse and storage
* The scholarly publication process recommends or mandates data sharing as a condition for publication
* Researchers are becoming increasingly aware that they must share and reuse data, attracted by the benefits of increased altmetrics through data publication citations

Sharing data is acknowledged as promoting scientific progress and sharing data within the scientific community encourages a culture of openness and accountability in scientific research. More specifically, improved access to, and sharing of, data:

* Reinforces open scientific inquiry
* Encourages diversity of analysis and opinion
* Promotes new research
* Makes possible the testing of new or alternative hypotheses and methods of analysis
* Supports studies on data collection methods and measurement
* Facilitates the education of new researchers
* Enables the exploration of topics not envisioned by the initial investigators
* Permits the creation of new data sets when data from multiple sources are combined. (OECD[[6]](#footnote-6))

Data policies that foster and facilitate sharing and open access to data include recent developments that should be part of a new data sharing policy including open data, data licensing, FAIR data principles, TRUST Principles for digital repositories and data management plans. These developments are briefly discussed below

## Open data

Open data can be freely used, modified, and shared by anyone for any purpose. Open data can generally be defined as data that is:

* freely available to download in a reusable form
* licensed with minimal restrictions to reuse
* well described with provenance and reuse information provided
* available in convenient, modifiable and open formats
* managed by the provider on an ongoing basis.

To be open, data must be both technically open and legally open.

* Technically open which means they must be provided in a non-proprietary, machine-readable format that allows data to be easily read and modified. Open data should also be available and searchable online and should include metadata to make the data usable
* Legally open which means they must be placed in the public domain or licenced with minimal restrictions.

Although fully open data should be the default, there can be reasons to restricts data access, such as sensitive species information, proprietary data, indigenous knowledge, etc. From a scientific perspective, there are many reasons to make data open. Open data avoids unnecessary duplication, and, because data is more visible, can lead to more collaboration and advances in the fields of research and innovation. In Europe there is a general push to make data "as open as possible, as closed as necessary". In the academic world, this can mean keeping data embargoed until a scientific paper has been published or until a set period of time has lapsed.

## Data licensing

All data intended for reuse should have a licence. A data licence is a legal instrument that specifies the terms and conditions under which data can be accessed, used, shared and attributed to the original data owner. Wherever data is made available (through a catalogue, archive or portal), the licence should be displayed. Many research funders require data to be made available to other researchers to discover, examine and build upon and the most effective way of communicating permissions to potential re-users of data is through a data licence. When reusing licensed data, it may only be used in the way permitted by the licence. If no licence has been assigned then the data owner must be contacted for permission to use the data. There are many kinds of standard licences, the primary difference being the number of rights that are granted to the licensee by the licensor. Some licences permit only a restricted number of uses, while others grant the user greater freedom to reuse the work, with only some rights reserved by the licensor.

The most commonly and widely used data licences are the suite of Creative Commons[[7]](#footnote-7) licences. Creative Commons (CC) licences provide a simple, standardized way to share data that allow users to re-use, re-mix and share content legally. Offering data under a CC licence does not mean renouncing copyright, it simply means that others are permitted to use the data in various ways, but only under certain conditions specified through the licence. Creative Commons provides a set of six licences, ranging from few, to many, conditions of reuse. Creative Commons Attribution (CC BY) is the default licence recommended the most research funders and is widely used for the licensing of datasets.

## FAIR Data Principles

The FAIR Data Principles[[8]](#footnote-8) are a set of guiding principles (Findable, Accessible, Interoperable, Reusable) that can be used as a guide in data management and data stewardship and to promote sharing and reuse of data.

The FAIR guiding principles are applicable to both data and metadata and can be applied across multiple disciplines and provides a range of benefits including:

* increasing the visibility and citations of your research
* improving the reproducibility and reliability of your research
* enabling  new innovative research approaches and tools
* aligning with international standards and approaches

FAIR also provides a range of benefits to researchers, research communities, research infrastructure facilities and research organisations, including:

* support knowledge discovery and innovation
* support data and knowledge integration
* promote sharing and reuse of data
* are discipline independent and allow for differences in disciplines
* move beyond high level guidance, containing detailed advice on activities that can be undertaken to make data more FAIR
* help data and metadata to be machine readable, supporting new discoveries through the harvest and analysis of multiple datasets.

FAIR does not necessarily imply open. Data can be FAIR and shared under restrictions, for example, data could meet the FAIR principles but be private or only shared under certain restrictions. According to Tanhua et al[[9]](#footnote-9), “*A FAIR data policy should be a priority for all marine datasets and should be supported by nations and stakeholders*.”

## TRUST Principles

The Research Data Alliance (RDA) has developed a set of guiding principles, the TRUST Principles for digital repositories[[10]](#footnote-10), to demonstrate the trustworthiness of digital repositories, centred around Transparency, Responsibility, User focus, Sustainability, and Technology.

|  |  |
| --- | --- |
| **Principle** | **Guidance for repositories** |
| **T**ransparency | To be transparent about specific repository services and data holdings that are verifiable by publicly accessible evidence. |
| **R**esponsibility | To be responsible for ensuring the authenticity and integrity of data holdings and for the reliability and persistence of its service. |
| **U**ser Focus | To ensure that the data management norms and expectations of target user communities are met. |
| **S**ustainability | To sustain services and preserve data holdings for the long-term. |
| **T**echnology | To provide infrastructure and capabilities to support secure, persistent, and reliable services. |

The TRUST Principles provide a framework to facilitate discussion and implementation of best practices in digital preservation and provide clear guidance for repository stakeholders on how these qualities may be developed, maintained, and demonstrated. The TRUST Principles have since been endorsed by over 25 organizations.

## Data management plan

A Data Management Plan (DMP) is a formal document outlining how research data will be managed, stored, documented and secured throughout a research project as well as planning for what will happen to the data after completion of the project. The data management plan is intended to provide descriptive details of the data, the processes, the decisions, as well as identifying roles and responsibilities. This also includes a long-term data sharing and preservation plan to ensure data are publicly accessible beyond the life of the project. A data management plan is often a requirement of funding agencies.

Each DMP - regardless of the kind of data that is involved - needs to address the following six requirements:

* Data description and collection or reuse of existing data
* Documentation and data quality
* Storage and backup during the research process
* Legal and ethical requirements, codes of conduct
* Data sharing and long-term preservation
* Data management responsibilities and resources

Data sharing is an expected part of every data management plan requirement. Licensing and access to data should be described and any restrictions on data sharing, such as legal constraints or sensitive data, should be presented in the DMP.

The IOC Manuals and Guides 73[[11]](#footnote-11), Guidelines for a Data Management Plan (2016), has been prepared by the IODE to encourage researchers to prepare a DMP for research projects that will collect marine data and to ensure the data generated by research projects be permanently archived in the IODE network of NODCs and ADUs.

# Overview of Data Policies

A number of organisations (intergovernmental, international and national) have established policies on data exchange and sharing. Within the IODE community, a number of data centres have developed their own data policies. In the broader community, data policies have been applied by international and intergovernmental organizations for the sharing and exchange of data. The following is a review of selected data policies used by the IODE and the international community.

## IODE NODC, ADU and Project Data Policies

One of the objectives of the IODE programme is 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. All IODE National Oceanographic Data Centres, Associate Data Units and Projects are expected to comply with the IOC Oceanographic Data Exchange Policy. IODE has initiated an accreditation process to ensure that NODCs and ADUs are established and operate according to defined principles and adherence to the IOC Oceanographic Data Exchange Policy is mandatory for accreditation.

The IODE National Reports 2019-2020 Survey: Data Management (NODCsand ADUs)[[12]](#footnote-12) asked the question:

*“Has your country applied (in 2019 and/or 2020) the IOC Oceanographic Data Exchange Policy adopted as Resolution IOC-XXII-6 in 2003?”*

From the 70 responses, 46 data centres indicated they applied the IOC Policy, 11 data centres did not apply the IOC Policy and 13 data centres did not know.

