International data sharing workshop for non-UN IGOs, Global and Regional organizations and projects, NGOs and private sector

Online meeting

12 October 2020, 17.00 – 19.15 CET
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Participants of the meeting

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## ANNEXES

I. LIST OF PARTICIPANTS

II. AGENDA

III. LIST OF ACRONYMS
1. INTRODUCTION AND OBJECTIVES OF THE MEETING

Mr Ariel Troisi, IOC Chair addressed the workshop. He welcomed the participants and briefly explained the objectives of the meeting.

For many years now, we have known we were running out of time to stop and revert the decline of ocean health and start managing the ocean in a sustainable way. The UN Decade of Ocean Science for Sustainable Development is an initiative of all and for all stakeholders, embracing natural and social science disciplines, local and indigenous knowledge, science policy and innovation interfaces, technology and infrastructure, aimed to achieve sustainable management of the ocean and development.

This Decade will be transformative and will create a paradigm shift in the generation of ocean related knowledge, based on the principles of synergies, co design and co development of actions towards the agreed goals in a multi-stakeholder environment.

From the very outset, data and information have been recognized between the key issues cutting across all other elements and dimensions of the Decade. The Decade will facilitate the exchange of ocean knowledge between generators and diverse users of ocean knowledge through new data, information and knowledge platforms and services.

Amongst the identified outcomes, outcome #6 tackles an accessible ocean with open and equitable access to data, information, technology, and innovation, improving access to and quality control of data, knowledge and technology. Data and information is further referred to in two of the challenges identified in the implementation plan, namely Challenge 8: “Through multi-stakeholder collaboration, develop a comprehensive digital representation of the ocean, including a dynamic ocean map, which provides free and open access for exploring, discovering, and visualizing past, current, and future ocean conditions in a manner relevant to diverse stakeholders” and Challenge 9: “Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology across all aspects of ocean science and for all stakeholders”.

We have now an opportunity to build together a community of ocean related data and information practitioners that shares resources, experiences, guidelines, tools, ways of addressing recurring problems. In short, a shared practice, so we can address together, efficiently, and effectively, the challenges of the Decade.

The workshop was then addressed by Dr Vladimir Ryabinin, IOC Executive Secretary.

Dr Ryabinin started by stating that this workshop is about how we achieve our common goal in the Decade to generate the capacity of ocean science, to generate data and information, and turn this into actions that contribute to sustainable development.

This workshop is not only about how you would like to exchange data, about formats or on what data exist in your area, but this is the first attempt to start understanding what is important for your organization and on how we can work together. We have experience in technology. We have some infrastructure in terms of national oceanographic data centres, we have protocols, and we have practices. However, we now need to work together on the design of a new way of joining all these elements. We want to find a way to increase the capacity of all of you to work with your data and to deliver to your
users. That is exactly the point of the Decade and the decade implementation plan is actually a framework: it does not go into a lot of technical detail. We expect the Plan to be taken note of by the next Session of the UN General Assembly and we hope to start the decade on 1 January 2021. Later in the agenda, you will be informed on the call for Decade actions.

During this workshop, we are asking you to start thinking with us about how we can construct the digital ecosystem that will benefit humankind. This does not require addressing technical issues like protocols and technology yet, but rather thinking about how we can work together and how we can start co-designing the future data system of the Ocean.

2. INTRODUCTION OF PARTICIPANTS

Mr Peter Pissierssens, Head of the IOC Project Office for IODE in Oostende, Belgium and IOC Capacity Development coordinator noted that the meeting had attracted 84 participants from 43 organizations, programmes, projects and companies. The list of participants is available in Annex I to this report. In preparation for the workshop all participating organizations, programmes, projects and companies had been invited to submit a brief document describing themselves. These documents are available online through this link. The agenda is available through this link.

He recalled that this workshop had been planned as a face-to-face meeting to be held in 2020 but that the Covid19 pandemic had forced us to implement the workshop as an online event of 2 hours. He noted that because this limited time, there would be no time for individual presentations by participants. He further thanked participants in the various time zones for making themselves available. In this regard it is noted that a second workshop of this type may be organized for organization in Asia later this year at a time which is more appropriate for their time zone.

3. UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

3.1. GENERAL

This agenda item was introduced by Ms Alison Clausen. The PowerPoint Presentation is available online through this link.

Ms Alison Clausen briefly explained the vision and mission of the Ocean Decade and noted several key elements i.e. that the Ocean Decade is based on a broad definition of ocean science, and that the Decade is focused on transformative and solutions-oriented research that connects knowledge generators and users.

On 5 December 2017, the United Nations declared that a Decade of Ocean Science for Sustainable Development would be held from 2021 to 2030. This Decade will provide a common framework to ensure that ocean science can fully support countries to achieve the 2030 Agenda for Sustainable Development. The Decade will provide a ‘once in a lifetime’ opportunity to create a new foundation, across the science-policy interface, to strengthen the management of our oceans and coasts for the benefit of humanity. The Decade will strengthen the international cooperation needed to develop the scientific research and innovative technologies that can
connect ocean science with the needs of society serving, at the same time, several major frameworks and processes. The Decade will require the engagement of many different stakeholders to create new ideas, solutions, partnerships and applications, these include: scientists, governments, academics, policy makers, business, industry and civil society. The Intergovernmental Oceanographic Commission (IOC) of UNESCO has been tasked by the UN General Assembly to work with all interested stakeholders in the preparation of the Decade.

