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Oceanographic
Commission

**OceanPractices:
Ocean Best Practices Workshop VI
05 -19 October 2022 [Online]**

Proceedings



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OceanPractices: Ocean Best Practices Workshop VI 05-19 October 2022 [Online]

Proceedings

[Evolving and Sustaining Ocean Best Practices Workshop Series VI]



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Executive Summary

The goal of the [sixth Ocean Best Practices System workshop](#) (OBPS VI) was to guide the development of best practices and operating practices, to promote their documentation, and to share them widely using the OBPS. The workshop featured two plenaries held in two time zones each and 19 theme sessions held over two weeks.

Figure 1: Workshop Timetable Overview

Workshop Timetable Overview						
Wed 05 Oct 2022	Wed 05 Oct 2022	Thu 06 Oct 2022	TO	Tue 18 Oct 2022	Wed 19 Oct 2022	Wed 19 Oct 2022
Plenary 1a Time Zone 1 03.00 UTC	Plenary 1b Time Zone 2 14.00 UTC	Theme Sessions Self-Organized			Plenary 2a Time Zone 1 03.00 UTC	Plenary 2 b Time Zone 2 14.00 UTC

These theme sessions were planned and held by separate communities of practice in ocean science, engineering, and technology. The workshop attracted the attention of a total of 1152 registrants from around the world, with some 600 people attending across time zones in the theme sessions and the plenaries.

The workshop allowed the different communities of practice to focus on the creation, documentation and use of best practices working with members of the OBPS Steering Group. It drew on the experience of OBPS User Groups and stakeholders and provided an opportunity to gather feedback on how the system should evolve to better fulfil each community's vision, mission, and needs.

A common theme was that the broad ocean observing community appreciates the opportunities provided by the OBPS to focus on best practices. The community requested that this service be continued through additional workshops, opportunities to publish and share documents through the OBPS, and allow for cross-fertilization between different sectors of the community.

Workshop Recordings are available on YouTube:

<https://tinyurl.com/yy84kdh2>

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INTRODUCTION

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The goal of the [6th Ocean Best Practices System workshop](#) (OBPS-WS VI) was to guide the development of best practices and operating practices, to promote their documentation, and to share them widely using the OBPS. The workshop featured two plenaries held in two time zones each, and 19 theme sessions held over two weeks.

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Figure 1: Workshop Timetable Overview

These Theme Sessions were planned and held by separate communities of practice in ocean sciences, engineering, and technology. The workshop attracted the attention of a total of 1152 registrants from around the world, with more than 600 people attending across time zones in the Plenaries and Theme Sessions. (Participants see Annex 1)

Cafes

More than six “Cafe” sessions were scheduled throughout the workshop. These provided an opportunity to connect in an informal way outside the context of the Theme-specific sessions and Plenaries. They offered a space for cross-Theme conversations as well as for general networking and ‘talking shop’. Members of the Workshop Organizing Committee hosted the sessions and were there to answer questions. Breakout rooms were also offered for participants to split into multiple small groups to have a variety of conversations in parallel.

The cafes attracted multi-language participants. A need for non-English cafes was identified and a language [inclusion survey](#) conducted. 51 responses identified clusters of Arabic, French, Portuguese, Spanish, and Chinese speakers with Greek, Malay, or Hindi also responding. The different language groups needed to organize their own “cafe” schedule to have their discussions, and our Technical Support (Ben Roberts) was available to assist. We recommend that a solution to facilitate inclusion of non-English cafes for future workshops be considered working with registered participants, possibly based on a pre-workshop survey.

1. PLENARY 1 (a and b) 05 October 2023

To accommodate different time zones two separate Plenaries were held:

Plenary 1a - 03.00 UTC; **Plenary 1b** - 14.00 UTC

Recording for Plenary 1a: <https://youtu.be/Zuid6L9vMN8>
Recording for Plenary 1b: https://youtu.be/JeB0mZc7_A0

a. Welcome

Jay Pearlman, Co-chair OBPS / Moderator Plenary 1a

Frank Muller-Karger, Chair, OBPS Workshop VI / Moderator Plenary 1b

Jay Pearlman and Frank Muller-Karger welcomed participants to the sixth Workshop of the Ocean Best Practices System (OBPS) during the different Plenaries. They explained that the OBPS is a global service sponsored jointly by the Global Ocean Observing System (GOOS) and the International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC), to support ocean communities engaged in observation, data analyses, and applications.