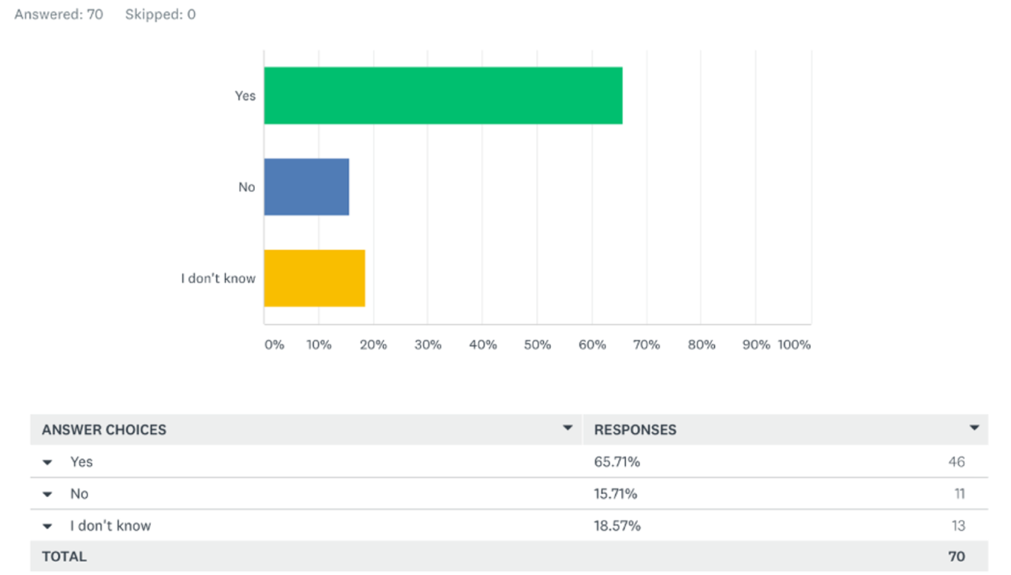


Figure 1: application of IOC data policy by NODCs and ADUs (2019-2020)

The survey also asked the question *“Does your data centre have its own data policy?”* Forty nine data centres responded they have their own data policy and the following IODE NODCs and ADUs provided a reference to their policies:

1. Australia (ADU CSIRO)
2. Australia (NODC)
3. Belgium (NODC VLIZ)
4. Brazil (NODC)
5. Canada (ADU OTN)
6. Colombia (ADU INVEMAR)
7. Colombia (NODC)
8. Denmark (ADU ICES)
9. Finland (other)
10. Greece (ADU)
11. Iceland (ADU CAFF)
12. Ireland (NODC)
13. Japan (ADU JAMSTEC)
14. Norway (NODC)
15. Portugal (other)
16. South Africa (NODC)
17. Spain (ADU SOCIB)
18. Sweden (NODC)
19. UNITED KINGDOM (NODC)
20. UNITED KINGDOM (ADU CEFAS)

In addition, the Ocean Biodiversity Information System (OBIS), a project under the IODE programme, has defined its own data policy. Annex II summarises these IODE NODC, ADU and Project data policies.

## International/Intergovernmental Data Policies

Many international organizations have implemented data policies for the sharing and exchange of data. In the following selected international and intergovernmental data policies, the core principles and best practices of data sharing are identified and examined. Annex III summarises the data policies of the selected International and Intergovernmental organizations.

### WMO Unified Data Policy

The WMO Unified Policy for the International Exchange of Earth System Data[[13]](#footnote-13) (2021), which was approved by the WMO Congress in October 2021, replaces three separate policies (WMO Resolutions 40, 25 and 60) for the exchange of weather, water and climate data. The WMO Unified Data Policy encompasses seven domains and disciplines of Earth system data: weather, climate, hydrology, atmospheric composition, cryosphere, oceans and space weather. The policy defines the international exchange of Earth system data as a fundamental principle of WMO and commits to broadening and enhancing the free and unrestricted international exchange of Earth system data.

The policy retains a two-tier approach to the international provision and exchange of Earth system data and mandates that core data ***shall*** be exchanged, alongside recommended data that ***should*** be exchanged:

* WMO Members shall provide on a free and unrestricted basis the ***core data*** that are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations and which are required to monitor and predict seamlessly and accurately weather, climate, water and related environmental conditions.
* Members should also provide the ***recommended data*** that are required to support Earth system monitoring and prediction activities at the global, regional and national levels and to further assist other Members with the provision of weather, climate, water and related environmental services in their States and Territories.

The specific details on what are considered ***core data***[[14]](#footnote-14) and ***recommended data*** is contained within WMO technical regulations, which can be amended, extended and updated to keep pace with technology and emerging needs, rather than requiring a fully-fledged amendment to the policy resolution itself. Ocean data are explicitly included in the policy covering in situ and remotely sensed observational data both in and above the ocean and at the sea surface, from the open ocean to the coast, along with other data that provide necessary input to ocean monitoring and prediction and for a variety of other Earth system applications. The core and recommended ocean data included in the policy are:

Core observational data

* Marine meteorological and oceanographic observations, as defined in the Manual on the WMO Integrated Global Observing System(WMO-No. 1160)
* All other physical Global Ocean Observing System (GOOS) Essential Ocean Variables (EOVs) and physical ocean domain GCOS ECVs, some of which are included in section 2, Climate, above made as part of a GOOS observational network, programme or project, consistent with the Intergovernmental Oceanographic Commission (*IOC) Oceanographic Data Exchange Policy* (IOC Resolution XXII-6)
* Ocean analysis and prediction fields provided by global NWP systems operating under the auspices of the GDPFS, as defined in the Manual on the Global Data- processing and Forecasting System(WMO-No. 485)
* All ocean reanalysis fields provided by the Global Processing Centres of the GDPFS
* All watches, warnings, advisories and alerts for public safety (protection of life and property) issued by Members’ designated warning and alerting authorities according to WMO Technical Regulations

Recommended data

* Physical GCOS ECV and GOOS EOV observations that have been collected outside of designated GOOS activities
* All other observed biogeochemical and biological/ecosystems GCOS ECVs and GOOS EOVs
* Observations of pH, chlorophyll-A, suspended particles and downwelling irradiance which are fundamental to address significant scientific and societal ocean/climate- related issues

The ocean data aspects of the policy were developed in collaboration with the GOOS community and specify that all physical GOOS Essential Ocean Variables (EOVs) and GCOS Essential Climate Variables (ECVs) data collected as part of GOOS are classed as core data that shall be exchanged on a free and unrestricted basis, while the exchange of all other observed biogeochemical and biological/ecosystems GOOS EOVs and GCOS ECVs is recommended.

### EU Open Data Directive

The EU Open Data Directive[[15]](#footnote-15) is a directive that stipulates minimum requirements for EU member states regarding making public sector information available for re-use. The Directive is an attempt to remove barriers that hinder the re-use of public sector information throughout the Union. The Open Data Directive establishes the principle that research data resulting from publicly funded research must be Open Access by default. Directive stresses the importance of the principle of reusing and publishing open government data from public sector bodies for both commercial and non-commercial purposes.

The Directive introduces the concept of high-value datasets. The reuse of high-value datasets is associated with important benefits for the society and economy and are subject to a separate set of rules ensuring their availability free of charge, in machine readable formats. The thematic categories of high-value datasets, as referred to in Article 13(1) of the Directive, are:

1. geospatial
2. earth observation and environment
3. meteorological
4. statistics
5. companies and company ownership
6. mobility

The directive stresses the importance of open data licensing and in February 2019, the Commission decided to standardize the usage of Creative Common licences as the standards for open licences. Member states had until 16 July 2021 to transpose the new directive into national law.

### UNESCO Recommendation on Open Science

The aim of the UNESCO Recommendation[[16]](#footnote-16) (2021) is to provide an international framework for open science policy and practice that recognizes disciplinary and regional differences in open science perspectives, takes into account academic freedom, gender-transformative approaches and the specific challenges of scientists and other open science actors in different countries and in particular in developing countries, and contributes to reducing the digital, technological and knowledge divides existing between and within countries. The Recommendation defines shared values and principles for Open Science and identifies concrete measures on Open Access and Open Data, with proposals to bring citizens closer to science and commitments to facilitate the production and dissemination of scientific knowledge around the world.

The Recommendation sets an international standard for the definition of open science and associated policies and practices to drive better sharing throughout the global science community. It details seven broad areas for action:

1. Promoting a common understanding of open science and its benefits and challenges, as well as diverse paths to open science
2. Developing and enabling a policy environment for open science
3. Investing in open science infrastructures and services
4. Investing in human resources, training, education, digital literacy and capacity building
5. Fostering a culture of open science and aligning incentives
6. Promoting innovative approaches for open science across the scientific process
7. Promoting cooperation in the context of open science to reduce digital, technological and knowledge gaps

### The Beijing Declaration on Research Data

The International Council of Science Committee on Data for Science and Technology (CODATA) and its Data Policy Committee issued The Beijing Declaration on Research Data[[17]](#footnote-17) in September 2019 as a statement of the core principles of open data and research, encouraging global cooperation. The Beijing Declaration supports international efforts to make research data as open as possible and only as closed as necessary. It seeks to make data and metadata to be FAIR (Findable, Accessible, Interoperable, and Reusable) and as open as possible on a global basis.