The vision of the Decade is the ‘science we need for the ocean we want’ and it will mobilise resources and technological innovation in ocean science needed to deliver the following key outcomes that characterise the ocean we want by 2030:

1. A clean ocean where sources of pollution are identified and removed
2. A safe ocean where people are protected from ocean hazards
3. A healthy and resilient ocean where marine ecosystems are mapped and protected
4. A sustainably harvested and productive ocean ensuring the provision of food supply
5. A predictable ocean where society has the capacity to understand current and future ocean conditions
6. A transparent ocean with open access to data, information and technologies
7. An inspiring and engaging ocean that incites a step change in human’s relationship with the ocean.

The Ocean Decade Action Framework is structured around 10 Ocean Decade Challenges that represent the most immediate and urgent priorities of the Decade that can convene stakeholders in collective action around common priorities. She explained that data, information and knowledge management is an essential element of all of the Challenges and is specifically mentioned in Challenge No. 8 related to the development of a digital representation of the ocean, and in Challenge No. 9 related to developing capacity and access to data, information, knowledge and technology.

The Ocean Decade Action Framework also references the three process objectives of the Decade that refer to three overlapping and iterative steps in an end to end ocean science value chain that will be promoted during the Decade. She pointed out that the Implementation Plan presents a framework for the Decade, and that as such, it does not identify the specific Decade Actions that will be carried out in the context of the Decade objectives and challenges. These Actions will be identified, implemented and resourced by diverse actors in response to Calls for Decade Actions – the first of which will open on 15 October 2020. Initiatives related to data management that align with the Decade Challenges, fulfil the endorsement criteria for Decade Actions and align with the principles for data management outlined in the Implementation Plan are encouraged and will be welcomed in response to Calls for Decade Actions throughout the next ten years.

She explained the communities of practice will be developed around key actions throughout the Decade and will be linked through the Global Stakeholder Forum – a hybrid virtual / in-person forum for Decade partners and stakeholders that will be launched in 2021.

She described the following key milestones for the Ocean Decade:

- **September to December 2020**: Consideration of Implementation Plan by United Nations General Assembly.
• **15 October 2020**: Information Session to present Implementation Plan to UN Member States.

• **15 October 2020**: Launch of first “Call for Decade Actions” for large-scale programmes and major contributions.

• **4 December 2020**: Virtual high-level supporters event and pre-launch of Ocean Decade Alliance.

• **1 January 2021**: Decade starts.

• **January – October 2021**: Progressive establishment of coordination structures and roll-out of Stakeholder Engagement Mechanisms.

• **March – April 2021**: Decisions on first group of endorsed Decade Actions (programmes and contributions).

• **31 May – 2 June 2021**: First International Ocean Decade Conference, Berlin.

• **? 2021**: 2021 UN Ocean Conference, Lisbon.


3.2. DATA CHAPTER

This agenda item was introduced by Mr Taco de Bruin, IODE Co-Chair. The PowerPoint presentation is available through this link.

Mr de Bruin, IODE Co-Chair, started by introducing the International Oceanographic Data and Information Exchange (IODE) committee of the Intergovernmental Oceanographic Commission of UNESCO as an organization of 66 National Oceanographic Data Centres (NODC) and 30 Associated Data Units (ADU). Keywords for IODE are: discovery, exchange of, and access to, marine data and information, for which archival, preservation, documentation, management and services of all marine data, data products, and information are prerequisite. Other keywords for IODE are best practices, capacity development and support of international scientific and operational marine programmes.

He recalled that the Decade Implementation Plan explicitly states that ‘data and information are key to the outcomes and success of the Decade’. He quoted the Implementation Plan and emphasized that:

“Through multi-stakeholder collaboration, develop a comprehensive digital representation of the ocean […] digital ocean ecosystem […]], which provides free and open access for exploring, discovering, and visualizing past, current, and future ocean conditions in a manner relevant to diverse stakeholders.”
“Implementation of the digital ocean ecosystem will require inclusive and outward-facing co-design and co-construction of a distributed, integrated and interoperable set of digital solutions that will form components of the overall ecosystem.”

“Implementing a “digital ocean ecosystem” […] will be a dynamic and continuous process, incorporating established approaches and technologies as well as those […] only just emerging.”

He further emphasized that this will need to be a joint effort, inclusive, cross-disciplinary and aimed at full range of users and uses.

Regarding the “joint effort” he noted that this would need to involve UN Oceans organizations, non-UN IGOs, NGOs and private sector, global and regional observation and data networks, projects and programmes, fisheries management, socio-economic systems, marine spatial planning and management, and a long list of hundreds of systems and networks. These would need to be interoperable components of a “global commons” and should include local and traditional knowledge as well as span all relevant disciplines from natural sciences to social sciences and economics. The basic need for data, information and systems within the UN Decade framework would be based on the FAIR principles: Findable, Accessible, Interoperable and Re-usable. The data framework would need to be adaptive and flexible to user needs and to developing technical capabilities.

Mr de Bruin noted that many excellent data and information systems already exist and are operational, both within and outside the various UN organizations, but these are not linked or interoperable and therefore, from a user perspective not always (re-)usable. Fortunately, building upon these existing and excellent data systems and making use of the currently developed building blocks, such as ODIScat (the catalogue of data, information, products and services), OBPS (Ocean Best Practices System), OIH (Ocean InfoHub project) and ODIS (IOC Ocean Data and Information System), it will be possible to jointly, and in close cooperation, develop the UN Decade data framework.

He concluded by saying that the UN Ocean Decade offers all of us a ‘once in a lifetime opportunity’ to build the ‘digital ocean ecosystem’ suited to our needs and to the needs of the UN Ocean Decade.