The first Plenary (Plenary 1) was offered in two time zones to set the tone for activities to be discussed during self-organized Theme Sessions that would take place over the following two weeks. The closing Plenary (Plenary 2) was also held in two time zones on 19 October 2022. At the Plenary 2, Workshop VI recommendations from the Theme Sessions were discussed.

b. Keynote 1 : History, Vision, and Impact of BP and OBPS: Rachel Przeslawski and Johannes Karstensen

The Plenary opened with a presentation, '*History, Vision, and Impact of the OBPS*' by Rachel Przeslawski (Plenary 1a) and Johannes Karstensen, (Plenary 1b). Both are members of the Steering Group of OBPS.

This comprehensive overview of the OBPS provided a foundation to understand the system and its application in the context of other topics of interest to different ocean observing groups. It covered the definition of best practices and their value, including increased efficiency, collaborative opportunities, and greater trust in data when they are applied. The four original capacities of the OPBS were then introduced: the Repository discovery and submission functionality, the journal

research theme, capacity development including OBPS Training Courses via the Ocean Teacher Global Academy (OTGA) platform, and user support and communication through the bimonthly Newsflash and other communications. Some newer activities and capacities of the OBPS were described: Task Teams to complete discrete projects, an Ocean Decade Programme ('Ocean Practices for the Decade'), additional periodic workshops to discuss topical issues, an active Early Career Ocean Practitioner (ECOP) network, and collaborations with GOOS and other groups to support and advance international endorsement of best practices.

The OBPS is working to be a global, sustained and trusted hub of knowledge about ocean practices in the following ways:

- Expand work with developing nations, remote regions and Indigenous Peoples (e.g. in Africa, Arctic, South Pacific)
- Motivate and focus a global conversation around best practices
- Encourage organisations to endorse what "is best" for them
- Harmonize metadata and structures (FAIR BP)
- Promote federated network of methodological management systems
- Synergize best practices and standards (convergence)

c. Keynote 2 : Best Practices in Australia's Integrated Marine Observing System. Paul Van Ruth

Paul van Ruth, Principal Scientist with Australia's Integrated Marine Observing System (IMOS), presented a case study on the creation and implementation of best practices in Australian marine systems and the positive impact they have had.

IMOS is a collaborative research infrastructure funded by the Australian Government to provide systematic, sustained, long-term observations of the marine environment. IMOS operations are underpinned by guiding principles that ensure that data collected through the programme contribute to community, management, legal and policy needs in Australia that support operational services, research, management and marine industries at regional, national, and global scales. A key component of these principles involves building trust through high standards and transparency. As a condition of funding through the IMOS programme, all procedures and protocols used for a given operation need to be standardised, endorsed by the IMOS community of experts, then registered with the Oceans Best Practices System. There are many benefits that flow from this approach. Operators unambiguously understand expectations. They have ready access to documented IMOS best practice protocols with regular, updated training. Users of IMOS data can be confident that it is of the highest possible quality and is readily accessible in standardised formats, which ensures the data will be used. Funders can be confident that investments made through the IMOS programme will generate outcomes that

create impact in policy and management.

Through this focus on building trust through transparent, best practice operations, IMOS has developed a reputation as a leader in marine science observations and data management.

d. Dialogue of Ocean Community Priorities: a participatory mixer. Ben Roberts

To connect people with one another and to surface challenges and opportunities that might be addressed during the Workshop, Plenary 1, participants took part in a “mixer” consisting of three nine-minute breakouts. In each round, groups of 2-4 people considered these two questions:

- “What big challenge do you bring to this gathering?”
- “What do you hope to get from, and give to, this workshop?”

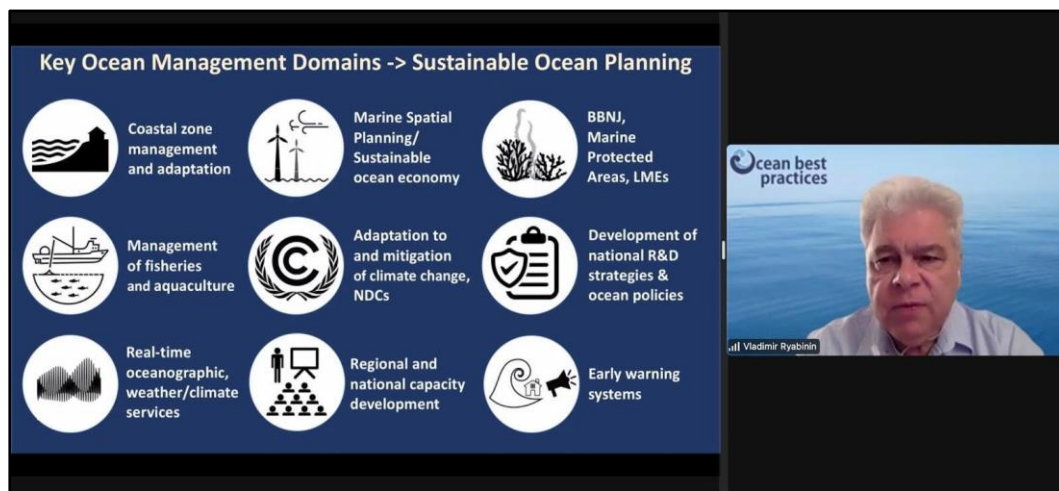
After the breakouts, participants were asked to share a challenge that stood out for them, via the Zoom chat. The output was uploaded to [this Miro Board](#) for further reflection. Here are some of the patterns that emerged from this harvest around these challenges:

- Working across multiple cultures and in multiple languages
- Working across scales from local to global
- Building capacity to implement and coordinate best practices
- Establishing data standards across multiple platforms

Language was a challenge in the dialogue. Many participants were not comfortable speaking in English and had signed up for the Workshop with the expectation that they would not need to participate. However, working on best practices led to discussions where these participants wanted to also provide their perspective. This also became apparent in the “Cafes”. This led to the creation of a [language inclusion survey](#) that garnered 51 responses and identified clusters of Arabic, French, Portuguese, Spanish, Chinese, and other speakers.

e. Keynote 3: Plenary 1a : UN Decade of Ocean Science for the Sustainable Development and best practices . Vladimir Ryabinin

Vladimir Ryabinin, Executive Secretary, (Intergovernmental Oceanographic Commission) highlighted best practices in the Ocean Decade and the key domains where best practices are part of the foundation for advancing the Ocean Decade objectives.



He acknowledged that there is still a lot more to do to develop best practices and to converge toward their adoption across the ocean observing community. He presented the Ocean Decade as an opportunity that maps to the best practices vision and mission. He compared Oceanography and Meteorological observations and said a dramatic increase was needed for oceanographic observations to reach the level



of meteorological observations. He listed achievements up to the Calls for Actions for the Ocean Decade and highlighted the need for inclusion and partnerships of traditional natural science and social sciences. This includes designing mechanisms for co-design, adopting best practices, and addressing inclusion and equity

issues across gender and early career professional communities. He noted new structures at the IOC and the Ocean Decade where data sharing and ocean observation officers are involved with the development of best practices. Dr Ryabinin applauded the growing success of promoting, creating and sharing best practices and finished with a supportive take-home message for all to maximise the potential of best practices to move forward the Ocean Decade itself.

Best practices are essential for moving towards managing the ocean sustainably on the basis of capable ocean science. The potential is mighty.

Ashwini Sathnur of Scientific Marine Research, UNESCO, followed with a presentation which outlined the digital tools supporting the Ocean Decade and

acknowledged that standardization was a primary goal. She concluded with stressing that the OBPS platform was an important source of historic, existing, and novel methods for ocean observation, applications and data management.

f. Keynote 3: Plenary 1b : BP in the Ocean Decade

Sara Venturini

Sara Venturini spoke on behalf of Group on Earth Observations/GEO. She reminded participants how GEO and particularly GEOBlue Planet (the ocean 'arm' of GEO) was supporting the Ocean Decade Actions by working to monitor and share earth observation data alongside such organisations as GOOS. GEOBlue Planet focuses on the knowledge gap in scientific questions and priorities and has produced a set of inputs around the need for a clean ocean; a predicted ocean where society has capacity to understand the ocean; a safe ocean to protect from hazards and for coastal zone management; and a sustainable, harvested and productive ocean. The policy of GEO leveraging its convening power across stakeholders was developed in 2019 in Canberra, where panellists discussed how GEO could contribute to the UN Ocean Decade. More recently in July 2022 there was a dedicated session on developing policies on how earth observations can enable integrated coastal zone management and support activities, such as marine spatial planning in which the use of best practices particularly in less developed regions was considered.

COP26 in Bonn, first mandated to anchor the Ocean Decade under IOC, and in July 2022, the UN Ocean Conference in Lisbon recognized the importance of ocean observations deploying new technology and using earth observation data to tackle existing and emerging environmental challenges. There is a push to frame the discussion through a lens of ocean climate/biodiversity nexus and integrate big earth data for coastal zone management and ocean actions in general.

The Geo community consists of member countries and agencies and networks (MBON etc) and it aims to take on the role of implementing work to fill the data gap. She welcomed discussion on best practices and sharing knowledge.