The Beijing Declarationproduced the following set of ten principles:

1. Research is increasingly driven by data that are beyond human processing alone. Researchers therefore should have access to diverse, trustworthy, and reusable sources of data that are readily available and machine actionable. Data stewardship capacity building and comprehensive policies that enable the creation, dissemination, preservation, and above all the global reuse of data and information are essential, including sustained support for the required infrastructure and expertise.
2. Research data have global public good characteristics. A pure public good cannot be depleted by use (also called non-rivalrous) and cannot be excluded from use. Research data cannot be depleted, but can be restricted in use, although exclusion of reuse by others can be very inefficient and controversial, especially if the data are generated by public funding. The value of research data increases with use.
3. Publicly funded research data should be findable online to build an international data commons. Findable data require comprehensive metadata descriptions and persistent identifier tags because data that cannot be easily located by potential users—whether by humans or machines—are of limited value. Together, principles three to seven result in FAIR data—both for machines and humans.
4. Publicly funded research data are, by default, in the public interest and should be accessible to the greatest extent possible for international reuse. They were created or collected on behalf of the public that paid for them, and thus should be as open as possible and only as closed as necessary. This is even more important in cases where the data relate to issues covered by the UN landmark agreements.
5. Publicly funded research data should be interoperable, and preferably without further manipulation or conversion, to facilitate their broad reuse in scientific research. Software, instruments, and data formats should be well-documented and should not impose any proprietary lock-in that restricts reuse. Data should be described with rich metadata and should use community-recognized terminologies to maximize interoperability and reuse.
6. Despite strong reasons for making research data as open as possible, there are legitimate reasons to restrict access to and reuse of data, including interests of national security, law enforcement, privacy, confidentiality, intellectual property, and indigenous data governance, among others. Restrictions should have an express justification and research data otherwise should be open by default on a global basis. If the data need to be closed, an effort should be made to provide responsible and proportionately controlled access.
7. National legislation that exempts research data from copyright or other intellectual property (IP) protections is one way to enable and support reuse of public data. Another way is for researchers to choose a minimally restrictive and voluntary common-use license
8. Funders of academic and applied research should require the submission of adequate data stewardship plans, including clear guidelines for the provision of long-term availability, accessibility, and conditions for reuse. Open data policies should be accompanied by commensurate penalties for noncompliance as well as appropriate incentives.
9. Activities that address the “divide in scientific production” between less economically advanced regions and those economies with advanced research infrastructures should include access to publicly funded research data and related information. The wider deployment and access to advanced technical research infrastructures is a necessary, but not sufficient, condition to reduce the divide.
10. Research data policies should promote the principles in this Declaration and be coordinated internationally. They should be implemented with clear policy wording and guidelines, specific funding, and a commitment to monitor their impact with the overall objective of building a global FAIR data commons.

### Principles for Polar Data policies

The Third Polar Data Forum (2019) initiated a process to update and align the data policies of the International Arctic Science Committee (IASC), the Scientific Committee on Antarctic Research (SCAR) and the Southern Ocean Observing System (SOOS). These three polar data committees have been working to identify the core principles of all the major policies that are relevant to polar regions and their recommendations have been published as Alignment of Polar Data Policies - Recommended Principles[[18]](#footnote-18).

The recommended core principles for all polar data policies are summarized as:

1. **Data must be ethically open**. Data from publicly funded research should be open by de- sign and by default in order to release their full potential as a primary resource for knowledge discovery. Full, free, and open access for all users should be the norm unless there are valid reasons for restricted access
2. **Data should be free**. The distribution and reuse of research data should be free of charge and delivered at no more than the cost of reproduction and delivery.
3. **Data must be provided in a timely manner**. To facilitate reuse of data while they are most valuable, all research data should be made available as soon as possible after their collection and, if possible, near real-time.
4. **FAIR Principles should be applied to the greatest extent practicable**. To ensure the efficient and effective uptake of data, the FAIR principles must be followed to the greatest extent practicable and ethical
5. **All data must be accompanied by a complete set of metadata**. Structured, standardised metadata are essential to the discovery, access, and effective reuse of data, allowing users to assess the quality of the data and any processing that has been applied to it.
6. **Data should have persistent and globally unique identifiers**. Persistent and globally unique identifiers (PIDs) should be used for all data and remain linked to the data through republication or data aggregation processes.
7. **Data must be labelled as reusable**. Open data access and legal interoperability requires that the rights to reuse the data are made clear to the user.
8. **Data sources should be attributable and attributed**. To recognise the valuable contributions of data providers and to enhance repeatability and transparency of research results, data users must formally acknowledge data authors and sources.
9. **Data must be appropriately preserved for the long term**. Given that the long-term value of data may not be recognised until long after collection, preservation of data to ensure a lasting legacy of research programmes and projects is essential.
10. **Data management and long-term curation must be planned and resourced**. Projects should develop data management plans in advance of collecting data that outline how any data captured, modelled or acquired will be managed both during the life of the program and beyond. Where possible, data should be deposited for long-term management in repositories that adhere to the TRUST principles.

### WDS Data Sharing Principles

The International Council for Science – World Data System (ICSU-WDS) adopted a new set of Data Sharing Principles in 2015. The WDS Data Sharing Principles[[19]](#footnote-19) express core ethical commitments that are operationalized in WDS Certification. For Regular and Network Members, it is anticipated that existing organizational policies align with these Principles; Partner and Associate Members are not subject to certification and therefore are not required to adopt them but are encouraged to do so. The Data Sharing Principles embody the spirit of 'Open Science' meant to unite diverse communities of data producers and data users, and thus could be adopted by anyone pursuing science for the public good. The Data Sharing Principles are in line with the data policies of national and international initiatives, including those of the Group on Earth Observations, the G8 Science Ministers' Statement and Open Data Charter, the OECD Principles and Guidelines for Access to Research Data from Public Funding, as well as the Science International Accord on Open Data in a Big Data World.

The WDS Data Sharing Principles are:

1. Data, metadata, products, and information should be fully and openly shared, subject to national or international jurisdictional laws and policies, including respecting appropriate extant restrictions, and in accordance with international standards of ethical research conduct
2. Data, metadata, products, and information produced for research, education, and public-domain use will be made available with minimum time delay and free of charge, or for no more than the cost of dissemination, which may be waived for lower-income user communities to support equity in access
3. All who produce, share, and use data and metadata are stewards of those data, and have responsibility for ensuring that the authenticity, quality, and integrity of the data are preserved, and respect for the data source is maintained by ensuring privacy where appropriate, and encouraging appropriate citation of the dataset and original work and acknowledgement of the data repository
4. Data should be labelled ‘sensitive’ or ‘restricted’ only with appropriate justification and following clearly defined protocols, and should in any event be made available for use on the least restrictive basis possible

### CLIVAR Data Policy

CLIVAR is a global multidisciplinary climate research project that requires a wide range of data and needs data centres to ingest, quality control, archive and distribute these data. The CLIVAR Data Policy[[20]](#footnote-20) provides guidelines for how these data should be handled in a consistent manner so as to achieve the project’s scientific objectives. The policy aims to strike a balance between the rights of investigator s and the need for widespread access through the free and unrestricted sharing and exchange of CLIVAR data and metadata. CLIVAR data policy is intended to be fully compatible with IOC, WMO, GCOS and GEOSS data principles. For CLIVAR to succeed, high-quality data and metadata need to be collected, processed and exchanged without significant delay in a free and unrestricted manner

The CLIVAR data policy is enshrined in the following CLIVAR data principles:

1. **Free and unrestricted exchange.** All CLIVAR data should be made available freely and without restriction. “Freely” means at no more than the cost of reproduction and delivery, without charge for the data itself. “Without restriction” means without discrimination against, for example, individuals, research groups, or nationality. In exceptional circumstances involving highly specialized or experimental data, principal investigators may temporarily limit access until such time as the data can be adequately validated.
2. **Timely exchange.** CLIVAR investigators should make data available voluntarily and with minimal delay, preferably also in real-time, to maximize their value to CLIVAR. In cases where extensive post-processing of delayed mode data is needed before a final research quality data set can be generated, early release of a preliminary version of the data is required.
3. **Quality control.** CLIVAR investigators retain the primary responsibility for the quality of the data they produce and distribute. Data originators and those generating climate data products are required to ensure that their data meet international quality standards wherever possible.
4. **Metadata.** Metadata are required to enable the use of data without ambiguity or uncertainty. Metadata for CLIVAR data sets will be developed and managed in accordance with international standards.
5. **Preservation of data.** Long-term survival, integrity, and access to CLIVAR data must be preserved for future generations. Internationally agreed standards should be used for the acquisition, processing, and final archival of data and metadata. Data distributed in real and near-real time should, wherever possible, be replaced in a delayed mode after it has undergone quality control and full documentation.
6. **Plan for reuse in reanalysis.** While datasets will be used individually and in combination for research purposes, the sum total of all CLIVAR and CLIVAR-relevant data will have great value in reanalysis activities. To aid this, uniformity of data format and quality should be a high priority.
7. **Easy access.** CLIVAR encourages the use of the most recent advances in communication to ensure widespread access to data collected under auspices of the programme.
8. **Use of existing national and international mechanisms and centres.** Where feasible, CLIVAR will use existing national and international mechanisms for the exchange and storage of oceanic and atmospheric data and build on the data management structure of existing programmes. In this way, the effectiveness of the data system will be improved by reducing redundancy and duplication and identifying opportunities and system economies, with financial costs minimized.
9. **Reporting Requirements.** Data and metadata should be submitted to recognized data assembly centres as well as to appropriate national and international archival institutions so that the collected information may be safeguarded for future analysis. Inventories of data and related information should be readily accessible and updated as needed on a routine basis.