3.3. IWG-SODIS: INTER-SESSIONAL WORKING GROUP TO PROPOSE A STRATEGY ON OCEAN DATA AND INFORMATION STEWARDSHIP FOR THE UN OCEAN DECADE

This agenda item was introduced by Dr Hernan Garcia, Head WDS Oceanography and Chair of the Inter-sessional working group to propose a strategy on ocean data and information stewardship for the UN Ocean Decade (IWG-SODIS). The PowerPoint Presentation is available through this link.

Dr Hernan Garcia recalled the vision of the Decade regarding data: “A sustainable world informed by world-class open access data. Data and information gathered during the Decade will be transparent and accessible to all through a network of interoperable resources, readily available in standardized forms, and served through open access in accordance with the applicable legal framework”. He informed the meeting that the IOC Committee on International Oceanographic Data and Information Exchange (IODE), at its 25th Session (2019) had established the “Inter-sessional working group to propose a strategy
on ocean data and information stewardship for the UN Ocean Decade (IWG-SODIS). The Working Group had been given the following tasks:

1. Explore through UN-Oceans the interest of relevant UN bodies to develop a joint data and information system under the Decade and to start assessing respective data and information guidelines and policies and identify relevant data and information access and repositories that may contribute to such a system,

2. Investigate the future scope of scientific data and information stewardship activities of the Decade, including and not limited to:
   - Agreement on common data contributions, flow, latency, discovery, access, and re/use principles,
   - Documenting data and information requirements and best practices,
   - Agreement on data and information protocols and metadata content and structure,
   - Agreement on science-based quality control/quality assurance requirements and procedures for all data types,
   - Agreement on modalities for contribution and dissemination of data and information,
   - Agreement on modalities and establish a strategy for the long-term preservation of Decade data for future use,
   - Agreement on access and use of potential data synthesis and tailored data products derived from the Decade,
   - Develop and update data and information management capacity,
   - Identify and review potential data and information management infrastructure that could be established during the implementation phase (2021 – 2030) to coordinate data management activities,

3. Prepare a proposed Ocean Data and Information Stewardship Strategy including a work plan, timetable, and required resources to be submitted to the Executive Planning Group (EPG) before its Second EPG meeting (November 2020) for their consideration and inclusion in the preparatory process and the Science Plan of the Decade.

4. Identify a group of subject matter experts that may continue providing advice and expertise on scientific data stewardship during the operational phase of the UN decade.

Dr Garcia then identified key challenges in developing a “global data policy framework” for the decade: (i) the data reside in many non-inter-operable online services at different geographic locations in varying formats, described using different vocabularies and metadata; (ii) data users may need to request permission to use the data from a particular data source. In addition, researchers may then need to convert the data into a common digital formats that facilitate data comparisons and data syntheses products; (iii) there is a lack of a single universal data policy that is applicable to all available international ocean data collected during the Decade.

Dr Garcia proposed a “universal data, metadata and product sharing principle”:

*Data, metadata, and products should be freely and openly shared online with minimum delay and restrictions, subject to national and international jurisdictional laws and policies.*
He noted that this principle supports the data policies of international initiatives including GEO, IOC, WMO, and WDS to cite a few instances as well as supporting data stewards by building on (1) the Findable, Accessible, Interoperable, and Reusable (FAIR) principles, (2) the Collective Benefit, Authority to Control, Responsibility, Ethics (CARE) principles, and (3) the Transparency, Responsibility, User Focus, Sustainability, and Technology (TRUST) principles. Dr Garcia informed the meeting that IWG-SODIS has developed its first interim report: https://iode.org/index.php?option=com_oe&task=viewDocumentRecord&docID=27050.

Dr Garcia informed the meeting that the current membership of the IWG includes mostly experts from IODE’s network of National Oceanographic Data Centres (NODCs), IODE Associate Data Units (ADUs), observing networks, and ocean data projects.

Dr Garcia invited the Organizations participating in the workshop to join the IWG in order to better represent the communities that will collaborate within the UN Ocean Decade by contacting Hernan.Garcia@noaa.gov with an expression of interest.

4. OVERVIEW OF CONTRIBUTIONS OF IOC (AND ITS IODE) TO DATA SHARING IN THE DECADE

The Ocean Data and Information System (ODIS) will provide an interoperability layer and supporting technology to allow existing and emerging ocean data and information systems (from any stakeholder) to interoperate with one another. This will enable and accelerate more effective development and dissemination of digital technology and sharing of ocean data, information, and knowledge. As such, ODIS will not be a new portal or centralised system but will provide a collaborative solution to interlink distributed systems for common goals. As ODIS will initially target mostly well-established systems, a second initiative is being developed “Ocean InfoHub” (OIH) that will develop a number of regional “nodes” that will facilitate the submission of data and information to, as well extraction of data and information from the ODIS network for users/partners without access to advanced technology. The OIH will therefore provide a lower threshold opportunity for partners and users in developing countries to contribute to, and access the UN Ocean Decade global data ecosystem while also offering capacity development opportunities to all to participate equitably in the UN decade data ecosystem.

Under this agenda item three key activities of the IOC’s International Oceanographic Data and Information Exchange (IODE) programme were introduced briefly.

4.1. ODISCat: CATALOGUE OF SOURCES

This agenda item was introduced by Mr Arno Lambert, IT Services Manager, IOC Project Office for IODE. The PowerPoint Presentation is available through this link.