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f, Keynote 3: Plenary 1b: Diversity, Equity and Inclusion in the Ocean Decade Ellen Johannesen, ICES, World Maritime University/ ECOP)

Ellen Johannesen is Coordinating Officer and ECOP representative with ICES. She is working as a PhD candidate on the WMU Project 'Empowering Women

for the UN Ocean Decade...' and is a member of the Ocean Decade ECOP



Diversity, Equity and Inclusion (DEI) task team which includes OBPS members.

She reflected that diversity and inclusion were elements planned into the Ocean Decade Programme even as early as the first meetings. She highlighted that diversity is a lot more than gender, and quoted that

"dimensions of diversity include the visible and invisible differences that exist between people" (Tulloch 2020). Inclusion is an action which should be tackled

at institution and personal levels. She highlighted the global work in many projects; and the work in underrepresentation for example in the Women in Marine Science initiative, and explained the launch of the Stakeholder Consultative Forum for Empowering Women and invited the community to engage. She continued with an outline of the ICES DEI activity where the need for change and working toward a more balanced inclusive organisation has been recognized. She showed the importance of collecting gender data not just quantitatively but qualitatively, to reflect particular career levels, and collecting experiences of female workers. Finally,



she emphasised the need for executive level commitment and resources to carry out DEI work and make it happen rather than "tokenistic" application. The inclusion of the DEI programme will be an important outcome of the Ocean Decade

g. Capacity Development Panel
Development of BP/Inteoperability. Globalisation of BP and the Role of Capacity Development and Curriculum for Formal Education Settings

Juliet Hermes, SAEON; **Steve Diggs**, SIO; Virginie van Dongen-

Vogels, AIMS,
Panelists: ECOPs; Suchana Apple Chavanich, Chulalongkorn University;
Talen Rimmer, University of Victoria; Johanna Diwa, IODE; Josephine
Edwards, Lady Marine Consultancy; Neelu Singh, NPI

This topic was addressed in two separate plenaries. The plenary presentations framed the discussion and addressed the desired outcomes; for example: increased awareness of careers in marine science and how to retain people in them, in particular retaining groups that historically have been minorities (cultural, geographic, ethnic, gender, age, etc.).

The panels put forward some thoughts for consideration -

- What is the definition of capacity development and best practices in this context - is it best practices for capacity development or capacity development of best practices?
- Are we developing skills or building and supporting human capacity through education of opportunities and awareness?
- Can this be done globally or is a regional approach necessary?
- What are the key factors to consider - human interaction; education; resources/economy; language
- Co-design for sustainability - people are best empowered to realize their full potential when the means of development are sustainable - home-grown, long-term, and generated and managed collectively by those who stand to benefit (UNDP).
- To what end do we need to develop local capacity? What will be its purpose and can it be sustained?
- Whose capacities need to be developed? Which group or individuals need to be empowered?
- What kinds of capacities need to be developed to achieve the broader development objectives?
- A Best Practice leads to optimal outcomes. Can we measure that we have developed capacity in a particular way and because of this, capacity has increased as compared to developing it in a different way?
- How can we assess when capacity has been developed or how can we measure what we have achieved if it is an evolving process?
- OBPS has been asking the question of how to include Best Practice content in formal undergraduate and graduate courses. It would be of real value if guidance on this could be an outcome of the discussion. Since OBPS takes the recommendations in forming its strategic and tactical plans, these would be actionable items.
- How can we engage at a level that is not tweeting and instant gratification

h. Meeting Technology

Workshop expert technical support for participants was available via live expert support and via email. Support was provided for the QiqoChat Platform that provided the interface to the meeting calendar and different sessions. This included the TeamUp Calendar, Plenaries, Workshop Cafes, and Theme Sessions.

The OBPS Workshop VI technology configuration is summarised in Figure 2.

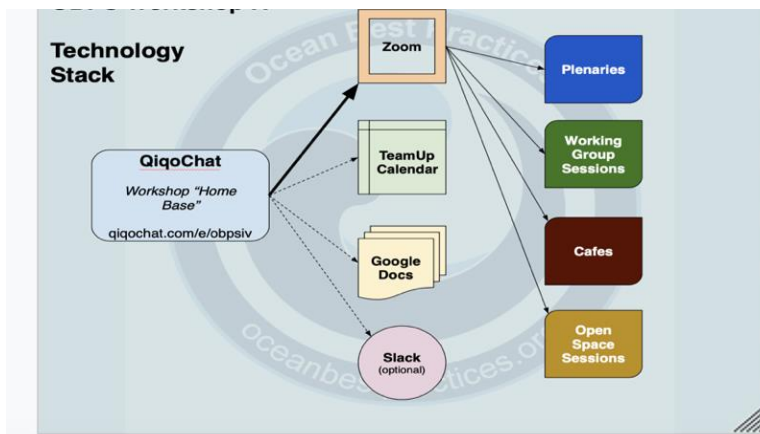


Figure 2 OBPS Workshop Technology Stack

The main platform was [QiqoChat](#) which complements the virtual meeting platform (Zoom), allowing participants to move in and out of different virtual spaces, and to use chat within each space. QiqoChat also served as a firewall for net security. In addition, we used Eventbrite for registration and used a Google [Teamup](#) calendar to provide an overview of all meetings, and how to access them.