### GEOSS Data Sharing Principles (2015)

GEO recognizes that the societal benefits arising from Earth observations can only be fully achieved through the sharing of data, information, knowledge, products and services and has promoted fundamental principles for data sharing, expanding the trend towards open data worldwide. The GEOSS Data Sharing Principles[[21]](#footnote-21) are:

* data, metadata and products will be shared as Open Data by default, by making them available as part of the GEOSS Data Collection of Open Resources for Everyone (Data-CORE) without charge or restrictions on reuse, subject to the conditions of registration and attribution when the data are reused
* where international instruments, national policies or legislation preclude the sharing of data as Open Data, data should be made available with minimal restrictions on use and at no more than the cost of reproduction and distribution
* all shared data, products and metadata will be made available with minimum time delay

### OECD Principles and Guidelines for Access to Research Data from Public Funding

The OECD Principles and Guidelines for Access to Research Data from Public Funding[[22]](#footnote-22) (2007) provide broad policy recommendations to the governmental science policy and funding bodies of member countries on access to research data from public funding. They are intended to promote data access and sharing among researchers, research institutions, and national research agencies, while at the same time, recognising and taking into account, the various national laws, research policies and organisational structures of member countries. The Principles and Guidelines apply to research data supported by public funds for the purposes of developing publicly accessible scientific research and knowledge.

The specific aims and objectives of the OECD Principles and Guidelines are to:

* Promote a culture of openness and sharing of research data among the public research communities within member countries and beyond
* Stimulate the exchange of good practices in data access and sharing
* Raise awareness about the potential costs and benefits of restrictions and limitations on access to and the sharing of research data from public funding
* Highlight the need to consider data access and sharing regulations and practices in the formation of member countries’ science policies and programmes
* Provide a commonly agreed upon framework of operational principles for the establishment of research data access arrangements in member countries
* Offer recommendations to member countries on how to improve the international research data sharing and distribution environment

The OECD recommends the following Principles for access to research data

1. **Openness** means access on equal terms for the international research community at the lowest possible cost, preferably at no more than the marginal cost of dissemination.
2. **Flexibility** requires taking into account the rapid and often unpredictable changes in information technologies, the characteristics of each research field and the diversity of research systems, legal systems and cultures of each member country.
3. **Transparency**. Information on research data and data-producing organisations, documentation on the data and specifications of conditions attached to the use of these data should be internationally available in a transparent way, ideally through the Internet.
4. **Legal conformity**. Data access arrangements should respect the legal rights and legitimate interests of all stakeholders in the public research enterprise.
5. **Protection of intellectual property**. Data access arrangements should consider the applicability of copyright or of other intellectual property laws that may be relevant to publicly funded research databases
6. **Formal responsibility**. Access arrangements should promote explicit, formal institutional practices, such as the development of rules and regulations, regarding the responsibilities of the various parties involved in data-related activities.
7. **Professionalism**. Institutional arrangements for the management of research data should be based on the relevant professional standards and values embodied in the codes of conduct of the scientific communities involved.
8. **Interoperability**. Technological and semantic interoperability is a key consideration in enabling and promoting international and interdisciplinary access to and use of research data.
9. **Quality**. Data managers, and data collection organisations, should pay particular attention to ensuring compliance with explicit quality standards.
10. **Security**. Specific attention should be devoted to supporting the use of techniques and instruments to guarantee the integrity and security of research data.
11. **Efficiency**. One of the central goals of promoting data access and sharing is to improve the overall efficiency of publicly funded scientific research to avoid the expensive and unnecessary duplication of data collection efforts.
12. **Accountability**. The performance of data access arrangements should be subject to periodic evaluation by user groups, responsible institutions and research funding agencies.
13. **Sustainability**. Due consideration should be given to the sustainability of access to publicly funded research data as a key element of the research infrastructure.

## UN Decade of Ocean Science for Sustainable Development

Proclaimed by the United Nations General Assembly, the Ocean Decade[[23]](#footnote-23) aims to produce ‘the science we need for the ocean we want’, catalysing transformative ocean science solutions for sustainable development, from 2021 onwards. Data and information are key enablers of the Ocean Decade outcomes and access to ocean-related data, information and knowledge will be cornerstones of the success of the Ocean Decade.

The Decade aims to achieve a major change in the knowledge and management of the ocean and one of the over-arching goals of the Decade is:

* To provide ocean science, data and information to inform policies for a well-functioning ocean in support of all Sustainable Development Goals of the 2030 Agenda.

One of the six societal outcomes of the Decade is:

A “transparent and accessible” ocean, whereby all nations, stakeholders and citizens have access to ocean data and information technologies and the capacities to inform their decisions. Open access to ocean information, increased interactions between the academic and societal actor communities, and ocean literacy for all should capacitate all citizens and stakeholders to have a more responsible and informed behaviour toward the ocean and its resources. Innovative capacity development schemes between south–south and north–south ocean actors as well as courses for ocean professionals will be key in raising ocean awareness and promoting better solutions.

The Decade R&D Priority Area 4 is Data and Information System. A Decade data policy will be developed and proposed, and compliance with the IOC data policy of free, unrestricted and open access to data should be considerably strengthened in the course of the Decade.

# Discussion

The data sharing principle underlying many current data policies is open access: making data openly available to the maximum extent and with as few restrictions as possible. The benefits of open access include providing greater access to data and enhancing the visibility research. Open data policies facilitate science and maximize the value of data, efficiency and expanded capabilities as well as equity. Many of the data policies reviewed here promote and encourage open access to data (GEOSS, OECD, Polar Data Policy, UNESCO Recommendation on Open Science, EU Open Data Directive, Beijing Declaration on Research Data).

Data licensing. The assignment of a licence to data adds clarity around permissions for use and re-use and eliminates the need to contact the copyright holder. A data licence should be non-restrictive specifying that the data may be re-used and specifying minimum requirements. The most commonly and widely used data licences are the suite of Creative Commons (CC) licences which provide a simple, standardized way to share data that allow users to re-use, re-mix and share content legally. Creative Commons Attribution (CC BY) is the default licence recommended the most research funders and is widely used for the licencing of datasets. Most of the IODE data centres and projects that have implemented their own data policies, have specified the use of Creative Commons licences (in many cases CC-BY). Some of the international data policies reviewed here specify the use open licences to share data (WMO Unified Data Policy, EU Open Data Directive, UNESCO Recommendation on Open Science, Beijing Declaration on Research Data, Polar Data Policy, OECD Principles and Guidelines for Access to Research Data from Public Funding) and the use of Creative Commons licensing is identified in some of these policies.

FAIR Data Principles. The FAIR Principles have been widely adopted for the management of ocean data[[24]](#footnote-24). Adhering to the FAIR principles with free, timely, and unrestricted access to ocean observation data is beneficial for the originators, has obvious benefits for users and is an essential foundation for the development of new services made possible with big data technologies.

There is a push in many countries to require publicly funded research outputs to be FAIR. Access to funding is now often dependent specifically on how FAIR the data will be. FAIR principles are identified in some of the international data policies reviewed here (EU Open Data Directive, UNESCO Recommendation on Open Science, Beijing Declaration on Research Data, Polar Data Policy). Many of the IODE data centres and projects that have implemented their own data policies also promote FAIR principles to provide equitable access to data.

Data management plan. A Data Management Plan (DMP) is a key element of good data management. A DMP describes everything necessary to make data discoverable, accessible, usable and understandable. It can help plan the necessary resources and costs for data management and planning can help to increase the FAIRness of data and make data FAIR by design. A DMP has become a requirement for many funders and research institutes.