He pointed to the fact that the ODIS Catalogue of Source (ODISCat) (http://catalogue.odis.org) is not to be confused with ODIS (nor with SODIS, OIH or OBIS) but that ODISCat will be the foundation on which ODIS and OIH will be built. Mr Lambert also stressed the fact that ODISCat is not a (data) portal, an ocean database or metadata (as description of data sets) repository. He highlighted that the current ODISCat is not a final, finished product but a work in progress that needs the help of the complete ocean community far beyond the borders of IOC/IODE.
Mr Lambert continued by explaining that ODISCat aims to be an online browsable and searchable catalogue of existing ocean related web-based sources/systems of data and information as well as products and services and that ODISCat will provide information on products and visualize the landscape (entities and their connections) of ocean data and information sources. He explained that ODISCat will guide us to online sources where we can find these data, products and services by using descriptive information such as the URL, title, description, language, point of contact, geographic scope, available technologies for machine-to-machine interaction, keywords, etc. Once again, Mr Lambert drew our attention to the fact that ODISCat is aimed at a far larger number of stakeholders than our own IOC communities, it should also be of interest to policy makers, private sector etc. and it is a first, small, but very important step to ODIS and OIH.

In the second part of the presentation, Mr Lambert wanted to convince the meeting that entering any source into ODISCat is not a burden and showed us how, in 5 simple steps (login, Submitter Info, Basic Description, Advanced Description, save and check entry), we can enter a new source using any of the 16 content types and entering the mandatory fields. He also offered a very easy way to enter large amounts of source descriptions into the ODISCat by the use of an Excel file. It was mentioned that both ESCAP and FAO were already using this method to get their content in the database. Mr Lambert will provide an Excel template with all possible field to anyone who wishes to enter his/her data that way into ODISCat.

4.2. OCEAN DATA AND INFORMATION SYSTEM (ODIS)

This agenda item was introduced by Dr Pier Luigi Buttigieg, Digital Knowledge Steward and Senior Data Scientist, Helmholtz Metadata Collaboration / GEOMAR Helmholtz Centre for Ocean Research. The PowerPoint Presentation is available through this link.

Pier Luigi Buttigieg introduced the Mission of ODIS as “Creating a robust and extensible foundation of our planet’s digital ocean ecosystem”.

It was made clear that ODIS will be a distributed system which will be co-designed, co-
implemented, and co-governed through the alignment of existing and emerging digital stakeholders to a common interoperability architecture (ODIS-Arch).

Rather than a "hub-and-spoke" model, ODIS will use the Web itself to link participating nodes, be they major regional data centres or local contributors. (See Figure 2).

![Figure 2: From hub-and-spoke to the Web as the hub](image)

Using the “Web centred” approach:

The Web is our collective Hub (the digital commons)

- Data/Infrastructure/Software/Platform as a Service (DaaS, IaaS, SaaS, PaaS, resp.) and other Web-enabled models will be encouraged to reduce unneeded duplication of effort and allow efficient sharing of capacities
- Each node is in charge of their own contribution (data, services, dashboards, stakeholder-specific portals)
- Linked Open Data and Semantic Web technologies will bridge nodes
- A set of interoperability and exchange standards will allow any node to continuously cross-talk to any other (ODIS-Arch)
- Anyone can "spin up" solutions like portals & thematic hubs (or "hublets" for smaller applications) using the interoperability architecture, leading to greater inclusivity

Linked Open Data and Semantic Web technologies, standards, and best practices will create a robust and flexible digital ecosystem for ocean data, information, and knowledge to be used to rapidly address societal needs and challenges as they emerge. The Ocean InfoHub is a first implementation example of this concept (Figure 3): a Ocean InfoHub user or partner can pull together resources that it knows can fulfill a certain mission, pull additional digital resources out of the global linked data universe (made interoperable by alignment to ODIS-Arch) and then dynamically create regional and global solutions (e.g. dashboards, portals, hublets) according to the needs of their stakeholders.
Dr. Buttigieg proposed that the “digital ecosystem” concept should be treated as more than a metaphor: deploying a global, distributed, but interlinked ODIS can learn much from real ecosystems. ODIS will be a digital ecosystem with high cyberdiversity, but where its components operate using the same underlying rules (a base “digital ecology”). In this system every component has a “niche”, a role which can change over time.

This digital ecosystem will have producers of products and services, consumers at varying levels, and de/recomposers which will innovate around the wealth of legacy data already existing (Figure 4). Overall, we must promote the principle of symbiotic mutualism across all interactions.

The ODIS-Arch will provide “the laws of ecology” (i.e. the collection of interoperability conventions and standards) that holds all pieces of the structure together (Figure 5).
As an index and guide to this digital ecosystem, ODISCat can provide humans and machines rapid navigation and discovery of resources.

ODIS will adhere to the following key principles:

1. No one "owns" the ecosystem, but we're all charged with tending to it and keeping it healthy;
2. Nodes in our digital ecosystem:
   a. should have all the independence they need;
   b. should have clear "niches" (roles) to prevent redundancy and increase partnership;
   c. can pull and push resources to other nodes under automatically recognised usage conditions / licenses;
3. Reuse over re-invent, adapt as a community;
4. Easy to spin up solutions, minimal loss when spinning down;
5. Success is not measured by individual use of a node, but by how many nodes are used in a single user session;
6. Multiple entry points and levels of commitment to the ODIS network;
7. Digital products and streams should align to the FAIR principles, and link to metadata and related data to allow automatic discovery, quality diagnostics, and much more.

The strategy to achieve these goals will need to be based on co-design and co-development of the architecture with all stakeholders. This will require: (i) stepwise and responsive co-development based on stakeholders capacities, needs, and shared interests; (ii) ODISCat will be the nucleus – a common index that all nodes can reliably reference for trusted ocean data and information; (iii) based on the needs and visions of the collaborating nodes, the details of ODIS' implementation will take shape, around the core principles of linked open data and continuous interoperability.