[QiqoChat](#) provides a social wrapper around Zoom meetings so that participants can move themselves in and out of different sessions (each with their own zoom access). This creates a vibrant and empowering online event/conference experience that replicates the freedom of movement to enter and leave a session available at in-person events. Participants made choices in real time about which breakout, panel, or workshop they wished to attend. QiqoChat also integrated Google Documents, background descriptions of the working groups and other tools. For some, the use of computer video enhanced the interactions. Several orientation/onboarding sessions were offered to workshop attendees prior to the start of the workshop. While most participants would be familiar with Zoom, they may not have experienced QiqoChat before.

i. Theme Session Guidance

This short session provided guidance on the logistics of the workshop sessions and then reinforced the workshop goals: to encourage the development of best practices (BP), to promote their documentation, and to share them widely using the Ocean

Best Practices System. This includes developing a framework/method for establishing best practices in ocean observing, and for gaining endorsement for these practices from the community.

The goals of each of the sessions/themes was to address the following questions:

- Recommendations from your Theme Session on needs for development of methods and best practices

This includes:

- Recommendations for the community
- Recommendations for the IOC's Ocean Best Practice System (OBPS)
- Potential cross cultural collaborations across themes

2. THEME SESSIONS : 6-16 October 2022

There were 19 invited thematic sessions that brought experts and stakeholders together. These theme sessions were organized by either geographic scope (surface ocean/air-sea interactions, deep ocean, Arctic), or by topic (e.g., capacity development, biodiversity, environmental DNA, policy, ocean profiles of chemical variables, operational forecasting, time series observations, fisheries and aquaculture, plastics in the environment, data interoperability, transparency and traceability, cooperation between organizations, seagrass monitoring, and the UN Decade of Ocean Science for Sustainable Development - the Ocean Decade).

The requested output of each theme session, to be delivered to the workshop organizers, was a report (template provided) summarising the theme's requirements and recommendations for best practices, and recommendations to the OBPS Steering Group for future planning. These materials are reproduced below. They form the basis for the workshop recommendations outlined during Plenary 2.

Air-Sea Interaction

1. Scope of Theme Session

The objective of this session was to learn about recent successful efforts to create best practices for surface radiation and ocean



colour, and apply lessons to other air-sea interaction observations. Talks covered steps to endorsement, scientific and organisational aspects of mature best practices, and paths forward for fields developing new best practices. Group discussions after the talks surfaced themes such as the need to have organisations that can take over long term stewardship of best practices after fixed-term programmes (like OASIS) come to an end. We also had lively scientific discussions about, for example, the challenges of flow distortion around ships and buoys. We hope that the sessions will help new best practice efforts gather momentum, and will also propel developed best practices towards endorsement and adoption.

2. Lead, Co-leads, Rapporteur(s)

Reeves Eyre	Jack	NOAA CPC/ERT	USA	Lead
Xue	Cheng	USF	USA	Co-lead
Riihimaki	Laura	NOAA PSL	USA	Co-lead
Hermes	Juliet	SAEON	South Africa	Co-lead & rapporteur
Swart	Seb	Univ Gothenburg	Sweden	Rapporteur
Marandino	Christa	GEOMAR	Germany	Rapporteur
Ueki	Iwao	JAMSTEC	Japan	Rapporteur

3. Theme Session Meeting recording(s) available at:

11 October 2022: Session 1 https://youtu.be/i34_ZQQReIs

16 October 2022: Session 2 <https://youtu.be/NaUqhXRH7vM>

4. Location of Theme Session Meeting document:

https://docs.google.com/document/d/1-1D3yFfnIQwe_eNGWyTPtfo65yCXAgHaLcTP2ttK6OE/edit?usp=share_link

5. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

One of our co-leads (Laura Riihimaki) also led another session (Decision Trees).

6. Recommendations from your Theme Session on needs for development of methods and best practices

• Recommendations for the community

What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?

Multiple meetings, workshops and collaborative writing projects, with broad community input. A small number (1-3) of leaders with time, energy and connections to organize the effort.

What are the challenges?