Core and recommended data. The WMO Unified Data Policy maintains a two-tiered approach to the international provision and exchange of Earth system data. The policy lists the minimum set of **core data** that Members shall exchange on a free and unrestricted basis to underpin the services they provide for the protection of life and property and for the well-being of all nations. In addition, it identifies certain **recommended data** that should also be exchanged by Members to support Earth system monitoring and prediction efforts. Earth system data encompass data pertaining to weather, climate, hydrology, atmospheric composition, oceans, cryosphere, and space weather.

For the Ocean domain, the policy lists in situ and remotely sensed observational data both in and above the ocean and at the sea surface, from the open ocean to the coast, along with other data that provide necessary input to ocean monitoring and prediction and for a variety of other Earth system applications.

Ocean domain core data (observational and other) are defined as:

* Marine meteorological and oceanographic observations, as defined in the Manual on the WMO Integrated Global Observing System (WMO-No. 1160)
* All other physical Global Ocean Observing System (GOOS)9 Essential Ocean Variables (EOVs) and physical ocean domain GCOS ECVs, some of which are included in section 2, Climate, above made as part of a GOOS observational network, programme or project, consistent with the Intergovernmental Oceanographic Commission (IOC) Oceanographic Data Exchange Policy (IOC Resolution XXII-6)
* Ocean analysis and prediction fields provided by global NWP systems operating under the auspices of the GDPFS, as defined in the Manual on the Global Data- processing and Forecasting System (WMO-No. 485)
* All ocean reanalysis fields provided by the Global Processing Centres of the GDPFS
* All watches, warnings, advisories and alerts for public safety (protection of life and property) issued by Members’ designated warning and alerting authorities according to WMO Technical Regulations.

Ocean domain Recommended data are defined as:

* Physical GCOS ECV and GOOS EOV observations that have been collected outside of designated GOOS activities
* All other observed biogeochemical and biological/ecosystems GCOS ECVs and GOOS EOVs
* Observations of pH, chlorophyll-A, suspended particles and downwelling irradiance which are fundamental to address significant scientific and societal ocean/climate- related issues

The policy stipulates that core data shall be freely available, with no conditions on use.

## Revision of IOC Oceanographic Data Exchange Policy

The data sharing landscape has changed considerably in the twenty years since the IOC Assembly adopted the IOC Oceanographic Data Exchange Policy in 2003. Open data has entered the mainstream and many countries and organizations actively promote and, in some instances, mandate data sharing and have implemented policies to make data openly available to the maximum extent and with as few restrictions as possible.

A revised IOC Policy should clarify obligations of Member States with respect to open data, data licensing, FAIR data principles, data management plans and should incorporate these common policy elements. To promote sharing of data, a revised policy should be as open as possible and should only restrict access to data in situations where openly sharing the data is not possible. Any revision of the IOC Policy must take onto consideration the needs of the Ocean Decade, noting the Decade’s objective to further strengthen the policy of free, unrestricted and open access to data.

A two-tiered approach to sharing if data, as has been adopted by WMO for Earth system data, could be applied in the revised IOC Policy if there is a need to separate core and recommended data. This, however, would require defining the lists for these two types of data.

# ANNEX I. IOC Oceanographic Data Exchange Policy

IOC Resolution XXII-6

**IOC Oceanographic Data Exchange Policy**

The Intergovernmental Oceanographic Commission,

**Recalling** Resolution XX-11 on Oceanographic Data Exchange Policy (1999),

**Noting**:

1. WMO Resolution 40 (Cg-XII) which defined a policy and practice for the international exchange of meteorological and related data and is intended to promote the free and unrestricted exchange of basic data,
2. The “Statement on Data Management Policy for Global Ocean Programmes” as submitted by the IOC Committee on IODE (Recommendation IODE-XIV.6, December 1992) and adopted by the IOC Assembly at its 17th Session (Paris, 25 February–11 March 1993) (para. 20 of the Summary Report of the Session),

**Considering** the reports of deliberations of:

(i) The ad hocWorking Group on Oceanographic Data Exchange Policy (Paris, 15–17 May 2000),

(ii) The First Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy (Brussels, 29–31 May 2001),

(iii) The Second Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy (Paris, 17–18 June 2002),

**Adopts** the IOC Oceanographic Data Exchange Policy as detailed in the Annex to this Resolution.

Annex to Resolution XXII-6  
**IOC Oceanographic Data Exchange Policy**

**Preamble**

The timely, free and unrestricted international exchange of oceanographic data is essential for the efficient acquisition, integration and use of ocean observations gathered by the countries of the world for a wide variety of purposes including the prediction of weather and climate, the operational forecasting of the marine environment, the preservation of life, the mitigation of human-induced changes in the marine and coastal environment, as well as for the advancement of scientific understanding that makes this possible.

**Recognising** the vital importance of these purposes to all humankind and the role of IOC and its programmes in this regard, the Member States of the Intergovernmental Oceanographic Commission agree that the following clauses shall frame the IOC policy for the international exchange of oceanographic data and its associated metadata.

**Clause 1**

Member States shall provide timely, free and unrestricted access to all data, associated metadata and products generated under the auspices of IOC programmes.

**Clause 2**

Member States are encouraged to provide timely, free and unrestricted access to relevant data and associated metadata from non-IOC programmes that are essential for application to the preservation of life, beneficial public use and protection of the ocean environment, the forecasting of weather, the operational forecasting of the marine environment, the monitoring and modelling of climate and sustainable development in the marine environment.

**Clause 3**

Member States are encouraged to provide timely, free and unrestricted access to oceanographic data and associated metadata, as referred to in Clauses 1 and 2 above, for non-commercial use by the research and education communities, provided that any products or results of such use shall be published in the open literature without delay or restriction.

**Clause 4**

With the objective of encouraging the participation of governmental and non-governmental marine data-gathering bodies in international oceanographic data exchange and maximising the contribution of oceanographic data from all sources, this Policy acknowledges the right of Member States and data originators to determine the terms of such exchange, in a manner consistent with international conventions, where applicable.

**Clause 5**[[25]](#footnote-25)

Use of IODE system: Member States shall, to the best practicable degree, use data centres linked to the World Data System (WDS) and IODE’s NODCs, such as the World Ocean Database (WOD) and the Ocean Biogeographic Information System (OBIS), as long-term repositories for oceanographic data and associated metadata.

**Clause 6**

Member States shall enhance the capacity in developing countries to obtain and manage oceanographic data and information and assist them to benefit fully from the exchange of oceanographic data, associated metadata and products. This shall be achieved through the non-discriminatory transfer of technology and knowledge using appropriate means, including IOC’s Training Education and Mutual Assistance (TEMA) programme and through other relevant IOC programmes.

**Definitions**

**“Free and unrestricted”** means non-discriminatory and without charge. “Without charge”, in the context of this resolution means at no more than the cost of reproduction and delivery, without charge for the data and products themselves.

**“Data”** consists of oceanographic observation data, derived data and gridded fields.

**“Metadata”** is "data about data" describing the content, quality, condition, and other characteristics of data.

**“Non-commercial”** means not conducted for profit, cost-recovery or re-sale.

**“Timely”** in this context means the distribution of data and/or products sufficiently rapidly to be of value for a given application.