Dr Buttigieg further noted that most of the obstacles to realising ODIS are not technical but centred on building a culture of cooperation. The need of "digital diplomacy" to overcome obstacles to sharing and co-implementation was noted, with a call for UN leadership in its development. A global community of practice should be created, where the interests of each node must be heard and accommodated for a digital commons to be sustained.

The community looks to the UN partners to show how agreements can be forged to create a mutualistic digital ecology, turning competition into collaboration.

The presentation concluded with reference to a broader vision, in which the ODIS ecosystem will nest within a "digital biosphere" linking marine, terrestrial, atmospheric, human-focused, and other thematic data systems in order to respond to the cross-cutting needs of the SDGs and their successors.

4.3. IOC OCEAN INFOHUB

This agenda item was introduced by Ms Lucy Scott, IOC Ocean InfoHub Project Manager.

The PowerPoint Presentation is available through this link.

The IOC Ocean InfoHub Project (OIH) is a new, global initiative, to improve access to marine and coastal data and information. It is a three year project, commencing April 2020, funded by the Government of Flanders (Kingdom of Belgium).
The OIH project will be built on top of the two systems ODIScat and ODIS, demonstrating how the technology can be leveraged for partners and end users. The project will support the development of ODIS, but also implement, test and extend ODIS in a co-design process. The OIH will build partnerships and identify priority end user needs to test the ODIS proof-of-concept.

- The OIH will support communities of practice and a network of hubs that will be early implementers of the ODIS.
- The OIH will support the ongoing co-design of the Ocean Data and Information System (ODIS) architecture together with partners.
- The OIH will promote and foster awareness and collaboration with new and established partners, connecting contributors and users with the resources to support their efforts.

The OIH project will first work with global IOC-associated online resources - including

- OceanExpert,
- OceanDocs – soon to be incorporated into Aquadocs,
- the Ocean Best Practices System,
- the Ocean Biodiversity Information System,
- the World Ocean Database (WOD),
- the Ocean Data Portal (ODP),
- extended by partnerships with EurOcean, Marinetraining.eu and EMODnet as well as other sources in the IOC ODIS Catalogue of Sources (ODIScat).

Because of this wealth of resources and partners, the initial focus will be on six data types:

1. People and institutions/organizations,
2. Documents,
3. Spatial data/maps,
4. Training opportunities,
5. Vessels (research opportunities), and
6. Projects.

Regionally, three regions have expressed formal requests to participate in the development of the OIH: the African region, the Latin America and Caribbean region and the Pacific Small Island Developing states. These three regions have participated in the development of the proposal for the project and will take a lead on pilots to test interoperability between existing information hubs, and the OIH global information resources. The initial priorities for the Project will be to develop communities of practice for the three pilot regions, as well as to formalize partnerships with other UN agencies and key international partners. The OIH Project will also support the IOC’s Capacity Development Strategy and assist countries in their global reporting requirements.
A global ODIS (Ocean Data and Information System) architecture will be developed to enable interoperability with local, regional and thematic infrastructures. The project will support interlinkages and interoperability between these existing distributed resources. Through these actions, the OIH project will enable a digital ecosystem where users, from any entry point, can discover content and services that they require, while also having opportunities to become content creators themselves.

In conclusion, the Ocean InfoHub Project will facilitate better access to global databases, but also better visibility of national and regional data holdings. Users can more easily discover what they need. Regions and countries can learn from each other; Africa, Pacific and LAC regions all have success stories that will be useful to share. The OIH will therefore provide an opportunity for partners and users to contribute to, and access the UN Ocean Decade global data ecosystem while also offering capacity development opportunities to all to participate equitably.

The OIH development and implementation principles will be fully based on co-design: the project seeks the participation of a wide range of partners and end user communities that are involved in the sustainable use and management of marine areas. Through the OIH project, together with ODIScat and ODIS, we would like to invite partners to participate in the OIH and thus to leverage interoperability solutions and use the ODIS to meet your user needs.

5. BREAKOUT GROUPS

This agenda item was introduced by Dr. Sergey Belov. He informed the participants that they would be distributed randomly in 6 breakout groups. The groups would be invited to address three questions (see below) and were given 20 minutes to discuss. Dr. Belov then invited the moderators of the six groups to briefly summarize the discussions of their groups.

QUESTION 1

Where do you see opportunities to collaborate on data, based on the principles outlined in the Ocean Decade implementation plan? This could be in terms of infrastructure, partnerships, data sharing or other issues.

Group 1 moderated by Alison Clausen.

Group 2 moderated by Hernan Garcia.

The following opportunities were identified:

- **No new infrastructure** to be developed but partnering with existing structures (leveraging).

- Leveraging **industry cruises** to increase sharing with academic research stakeholders.

- **Industry data** accessibility is a key to this success - industry more willing to share now than 10 years ago - now seeing industry approaching data managers to ask how they can share data in some cases / they received better data structure and we received significant amounts of data. Decade can influence favorable regulatory environment particularly with reference to oil and gas producers.

- Good opportunity to have a **more transparent ecosystem** - avoid user confusion / we are starting to lose users if we don’t make it easy / see benefit of using data / Decade can do this - high visibility.
• Exploit **opportunities to harmonize data and information.**

• **High level visibility** for everybody.

• Generate a system that enables developers across industries/public/private to **co-operate** to build a more useful system to **convert data into useful knowledge** (machine interoperable).

• Even if it’s not realistic we have no choice!

Groups 1 and 2 also formulated some challenges and words of caution:

• Data usage licences - how can we use data? need to be addressed?