Time and energy demands on the leaders. Finding independent reviewers, especially for the peer-review process. Most people with knowledge to provide a thorough review will be involved or have associations with authors.

Where are there gaps?

In general: autonomous vehicles. For direct covariance fluxes: heat and momentum fluxes, motion correction and flow distortion assessment. For CO₂ fluxes: flow distortion on ships; transfer coefficients.

What are the success stories?

Surface radiation group has made good progress on documenting, updating and creating best practices. Next steps: publication, endorsement.

If you have established best practices, where are they deposited?

Community paper from the surface radiation group should be published soon.

What are the recommended steps to move forward?

Convene working group for direct covariance fluxes. Down the line, once need/position is better established, convene a working group on CO₂ fluxes.

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

- *How can OBPS help your community discover existing methodological documentation?*

Maintain the searchable database.

- *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*

Workshops like this provide a useful opportunity to get people together.

- *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*

Templates for necessary documentation, training.

- *What additional functions can the OBPS provide to encourage the*

broad use and updating of any best practices your community produces?

Use: making them easy to find and cite (DOIs and citation generators).

Updating: regular (annual?) reminders to a set of best practices stewards that updates can/should be made.

- *Are there existing approaches for formal community endorsement of your best practices?*

No, but we discussed the idea that endorsement from the OASIS community could be a useful first step, before GOOS endorsement, for best practices developed from OASIS working groups.

- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*

We have several researchers who are very well known in their fields. Their past work will likely be crucial in future best practices, so they should be involved in either writing or endorsing best practices.

- *Are there any capacity development activities in best practices that are currently active or that you recommend?*

We think it is important to have best practice working groups that are open to all - across career stages, continents, roles, all facets of individual identity. This may not be practical in the early stages. But it should be included as soon as possible to provide important learning and networking opportunities for students and early-career scientists, technicians, etc.

- *Please list any other recommendations to emerge from your Theme Session:*

- It is important to have a permanent body that can take over best practices that are developed by fixed-term programs like OASIS.
- Many best practices should really be a hierarchy of best practices, from instrumentation, to platform choice, to data archiving and data product development.

7. Future Collaboration

Direct covariance flux working group should collaborate with the SOLAS group working on direct covariance gas flux measurements. Many of the same people involved, and many similar challenges. Need to make sure no duplication of effort.

CO2 flux working group should work with several other carbon cycle groups/organizations (e.g., SOCCONET). OASIS needs to make sure the group works on something new and doesn't duplicate efforts - e.g., CO2 fluxes from autonomous vehicles; combining pCO2 measurements with other air-sea interface measurements.

Arctic Practices

1. Scope of Theme Session

The session was focussed on presenting selected Community-Based Monitoring (CBM) and Citizen Science (CS) initiatives across the Arctic. The most important topics for CBM programmes are fisheries, herding and hunting, forestry, mineral and hydrocarbon extraction, shipping and tourism. A major objective of the CBM/CS systems is to produce specific environmental and climate information to support management of resources, local decision-making and safety of human activities.



The session had the following presentations:

- 1) Lesson learned from developing CBM in Greenland through the PISUNA network and in Russia through collaboration with Indigenous Peoples' organisations
- 2) Results from Alaska where coastal communities produce and share information about erosion and permafrost thaw hazards
- 3) Developing Environmental Community-Based Monitoring Through Collaborative Research and Two-Way Capacity Sharing in Canadian Arctic.

The discussion at the end was centred around what are the models for sustaining CBM programmes and in addition to stable funding, another main challenge identified was the sharing of information and experiences.

○ 2. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Sandven	Stein	NERSC	Norway	chair
Mercer	Louise	University of Northumbria	UK	co-chair

3. Theme Session Meeting recording(s) available at:

12 October 2022: <https://youtu.be/rRSmRDxMTGs>

4. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/18c8r3emeddO_ggBhrRv5J92ZktSUvE_5?usp=share_link

- **5. Links to or collaborations with other Theme Sessions** (*e.g., Did your session have exchanges with other Theme sessions established for this workshop?*):
- **6. Recommendations from your Theme Session on needs for development of methods and best practices**

Recommendations for the community

The main challenges for CBM and CS projects in the Arctic are mainly to (1) bring CBM/CS systems from *ad hoc* initiatives to sustainable observing systems, (2) provide data sharing, including links to scientific data systems, (3) make use of CBM/CS data in decision-making, and (4) establish sustained funding.