**“Product”** means a value-added enhancement of data applied to a particular application.

# ANNEX II. Summary of IODE NODC, ADU and Project data policies

| **NODC/ADU/Project** | **Principles** | **Data access** | **Exclusions** | **Data licence** | **IOC Data Policy** | **Reference** |
| --- | --- | --- | --- | --- | --- | --- |
| Australia (ADU CSIRO Australia) | Data collected through access to any MNF Capability are managed in accordance with Open Access and Findable, Accessible, Interoperable and Reusable (FAIR) data management principles. | Data to be freely available and the intended repository for Data is required to be agreed to and recorded in the Data Management Plan developed prior to a Project being delivered. | The MNF shall not make Data public that are subject to legislative or regulatory requirements that prevent dissemination or that have not been appropriately quality controlled and labelled. | Data will be published under the terms of a Creative Commons Attribution Licence (CC-BY) | Not specified | [Data and Sample Management Policy](https://mnf.csiro.au/en/About/Policies/For-Chief-Scientists-and-Voyage-Applicants/Data-Management-Policy) |
| Australia (NODC) | All data provided to the program is unencumbered and freely accessible at no charge to third parties. All data provided to the AODN must be adequately documented with metadata and arrangements are made for data to be held by the custodian organisation or an alternate organisation for long term access. | Freely accessible at no charge to third parties. Data are delivered to meet FAIR principles | It is up to the data custodian to specify restrictions in the metadata record associated with the relevant data. The AODN will not be responsible for limiting access to these data. | AODN recommends that data is licensed through an appropriate Creative Commons license, preferably the By Attribution (CC-BY) licence. | Not specified | [AODN Data Policy](https://s3-ap-southeast-2.amazonaws.com/content.aodn.org.au/Documents/IMOS/Conventions/AODN_Data_Policy.pdf) |
| Belgium (NODC, VLIZ) | The Flanders Marine Data Centre (VMDC) aims to make data Open and FAIR. Scientific data is accessible to all and its dissemination transparent. | We strive to make scientific data accessible to all | Not specified | The digital objects have a licence indicating the conditions under which they can be used, | Not specified | [FAIR & Open data](http://www.vliz.be/en/fair-open-data) |
| Brazil (NODC) | Aims to guide and promote efficient access, use and dissemination of data and information under the custody or produced by the Directorate of Hydrography and Navigation (DHN), and maintained by the Navy Hydrography Center (CHM). | Data available on demand | Not specified | Internal licence agreement | Not specified | [NORMA DE ACESSO AOS DADOS E ÀS INFORMAÇÕES ABERTOS DA DIRETORIA DE HIDROGRAFIA E NAVEGAÇÃO (NAD-DHN)](https://www.marinha.mil.br/dhn/sites/www.marinha.mil.br.dhn/files/Port13-2018-DHN-Aprova-NAD-DHN.pdf) |
| Canada (ADU OTN) | Designed to balance the utility of data sharing, both within the acoustic telemetry community and with the broader public, against the real and practical concerns of sharing this very sensitive ecological information. | All acoustic receiver metadata are made public as soon as is practical. The detection data retrieved by these operations are not included in the information that is immediately publicized. Animal tagging metadata and their association with detections on any OTN platform are by default placed under 2 year embargo | Exceptions are considered given any ecological or economic sensitivities as identified by the Collaborator. Animal morphology information and ongoing locational information in whatever capacity the instrument is capable of reporting it are considered by default to be Restricted Data | Not specified | Not specified | [OTN Data Policy](https://members.oceantrack.org/data/policies/otn-data-policy-2018.pdf) |
| Colombia (ADU INVEMAR) | Commitment to use statement. The user agrees to comply with the conditions of use of the information provided: | Data must not be transferred in any way to third parties.  They will not be able to sell the information that is provided to them. | Not specified | Not specified | Not specified | [COMPROMISO DE USO](https://siam.invemar.org.co/compromiso-uso) |
| Colombia (NODC) | Intended to establish a policy for access, exchange and use of technical and scientific data and information of the General Maritime Directorate. | Data and public information financed with the Maritime General Directorate's own resources are open data, for non-commercial use, without additional costs to those of its reproduction | Operational products developed for the Colombian Military and Police Forces, reasons of defence and national security., on the material location of the elements of the submerged cultural heritage preserved by the General Maritime Directorate. | The licenses for the use of open data will have at least the following elements: a) Acknowledgment, that is, the licensee must refer to the source of the data and information at the bibliographic citation level. b) Non-commercial, that is, the use of data and information for commercial purposes is not allowed. | Compatible with international data exchange | [LA POLÍTICA DE ACCESO, INTERCAMBIO Y USO DE DATOS E INFORMACIÓN, TÉCNICOS Y CIENTÍFICOS DE LA DIRECCIÓN GENERAL MARÍTIMA](https://cecoldo.dimar.mil.co/web/sites/default/files/co_remac4_parte5_titulo2_politica_datos_tecnico_cientificos_dimar2020.pdf) |
| Denmark (ADU ICES) | Promotes the use of data ensuring their maximum value can be realized and contribute to an increased understanding of the marine environment | All data products are by default publicly available, including those derived from restricted data | Fisheries Database, VMS and Logbook data, biodiversity data where data may have been provided by non-governmental organisations. | Creative Commons (CC BY 4.0) licence | Not specified | [ICES Data Policy](https://www.ices.dk/data/guidelines-and-policy/Pages/ICES-data-policy.aspx) |
| Finland (Met. Institute) | **Finnish Meteorological Institute has made its data sets freely available for public use.** | Through the Open Data services of the Finnish Meteorological Institute it is possible to search for, browse and download the Institute's data sets in machine-readable format free of charge. | Not specified | Creative Commons Attribution 4.0 International license (CC BY 4.0) | Not specified | [Finnish Meteorological Institute's open data](https://en.ilmatieteenlaitos.fi/open-data) |
| Greece (ADU LifeWatch) | The Data Policy and Sharing Agreement of LifeWatch Greece provides both the users and the Data Providers with background information on datasets, metadata, data sharing, licenses and copyright issues concerning biodiversity data. | Data accessible via the LifeWatch Greece are openly and universally available to all potential users under the terms and conditions that the Data Provider has identified for his/her data. FAIR reuse of data published through LifeWatch Greece | Sensitive data to be requested from the Data Providers who are the only persons or entities having the jurisdiction to take decisions on making such data available to certain third persons or parties. | LifeWatch Greece uses Creative Commons as a legal instrument to define the usage rights of the data. under two different conditions: CC Zero or CC-BY | Not specified | [Data Policy and Data Sharing Agreement](https://www.lifewatchgreece.eu/sites/default/files/documents/D1.2%20Policy%20Background%20Doc_En.pdf) |
| Iceland (ADU CAFF) | The ABDS data policy will, where possible, be in accordance with the Conservation Commons and the International Polar Year (IPY) data policies | Free and open access to data, information and knowledge for conservation and management purposes will be promoted. | In some cases compelling reasons exist for restricting data availability, such as revealing sensitive sites of endangered species, and such cases will require the application of appropriate safeguards. | Not specified | Not specified | [ABDS Data Policy](https://abds.is/index.php/data-policy) |
| Ireland (NODC) | The MI Data Policy seeks to promote access to its data archives, subject to conditions under which data has been collected. | MI data holdings should bemade available in a controlled manner, using centralised managed services where practical. | There are considerations which may mean that certain data have restricted access. Availability of MI scientific and environmental data will be decided by a combination of the data ownership, data classification and the category of those wishing to access the data. | MI data should belicensed using the Creative Commons CC-BY 4.0 license. Where specific conditions are required to be attached to the use of the data the MI data license should be used. | Not specified | [Marine Institute Data Policy](https://www.marine.ie/Home/sites/default/files/MIFiles/Docs/DataServices/Marine%20Institute%20Data%20Policy%202017.pdf) |
| Japan (ADU JAMSTEC) | This Basic Policies refers to the handling and scientific and educational use of the various kinds of Data and Samples obtained by JAMSTEC as the result of its scientific research and development. | Data and Samples to be made open for research and educational purposes and be available for use into the future on a global basis. | Some of the Data and Samples must be protected as intellectual properties, which will be identified by JAMSTEC whenever applicable. | Not specified | Not specified | [Basic Policies on the Handling of Data and Samples by Japan Agency for Marine-Earth Science and Technology](https://www.jamstec.go.jp/e/database/data_policy.html) |
| Norway (NODC) | The Data Policy states that IMR requires that all its research data is processed ethically both internally and by external users. | IMR data are freely available to all users on condition that the source is acknowledged. | In the interest of publishing and project cooperation, full access to experimental data may be deferred for up to two years after project completion. | IMR data should be published under open access data licenses such as the Norwegian License for Open Government Data (NLOD) or compatible international licenses, such as Creative Commons (CC BY 4.0) | Not specified | [IMR Data Policy](https://www.hi.no/resources/imr/Data-policy-IMR.pdf) |
| Portugal (other) | This Directive regulates the access, availability and prices related to the transfer of the Hydrographic Institute (HI) technical-scientific data. | Free - Citizenship data available on the HI website with no charge to the user. | This Directive does not apply to national protocols or commitments entered into with other entities for the transfer of data taken by the HI or the Navy. | Not specified | Not specified | [POLÍTICA DADOS](https://www.hidrografico.pt/op/31) |
| South Africa (NODC) | The principles on which this data policy is founded ... provide for the open dissemination and availability of information and data, especially in terms of information collected and held using public funds. | External data will fall into the following categories: (i) Open: Data will be available freely, openly and without restrictions; (ii) Sensitive: Data that will not be released due to copyright agreements; (iii) Embargoed: Data will only be made available to the public by the Data Provider after a defined period of time. | Sensitive and embargoed data | To promote FAIR data sharing, the Creative Commons ShareAlike (CC BY-SA) license will be applied by default | Not specified | [Data Policy for MIMS](https://data.ocean.gov.za/documents/data-policy/) |
| Spain (ADU SOCIB) | It is on SOCIB mission to provide free open-access to quality controlled and timely streams of data. | Delivery is achieved through systems and processes for data and information management developed by the Data Centre Facility and through international portals for oceanic observations to which SOCIB contributes | Caveats in terms of open-access deferral of datasets, apply to the protection of student theses and postdoc research areas, the publication of scientific papers and commercial reports. | SOCIB will issue an automatic non-exclusive licence to any user of near real time or delayed mode data for downstream IPR, provided the user registers it’s details and interests with the SOCIB data centre facility. | Not specified | [SOCIB Data access policy](https://www.socib.es/?seccion=dataCenter&facility=accessPolicy) |
| Sweden (NODC) | In the current policy, SMHI's basic information is freely available without fees for all use, including research and education and for government activities. | SMHI shall provide information in machine-readable form immediately or as soon as possible. SMHI shall provide real-time information and historical data for all types of activities. | This data policy does not cover information that is covered by secrecy in accordance with the Public Access to Information and Secrecy Act | For data from national environmental monitoring, the license terms Creative Commons CC0. The licence terms mean that you have permission to use, distribute, redo, modify and build on data, even in commercial contexts. | Not specified | [SMHIs data policy](http://www.smhi.se/oceanografi/oce_info_data/shark_web/downloads/datapolicy_sv.pdf) |
| UK (NODC) | NERC will supply the environmental data it holds for free, apart from a few special cases as detailed in the policy. | All the environmental data held by the NERC Environmental Data Centres will normally be made openly available to any person or any organisation who requests them | The only restrictions on access which we will apply are those supported by the exceptions on disclosure in the Environmental Information Regulations (2004). | All environmental data made available by the NERC Environmental Data Centres will be accompanied by a data licence. | Not specified | [NERC Data Policy](https://nerc.ukri.org/research/sites/environmental-data-service-eds/policy/data-policy/) |
| UK (ADU CEFFAS) | Cefas embraces the UK government agenda for openness and transparency, and actively encourages the sharing of data for the benefit of our customers, the public and other stakeholders. This policy promotes compliance with legislation and good practice in data management to deliver this aim. | Open access is provided externally via an online metadata/data portal the Cefas Data Hub. Cefas aims to follow and raise awareness of FAIR data principles | Not specified | Not specified | Not specified | [Data Management Policy](https://www.cefas.co.uk/media/wumgbpfr/cefas-data-management-policy.pdf) |
| IODE OBIS | The OBIS data policy is based on the principles of timely, free and unrestricted access to biodiversity data for the benefit of science and society, as defined by the IOC Oceanographic Data Exchange Policy. | OBIS data are freely available to everyone, following the principles of equitable access and benefit sharing and supporting capacity development and participation of all IOC Member States in global programmes. OBIS provides equitable access through FAIR principles | Not specified | Data is available under the following Creative Commons licenses: CC-0, CC-BY, CC-BY-NC. CC-0 is the preferred one and CC-BY-NC the least preferred. | Yes | [OBIS Data Policy](https://obis.org/manual/policy/) |