• How to overcome commercial confidentiality issues with industry data? Some good examples of barriers of incentives and obstacles - Five primary barriers to data sharing were identified: (1) Incentives, (2) Risk Perception, (3) Working Cultures, (4) Financial Models, and (5) Data Ownership. Details: https://www.sciencedirect.com/science/article/pii/S0308597X18302355

• Need to focus priority data needs for sustainable development - avoid overcommitment to communities - especially in early years but can evolve.

• Challenging structure: developing open access and ontologies. How to access and use.

• To bring about results, will need funding (from states and private) and commitment.

• How and who is using the data to build a better observing system.

**QUESTION 2**

Where do you see challenges to effective collaboration around data, based on the principles outlined in the Ocean Decade implementation plan? This could be in terms of infrastructure, partnerships, data sharing or other issues

Group 3 moderated by Julian Barbière.

Group 4 moderated by Sergey Belov.

The following **challenges** were identified:

• **Lack of common methods and best practices**, need interoperability and standards that will create trust - need to start at global level to ensure good acceptability.

• **Diversity of different data types** managed and stored, variety of different networks operation at different level: how to get them to work together. What could be a driver for change of practice?

• **Lack of effective dialogue** between data providers and users, particularly with decision makers /end-users /industry.

• **Data is only currency researchers have** to advance their career which is an **impediment to data sharing**. Incentives are needed for individuals to share data and respond to the needs of decision makers.
• **Need to find some boundaries, need convergence**, this can be driven by global monitoring systems to drive common approach to data interoperability, standards.

• Can SDG be a driver? Parameters on type of data, collected everywhere. SDG can be a driver but is this enough?

• We don’t need to share everything: focus on a core subset / prescriptive.

• Challenge is **integration of data in a way that is usable**, validation /versioning of data. Big efforts on the **harmonisation of data** is required. Prescribe some monitoring variables.

• **Unpublished data**, how do we tap on these? systems that can ingest data, maybe new technological advancement…

**QUESTION 3**

Who are existing and potential end user groups (no need to mention individual users) of your data? and how could more effective collaboration through the Decade help these end users access your data?

Group 5 moderated by Ariel Troisi.

Group 6 moderated by Lucy Scott.

• Existing user groups: Policy advisors, civil society, academia, coastal planners - also need to evaluate effectiveness of management; need data products, not raw data.

• Potential User Groups: Park and MPA managers.

• Users must be involved early on, fit-for-purpose products.

• The connection to society and the broader public is important: ocean literacy; backing for politicians to take necessary measures. Opportunity to serve scientific community but also keep in mind opportunity to reach broader public. Citizen engagement, and other stakeholders.

• **Large-scale, multidisciplinary regional data projects with many user groups**. Across these groups: quality assurance, indicators of level of validation, versioning, provenance data, up-to-date metadata are concerns across all stakeholders.

  (i) The Decade can promote and raise awareness on the need and use of such indicators (and their standardisation?) to support data re-use with confidence across stakeholder groups (they will at least know that data out of their domain has been validated).

  (ii) The Decade can promote the integration of quality-controlled data, which depends on improved communication of QC/QA metadata.

• **Economic/social/ ecological indicators** targeted to policy makers.

  (i) The Decade will make these data more known to the ocean community at large, as this data isn’t typically produced by the ocean community.

• **Data licensing** is sometimes restricted. Data required for key reports (e.g. state of
environment), not always available to all end users that can use it. Need to understand challenges derived from information not always available.

(i) The Decade can help through, perhaps, facilitating agreements / MoUs (but perhaps not the most effective/scalable way). As a minimal requirement, signature of bilateral or collective agreements.

(ii) Merging oceanographic/environmental data with socio-economic data will help promote more usage (i.e. by nesting in other data flows to gain momentum).

- **Unblock data access** in collaboration, translating policy & decision into action.

(i) The high-level concepts and calls need practical implementations and standards of compliance to facilitate local policy development that’s meaningful in a practical sense.

- The Decade offers the opportunity to give visibility to the existing databases of research infrastructures and promote their enhancement in an open and collaborative effort. Marine research infrastructures (vessels, large exchangeable instruments, ocean observatories, other) operators, scientists, engineers, policy makers, private companies and universities. The Decade offers an opportunity to make reporting on the EOVs more transparent and standardised, socialising the work of the GOOS Panels - right now, some EOVs have no clear data standards and these need to be co-developed.

- **Traditional knowledge groups as potential end users.** These groups can also be potential data providers as well.

  (i) e.g. information on Harmful Algal Blooms for harvesting information: Getting access to that data for some i.e. rural Alaska tribal groups, may be difficult.

  (ii) Other potential end users: fisheries managers, commercial and private fishers, beach goers.

- **Communication and outreach** needs to be a big part of getting data and metadata out to potential end users. Establishing trust.

6. DISCUSSIONS AND NEXT STEPS

6.1. REVIEW OF THE SURVEY RESULTS

This agenda item was introduced by Dr Pier Luigi Buttigieg. He informed the meeting that the online pre-workshop survey had been filled by 49 responses.

**Question 1: Does your organization/company manage ocean-related data or information?**
The results revealed that a large majority of the respondents manage ocean related data. Others do not manage data themselves but often coordinate networks that do.

**Question 2: Ocean-related data: topics and disciplines?**

Results revealed a wide variety in subject area, the most important ones being bathymetry, biology, biodiversity, chemistry, and physics. Dr Buttigieg commented that the increasing prominence of observing life in the ocean is bridging ocean observing to the understanding and management of the biosphere, upon which human wellbeing depends.