Regarding funding there are different possibilities:

- Individual grants from govt (e.g. Inuvialuit CBM)
- Individual grants from philanthropies and international bodies to local CSOs (Yakutia CBM)
- Financed by penalties from polluters (ex. AAOXH)
- Surplus from mineral exploration and exploitation (ex. Marion Watershed)
- Support from govt through annual appropriation based on a policy

Regarding data management

- Data quality is fundamental if participatory monitoring of biodiversity is to achieve its objectives; it is therefore essential that data collection be standardized at the necessary scales (among monitors, among communities, and among initiatives if the scale of monitoring is regional or global).
- Use and application of monitoring data should respect the characteristics, limitations and restrictions inherent in the data.

Recommendations for the IOC's Ocean Best Practice System (OBPS)

- *How can OBPS help your community discover existing methodological documentation?*

Include CBM methods on the Arctic Practices repository in cases where documentation exist and the provider is willing to share. In some cases written documentation is non-existing or is not available for sharing outside the community.

- *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*

The OBPS need to be promoted towards the CBM communities through workshops and training events.

- *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*

Since the best practices evolve quickly as new technologies are implemented and adopted in the communities, it is important that OBPS is in close dialogue with the community members.

- *What additional functions can the OBPS provide to encourage the broad use and updating of any best practices your community produces?*

OBPS need to show that the information about best practices is useful to the communities

- *Are there existing approaches for formal community endorsement of your best practices?*

Most of the CBM activities are bottom-up initiatives without formal endorsement.

- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*

The communities usually establish agreements on methods and standards within the CBM systems.

- *Are there any capacity development activities in best practices that are currently active or that you recommend?*

Capacity development takes place in ongoing and planned workshops and research schools organised by CAPARDUS.

Capacity Development

Best Practices in Developing Global Ocean Science Capacity , Thursday, October 6, 2022, 13h00 – 14h30 (UTC)

Lead: Johanna Diwa-Acallar (UNESCO/IOC)

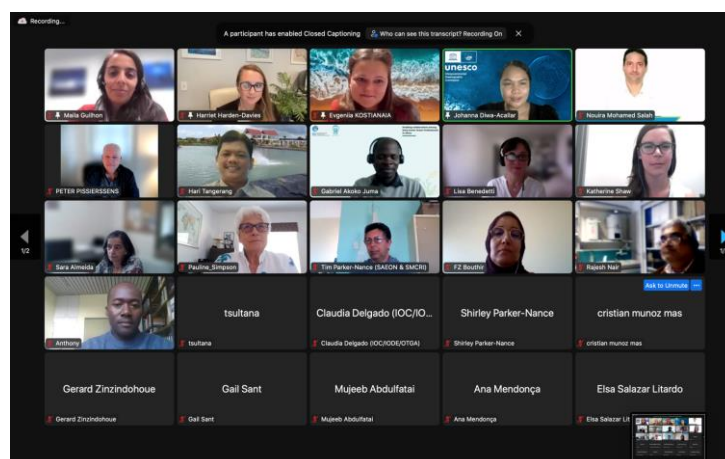
Co-Lead: Gabriel Akoko Juma (Alfred Wegener Institute)



Theme Session Meeting recording(s) available at:

<https://youtu.be/ijPA9YzwFC4>

<https://youtu.be/NPDjk2aNwXc>



Background

The session explored the potential role of OBPS as "an evolving system which fosters collaboration, consensus building, and innovation by providing coordinated and global access to best practices and standards across ocean sciences and applications" globally and equitably.

It was divided into two parts with the first part featuring selected presentations from beneficiaries of capacity development programs from developing countries, highlighting some best practices in various CD modalities that they participated in. Perspectives from CD providers were also included to highlight best practices in organizing CD activities. The aim was to identify the principles and methodologies that efficiently contribute to building ocean science capacity at individual, organizational and societal levels. The second part involved a panel discussion to identify where

communities of practice see the most potential and greatest value in capacity development. They also recommended ways on how to engage in the creation, adoption and routine employment of best practices in capacity development.

Presentation 1:

Gabriel Akoko Jum :

Best Practices in Developing Global Ocean Science Capacity;
Insights from NF-POGO Center of Excellence Programme

The presentation featured NF-POGO training programme on oceanography observation, at Alfred Wegener Institute. The beneficiary highlighted that the training has been conducted since 2008 and it aims to build capacity for a sustained ocean observation to address societal issues of the day. Through integrated and multi-disciplinary hands-on learning, the learners (majorly from developing countries) are taken through introductory and more detailed courses such as ecosystem modelling, remote sensing and GIS, instrumentation, sample collection and analysis as well as guidance through their independent research projects. They are also involved in co-curricular activities including ball games and athletics.