# ANNEX III. Data policies of selected International & Intergovernmental Organizations

| **Organization** | **Jurisdiction** | **Principles** | **Data access** | **Exclusions** | **Data licence** | **FAIR/Open data** |
| --- | --- | --- | --- | --- | --- | --- |
| WMO Unified Data Policy | Intergovernmental | International exchange of Earth system data is a fundamental principle of WMO and in consonance with the expanding requirements for its scientific and technical expertise | (i) Members shall provide on a free and unrestricted basis the core data that are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations  (ii) Members should provide without charge access to all recommended data exchanged under the auspices of WMO to public research and education communities, for their non-commercial activities | not specified | (i) Conditions may be placed on the use of recommended data by applying licensing agreements or other appropriate arrangements.  (ii) In cases where Members choose to apply conditions on the exchange of recommended data, they may wish to consider using forms of license that may be indicated in WMO guidance materials. | FAIR not specified in Policy.  WMO commits to broadening and enhancing the free and unrestricted international exchange of Earth system data. |
| EU Open Data Directive | International/EU | a regulatory framework for Public Sector Information establishing the principle of reuse by default. | an obligation on Member States to adopt open access policies with respect to publicly funded research data | research data which are excluded from access on grounds of national security, defence or public security should not be covered by this Directive | EC has standardized the usage of Creative Common licences as the standards for open licences under the EC re-use policy | Member States shall support the availability of research data by adopting national policies and relevant actions aiming at making publicly funded research data openly available (‘open access policies’), following the principle of ‘open by default’ and compatible with the FAIR principles. |
| UNESCO Recommendation on Open Science | Intergovernmental | The aim of the UNESCO Recommendation is to provide an international framework for open science policy and practice that recognises disciplinary and regional differences in open science perspectives, takes into account academic freedom, gender-transformative approaches and the specific challenges of scientists and other open science actors | The UNESCO Recommendation explicitly recognises the breadth of open science and the importance of each of its components including open access to research, open data, open educational resources, open source software, source code, and hardware. | data that is not openly available, accessible and reusable may nonetheless be shared among specific users according to defined access criteria made by local, national or regional pertinent governing instances. | Through open science, scientists and engineers use open licences to share their publications and data, software and even hardware more widely. | Open research data are available in a timely and user-friendly, human- and machine-readable and actionable format, in accordance with principles of good data governance and stewardship, notably the FAIR principles |
| Beijing Declaration on Research Data | International | a statement of core principles to encourage global cooperation, especially for public research data. | publicly funded research data are, by default, in the public interest and should be accessible to the greatest extent possible for international reuse | legitimate reasons to restrict access to and reuse of data, include interests of national security, law enforcement, privacy, confidentiality, intellectual property, and indigenous data governance, among others | researchers to one way to enable and support reuse of public data is for researchers to choose a minimally restrictive and voluntary common-use licence | efforts to make research data as open as possible and only as closed as necessary; it seeks to make data FAIR on a global basis and, wherever possible, automatically processable by machines |
| Polar Data Policy | International | A set of agreed principles aimed to provide a foundation for an aligned view of how polar data and information should be curated, managed and delivered. | Full, free and open access for all users should be the norm unless there are valid reasons for restricted access. | data should not be labelled as sensitive or restricted without proper justification | an internationally recognised data licence to be attached to a dataset which should be a non-restrictive licence specifying that the data may be re-used and specifying no requirement more onerous than an acknowledgement of the data’s source, e.g. the Creative Commons open attribution licence (CC-BY). | To ensure the efficient and effective uptake of data, the FAIR principles must be followed to the greatest extent practicable and ethical |
| WDS Data Sharing Principles | International | WDS Data Sharing Principles express core ethical commitments that are operationalized in WDS Certification and embody the spirit of ‘open science’ meant to unite diverse communities of data producers and data users, and thus could be adopted by anyone pursuing science for the public good | universal and equitable access to quality-assured scientific data, data services, products and information | data should be labelled ‘sensitive’ or ‘restricted’ only with appropriate justification and following clearly defined protocols, and should in any event be made available for use on the least restrictive basis possible | not specified | FAIR not specified. Data, metadata, products, and information produced for research, education, and public-domain use will be made available with minimum time delay and free of charge, or for no more than the cost of dissemination |
| CLIVAR Data Policy | International | high-quality data and metadata need to be collected, processed and exchanged without significant delay in a free and unrestricted manner | All CLIVAR data should be made available freely and without restriction. “Freely” means at no more than the cost of reproduction and delivery, without charge for the data itself. “Without restriction” means without discrimination against, for example, individuals, research groups, or nationality. | In exceptional circumstances involving highly specialized or experimental data, principal investigators may temporarily limit access until such time as the data can be adequately validated. | not specified | FAIR not specified. CLIVAR data should be made available freely and without restriction |
| GEOSS Data Sharing Principles | International | GEO recognizes that the societal benefits arising from Earth observations can only be fully achieved through the sharing of data, information, knowledge, products and services and promotes fundamental principles for data sharing, expanding the trend towards open data worldwide. | data, metadata and products will be shared as Open Data by default | data should be made available with minimal restrictions on use | not specified | FAIR not specified. Data, metadata and products will be shared as Open Data by default |
| OECD Principles and Guidelines for Access to Research Data from Public Funding | International | provide broad policy recommendations to the governmental science policy and funding bodies of member countries on access to research data from public funding | Access arrangements are defined as the regulatory, policy and procedural framework established by research institutions, research funding agencies and other partners involved, to determine the conditions of access to and use of data. | restrictions may include national security, privacy and confidentiality, protection of rare, threatened or endangered species | data access should be established in relevant documents, such as licences | FAIR not specified. Open access to research data from public funding should be easy, timely, user-friendly and preferably Internet-based |
| IOC Data Exchange Policy (2019) | Intergovernmental | The timely, free and unrestricted international exchange of oceanographic data is essential for the efficient acquisition, integration and use of ocean observations gathered by the countries of the world | Member States shall provide timely, free and unrestricted access to all data, associated metadata and products generated under the auspices of IOC programmes; Member States are encouraged to provide timely, free and unrestricted access to relevant data and associated metadata from non-IOC programmes | not specified | not specified | Fair and open data not specified |

# ANNEX IV. Terms and Definitions

**Creative Commons** (**CC**) **licence**

one of several public copyright licences that enable the free distribution of an otherwise copyrighted "work". CC licences all grant "baseline rights", such as the right to distribute the copyrighted work worldwide for non-commercial purposes and without modification. Different versions of licence prescribe different rights.