**Question 3: Regions your data/information holdings are about?**

The majority of respondents deal with the "global ocean" but also Black sea, Southern ocean, Arctic ocean. Baltic sea, Mediterranean sea are mentioned. Dr Buttigieg noted that some of the emerging terms show that regional work is also defined by those sites where phenomena and particular ecosystems occur (e.g. regions where coral reefs or estuaries occur, rather than cartographic boundaries.)
**Question 4: Does your organization make its data/information holdings available online?**

Nearly half of the responding organizations share data anonymously under a free and open license, while another 14% provide access after registration and login, but still under a free and open license. Twenty-eight percent (28%) responded to share “partially”. Only 9.3% reported not to provide data online.

Focusing more on those who share data online only **partially**.

**Question 5: How does your organization decide which holdings to release under free and open licensing?**

Overall, the policies of institutions, funders, or the restrictions required by data submitters / owners often limits open sharing. Another important limitation is capacity: some organizations do not have the resources to prepare their data for open sharing (by e.g., quality controlling, formatting, releasing through portals / APIs).

**POLICY CONTROL**
- Under institutional data management policies and restrictions.
- Dependent on committee/board decision (legal representatives of governments).
- Data about entities outside the EEZ are not subject to many national restrictions.

**FUNDERS AND SUPPLIERS**
- Dependent on funder requests/requirements and contributor constraints on compiled datasets.
- Customers (and data contributor) constraints on (e.g.) IP.

**CAPACITY**
- Capacity: not all contributing networks and participants can meet the FAIR principles, so their data is not as open.
- Capacity to fully process and make data available following quality control.
Question 6: Could you describe what would incentivise your organization to freely and openly share the rest of its data/information holdings during the UN Decade of Ocean Science for Sustainable Development?

Overall, a change of policies and more open licensing (using viral licenses to ensure openness is preserved on reuse) by controllers of the data would allow organizations that manage data holdings to release more. These must, however, preserve the legal rights of States and organizations. Further, improved crediting of open data sharing – recognised by institutions / funders such that it allows career advancement and funding opportunities – is needed, as this will also allow funding to be directed to curating and opening up existing holdings.

**FUNDERS/SUPPLIERS DECIDE**

- Requirements of data providers themselves (e.g. viral licensing).
- Customer approval and explicit permissions.
- Funding organizations must provide permission.

**UN POLICY CHANGE**

- UN policy should be adopted to preserve Member States privileges.
- The UN Ocean Decade should review its data exchange guidelines to relax restrictions due to scientific/academic IP rationale.

**SHARING AND CREDIT**

- Attribution for data in scientific publications; capacity development.
- Stronger and more collaborative regional networks promoting open data sharing.
- More capacity to process and make data open.
- Mechanisms to reward sharing/release of open data (e.g. through publications).

Focusing more on those who do not share data online.

Question 7: Ocean-related data: description of restrictions for closed holdings

Overall, legal restrictions to protect intellectual property and data holdings are often the primary barrier. Other organizations only make data open by request, often due to resource budgeting and allocation. Many respondents note that FAIR principles are followed – however, this may not translate to harmonised data, as implementations of FAIR can vary widely.

**CLOSED**

- Data acquired from some commercial or industry partners have legal restrictions on open access sharing.

**OPEN, BY REQUEST**

- Data only on request, public access in progress (early 2021), FAIR data policies are followed.
Data is available on request but shared openly. The institute follows open and FAIR data sharing policies and public access is in progress (early 2021).

**Question 8: What would incentivise your organization to freely and openly share data?**

Overall, respondents noted that a (1) fall in the cost of acquiring, holding, and managing data would allow more resources to be dedicated to sharing and (2) clear value propositions for data sharing would incentivise more data to be opened to the wider community.

- Cheaper and better satellite bandwidth
- Cross-sectoral partnerships
  - Sharing data with between Blue Economy sectors (e.g. oil and gas) and research could liberate data and add value for all.
- Resources to process these data holdings need to be provided
  - Lack of economic incentive for these steps from the viewpoint of industry.

### 6.2. GROUP DISCUSSIONS

This agenda item was moderated by Dr Linwood Pendleton. These discussions were held mainly through the meeting chat room and can be summarized in bulleted form as follows:

- Given that there is a multitude of disjointed observing and data centers, all collecting very large different types of data in different forms and formats, it is recommended that the Decade may define a limited set of Essential Ocean Variables for which specific data need to be collected by all participants, following specific best practices, and stored in specific formats, in linked databases. If the variables to be collected AND SHARED is constrained, we may be able to design an interoperable and useful digital ocean.

- It is suggested to look into the of the IHO S-100 specification, which is in line with ISO19100 and thus compatible/interoperable and open for extensions/expansions into other domains other than hydrographic.

- While "technical" glue is the easy (easier) part, the human/societal one is harder. However if you remove/limit the technical barriers, and demonstrate societal/sectoral benefits then the human-element follows. In addition we should focus first on adding "technical" value to existing systems where "humans" have their habits, without competing or replacing.

- Regarding traditional knowledge holders, important to ensure that their rights are protected (we are looking closely at the CARE principles and OCAP, but still need guidance on how to implement these effectively).

- It may be necessary to define the Decade 'products' we need for the ocean we want and focus efforts on information and knowledge management there. A focus on simply 'open data' (i.e. everyone give up all their data) may be too unfocused. However, it is difficult to anticipate all of the relevant questions from the start.

- Reference was made to IOC and Global Compact joint publication on the role of the private sector ([IOC/INF-1389](https://www.earthobservations.org/)), where several of the questions listed here were also discussed.
• Some sort of expert group of diverse stakeholders should develop outcomes for individual disciplines/challenges

• One approach that can be helpful is to ask stakeholders what problems they have or questions they are trying to answer and getting data/product experts together to determine what available data can be linked to address these issues. "End users" often do not know what data they need or what data could be useful to them.

• POGO: POGO itself doesn't manage data, our members do collect and manage data and POGO can play a role in the Decade with regard to advocacy for data sharing, and brokering collective agreements by its members to a certain level of data sharing and possibly more importantly data interoperability. I can foresee this as a kind of "pilot" to see how it can work on a limited scale (50 institutions/30 countries) before rolling out at the IOC scale.

• PICES: PICES is an international science organization for the north pacific with member countries that strive to collaborate with shared data across multiple nations. This is a prime area where we could help facilitate established relationships and trust across international boundaries, for more data sharing.

• The Decade should also focus its attention to data rescue efforts. The ocean community should develop a concerted effort to make sure that data sitting on computers and drawers is not lost forever. (reference to the IODE/GODAR project).

• If we agree on the idea of ocean related data (vs "oceanographic"), many manage a very interesting set of data and information on e.g. Capacity Development needs, requirements and capabilities e.g. on research vessels, on organizations.

6.3. NEXT STEPS

This agenda item was moderated by Mr Taco De Bruin. He briefly introduced the following proposed next steps:

1. All participants are kindly requested to discuss within their organizations how to participate and contribute to the UN Decade of Ocean Science for Sustainable Development.

2. Valuable information on data and data systems provided by the participants:
   • Condensed overview into report,
   • Enter records into ODISCat,
   • Follow up emails in a couple of days with link and explanation how to do this.

3. Invitation to all to join and participate in IWG-SODIS on the Strategy for Ocean Data and Information Stewardship.
   • Follow-up email in a couple of days.

4. Invitation to nominate domain experts on semantic interoperability to join the technical working group on data and information system architecture of the Ocean Infohub project.

5. Welcome ideas, suggestions and proposals for Decade Actions.

7. **CLOSING OF THE MEETING**

Mr Ariel Troisi and Mr Taco de Bruin closed the workshop on 12 October 2020 at 19:30 CET.
ANNEX I

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IOC Workshop Reports, 290

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ANNEX II

AGENDA

1. INTRODUCTION AND OBJECTIVES OF THE MEETING

2. INTRODUCTION OF PARTICIPANTS

3. UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT
   3.1. GENERAL
   3.2. DATA CHAPTER
   3.3. IWG-SODIS: INTER-SESSIONAL WORKING GROUP TO PROPOSE A STRATEGY ON OCEAN DATA AND INFORMATION STEWARDSHIP FOR THE UN OCEAN DECADE

4. OVERVIEW OF CONTRIBUTIONS OF IOC (AND ITS IODE) TO DATA SHARING IN THE DECADE
   4.1. ODISCAT: CATALOGUE OF SOURCES
   4.2. ODIS: OCEAN DATA AND INFORMATION SYSTEM
   4.3. IOC OCEAN INFOHUB

5. BREAKOUT GROUPS
   5.1. GROUPS 1 AND 2: QUESTION 1
   5.2. GROUPS 3 AND 4: QUESTION 2
   5.3. GROUPS 5 AND 6: QUESTION 3
   5.4. REPORTING BY BREAKOUT GROUPS

6. DISCUSSIONS AND NEXT STEPS
   6.1. REVIEW OF THE SURVEY RESULTS
   6.2. GROUP DISCUSSIONS
   6.3. NEXT STEPS

7. CLOSING OF THE MEETING
**ANNEX III**

**LIST OF ACRONYMS**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADU</td>
<td>Associated Data Units</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>EEZ</td>
<td>exclusive economic zone</td>
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<tr>
<td>EMODnet</td>
<td>European Marine Observation and Data Network</td>
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<tr>
<td>EOV</td>
<td>Essential Ocean Variables</td>
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<tr>
<td>ESCAP</td>
<td>Economic and Social Commission for Asia and the Pacific</td>
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<tr>
<td>EurOcean</td>
<td>European Centre for Information on Marine Science and Technology</td>
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<tr>
<td>FAIR原则s</td>
<td>Findable, Accessible, Interoperable, and Reusable</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>GEOMAR</td>
<td>Helmholtz Centre for Ocean Research Kiel</td>
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<tr>
<td>GODAR</td>
<td>Global Oceanographic Data Archaeology and Rescue Project</td>
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<tr>
<td>GOOS</td>
<td>Global Ocean Observing System</td>
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<tr>
<td>IGO</td>
<td>Intergovernmental Organization</td>
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<tr>
<td>IOC</td>
<td>Intergovernmental Oceanographic Commission</td>
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<tr>
<td>IODE</td>
<td>International Oceanographic Data and Information Exchange</td>
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<tr>
<td>IWG-SODIS</td>
<td>Inter-Sessional Working Group to Propose a Strategy on Ocean Data and Information Stewardship for the UN Ocean Decade</td>
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<tr>
<td>NGO</td>
<td>non-governmental organization</td>
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<tr>
<td>NODC</td>
<td>National Oceanographic Data Centres</td>
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<td>ODIS</td>
<td>Ocean Data and Information System</td>
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<td>ODISCat</td>
<td>ODIS Catalogue of Source</td>
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<td>ODP</td>
<td>Ocean Data Portal</td>
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<td>OIH</td>
<td>Ocean InfoHub</td>
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<td>PICES</td>
<td>North Pacific Marine Science Organization</td>
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<td>POGO</td>
<td>Partnership for Observation of the Global Oceans</td>
</tr>
</tbody>
</table>
SDG  Sustainable Development Goal

TRUST principles  Transparency, Responsibility, User Focus, Sustainability, and Technology

UN  United Nations

UNESCO  United Nations Educational, Scientific and Cultural Organization

WMO  World Meteorological Organization

WOD  World Ocean Database