**data**

facts, measurements, recordings, records, or observations about the world collected by scientists and others, with a minimum of contextual interpretation [[*CODATA*](https://codata.org/rdm-glossary/data/)]

**data licence**

a data licence is a legal instrument between the creator of the data and the end-user that specifies a standard set of terms and conditions regarding sharing and re-use of data.

**data management plan**

a data management plan is a formal document outlining how research data will be managed, stored, documented and secured throughout a research project as well as planning for what will happen to the data after completion of the project. [[*IOC MG73*](https://www.iode.org/index.php?option=com_oe&task=viewDocumentRecord&docID=16859)]

**environmental data**

data (observed and modelled variables) beyond those directly pertaining to weather, climate or hydrology, in particular atmospheric composition, properties of the marine environment, the land surface and the exosphere [[*WMO Unified Data Policy*](https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/Cg-Ext2021-d04-1-WMO-UNIFIED-POLICY-FOR-THE-INTERNATIONAL-approved_en_0.pdf?4pv38FtU6R4fDNtwqOxjBCndLIfntWeR)]

**FAIR principles**

FAIR principles (Findable, Accessible, Interoperable, Reusable) define characteristics that data resources, tools, vocabularies and infrastructures should exhibit to assist discovery and reuse by third-parties [[*The FAIR Guiding Principles for scientific data management and stewardship*](https://www.nature.com/articles/sdata201618)]

**free and unrestricted**

non-discriminatory and without charge. “Without charge”, in the context of this resolution means at no more than the cost of reproduction and delivery, without charge for the data and products themselves. [[*IOC Data Exchange Policy*](https://www.iode.org/index.php?option=com_content&view=article&id=51&Itemid=95)]

available for use, re-use and sharing unrestricted without charge and with no conditions on use [[*WMO Unified Data Policy*](https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/Cg-Ext2021-d04-1-WMO-UNIFIED-POLICY-FOR-THE-INTERNATIONAL-approved_en_0.pdf?4pv38FtU6R4fDNtwqOxjBCndLIfntWeR)]

**information**

products derived from data that lead to a greater understanding of an entity. For example, (i) the interpretation of a range of data from an array of conductivity sensors that informs us about that ocean’s salinity range or (ii) the narrative text of a report on harmful algal blooms that informs the reader on the timing of these blooms.

**metadata**

a description of data that refers to the information required to understand the data such as the data type, content, source, quality, format, structure, and accessibility

**open data**

open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike. [[*Open Definition*](http://opendefinition.org/)]

**open science**

an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. [[*UNESCO*](https://unesdoc.unesco.org/ark:/48223/pf0000378841)]

**research data**

data that are used as primary sources to support technical or scientific enquiry, research, scholarship, or artistic activity, and that are used as evidence in the research process and/or are commonly accepted in the research community as necessary to validate research findings and results [[*CODATA*](https://codata.org/rdm-glossary/research-data/)]

**TRUST principles**

TRUST Principles (Transparency, Responsibility, User Focus, Sustainability, Technology) for digital repositories offer guidance for maintaining the trustworthiness of digital repositories, especially those responsible for the stewardship of research data [[*Research Data Alliance*](https://www.rd-alliance.org/trust-principles-rda-community-effort)]

1. [*Meeting of the ad hoc Working Group on Oceanographic Data Exchange Policy, UNESCO Headquarters, Paris, 15-17 May 2000*](https://unesdoc.unesco.org/ark:/48223/pf0000120698?1=null&queryId=ce91d9b0-deea-4e96-ac18-29e2606ef97e) [↑](#footnote-ref-1)
2. [*First Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy, Brussels, Belgium, 29-31 May 2001*](https://www.ioc-cd.org/index.php?option=com_oe&task=viewDocumentRecord&docID=1820) [↑](#footnote-ref-2)
3. [S*econd session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy, UNESCO Headquarters, Paris, 17-18 June 2002*](https://unesdoc.unesco.org/ark:/48223/pf0000130096?2=null&queryId=6b8ea11f-4a7a-4e6f-b6f9-25e8a35a6684) [↑](#footnote-ref-3)
4. [*A-31 Summary Report of the 31st Session of the IOC Assembly, 14-25 June 2021*](https://oceanexpert.org/document/28652) [↑](#footnote-ref-4)
5. [*Bits of Power. Issues in Global Access to Scientific Data*](https://doi.org/10.17226/5504) [↑](#footnote-ref-5)
6. [*OECD Principles and Guidelines for Access to Research Data from Public Funding*](https://www.oecd-ilibrary.org/science-and-technology/oecd-principles-and-guidelines-for-access-to-research-data-from-public-funding_9789264034020-en-fr) [↑](#footnote-ref-6)
7. [*Creative Commons*](https://creativecommons.org/) [↑](#footnote-ref-7)
8. [*The FAIR Guiding Principles for scientific data management and stewardship*](https://www.nature.com/articles/sdata201618) [↑](#footnote-ref-8)
9. [*Ocean FAIR Data Services*](https://doi.org/10.3389/fmars.2019.00440) [↑](#footnote-ref-9)
10. [*The TRUST Principles for digital repositories*](https://www.nature.com/articles/s41597-020-0486-7) [↑](#footnote-ref-10)
11. [*IOC Manuals and Guides No. 73*](https://www.iode.org/index.php?option=com_oe&task=viewDocumentRecord&docID=16859) [↑](#footnote-ref-11)
12. [*https://surveys.iode.org/2019-2020-nodc-and-adu/*](https://surveys.iode.org/2019-2020-nodc-and-adu/) [↑](#footnote-ref-12)
13. [*WMO Unified Policy for the International Exchange of Earth System Data*](https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/Cg-Ext2021-d04-1-WMO-UNIFIED-POLICY-FOR-THE-INTERNATIONAL-approved_en_0.pdf?4pv38FtU6R4fDNtwqOxjBCndLIfntWeR) [↑](#footnote-ref-13)
14. [*Catalogue of core data*](https://meetings.wmo.int/Cg-Ext-2021/_layouts/15/WopiFrame.aspx?sourcedoc=/Cg-Ext-2021/InformationDocuments/Cg-Ext(2021)-INF04-1-CATALOGUE-OF-CORE-DATA_en.docx&action=default) [↑](#footnote-ref-14)
15. [*EU Directive on open data and the re-use of public sector information*](https://eur-lex.europa.eu/eli/dir/2019/1024/oj) [↑](#footnote-ref-15)
16. [*UNESCO Recommendation on Open Science*](https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en) [↑](#footnote-ref-16)
17. [*The Beijing Declaration on Research Data*](http://www.codata.org/uploads/Beijing%20Declaration-19-11-07-FINAL.pdf) [↑](#footnote-ref-17)
18. [*Alignment of Polar Data Policies - Recommended Principles*](https://zenodo.org/record/5734900#.Ye8_FC0Rrfa) [↑](#footnote-ref-18)
19. [*WDS Data Sharing Principles*](https://www.worlddatasystem.org/services/data-sharing-principles) [↑](#footnote-ref-19)
20. [*CLIVAR Data Policy*](https://www.clivar.org/resources/data/data-policy) [↑](#footnote-ref-20)
21. [*GEOSS Data Sharing Principles*](https://www.earthobservations.org/dswg.php) [↑](#footnote-ref-21)
22. [*OECD Principles and Guidelines for Access to Research Data from Public Funding*](https://www.oecd.org/sti/inno/38500813.pdf) [↑](#footnote-ref-22)
23. [*The Ocean Decade*](https://www.oceandecade.org/) [↑](#footnote-ref-23)
24. [*Ocean FAIR Data Services*](https://www.frontiersin.org/articles/10.3389/fmars.2019.00440/full) [↑](#footnote-ref-24)
25. *Clause 5 was revised in 2019 by Decision IOC-XXX/7.2.1(II) of the Assembly at its 30th session, Paris, 26 June–4 July 2019* [↑](#footnote-ref-25)