The programme outputs include skilled professionals and scientific observation, strengthened collaborations and networking among individuals and institutions in developing and developed countries as well as personal and professional development of scholars. The presentation also provided recommendations for documenting and promoting best practices in our communities of practice such as; developing templates and compiling ready made templates in ocean observation, demystifying guides/manuals for use by communities and ocean professionals in the informal sector, publishing reports on ocean observation guides as well as following up and supporting projects initiated by the scholars in their home countries.

Presentation 2:

Hari Mahardika: Capacity Development for Sustainable
Coastal Management: PEMSEA Traineeship Programme

The presentation provided insights on PEMSEA Traineeship programme with the aim of scaling up integrated coastal management (ICM) programs in

Indonesia. The objectives include awareness on the approach's strategies, activities and tools for strengthening, implementing and evaluating ICM programs. The focus areas include development of MPAs for habitat protection, biodiversity conservation and livelihood improvement.

The presentation also cited the activities of the programme including training and outdoor activities on mangrove nursery establishment and planting, resource mobilization and stakeholder collaboration as well as training on community projects' monitoring and evaluation. In terms of output, a restoration and conservation of 121 ha in 2021 from 79.2 ha of coastal ecosystems in 2014 has been realized.

Hari shared some good practices from PEMSEA's capacity development programme that led to better coordination mechanisms in implementing ICM programmes in Tangerang. One example is the co-design process in the whole cycle of the programme, which was designed based on the specific needs in his organization and its focus area on habitat conservation, which resulted from needs assessment and consultation between PEMSEA and Tangerang Regency. The institutional arrangements following the completion of the programme also enabled the retention of capacity built in their organization, and largely in Tangerang, Indonesia.

Presentation 3:

Brian K. Arbic: The Coastal Ocean Environment Summer School in
Nigeria and Ghana

The presentation highlighted activities of COESSING as an endorsed project of the UN Decade of Ocean Science. It is a one-week programme with about 100-120 participants from Africa and about 10-40 from the US since 2016. It takes place in Nigeria and Ghana and engages learners in lectures, lab work, computer programming workshops, field trips and participants' project presentations, with the goal of networking, enhancing capacity and connecting African ocean scientists with other scientists.

The programme has the vision of building a global ocean science enterprise with networks of summer schools and other exchange modalities such as longer visits and online sessions. The presentation also highlighted some of the challenges faced including inadequate funding despite requests to expand the training to other regions such as Port Harcourt.

**Panel Discussion (Panelists: Evgenia Kostianaia; Maila Guilhon;
Harriet Harden-Davies)**

Johanna Diwa opened the panel discussion with a short introduction of an online tool that UNESCO-IOC is currently developing which addresses one of the most common challenges in looking for one place for capacity development opportunities. In response to Capacity Development (CD) needs identified by the Member States, UNESCO-IOC has developed a prototype of an online tool (a catalogue of sources) which allows users (e.g., early career professionals, managers, technicians, government officials, etc.) to easily search for on-line sources of information on capacity development opportunities (e.g., trainings, fellowships, internships, grants, etc.) at global, regional, and national levels. The tool is called “The Ocean CD-Hub: Gateway to Ocean related Capacity Development opportunities around the world”. [Ocean CD- Hub](#)

The overall aim of the Ocean CD-Hub is to:

- Serve as a one stop to easily search for available CD opportunities (for CD beneficiaries)
- Identify synergies and potential partnerships with other organizations (for CD providers)
- Help avoid duplication of effort and save resources (for CD providers)
- Help Member States report on progress and achievements towards: SDGs, UN Ocean Decade, etc.

The current prototype is limited to CD activities and opportunities that are:

- Open to developing country nationals
- Ongoing programmes rather than ad hoc one-time activities like workshops or one-time courses
- Currently active or planned future activities, i.e., completed activities were not included

At the panel discussion, the panelists gave their views on the best approaches to implement capacity development and mechanisms to engage in creation and adoption of best practices in capacity development. The discussion was guided by the following questions:

1. Are there success stories in your community that were established as best practices on capacity development?

2. What steps are needed to encourage wide use of BPs and its adoption, creation, promotion and replication in your community?
3. How to leverage BP and its recognition as a huge potential to 'incentivize' career/academic promotion?
4. Is a generic BP template on capacity development enough to cover all use cases, or are there specific CD use case which will be more useful as a guide in your community?

They highlighted:

- The need to build connection between academia and the industry. These connections strengthen career growth and enhance job creation among early career ocean professionals. There is also the need to strengthen connections between different CD programmes with government to ensure maximum benefits.
- Need to strengthen ocean observation through cruise trainings. After the training, the participants should communicate their findings by presenting in conferences or publishing the scientific findings.
- The government agencies should be aware of the existence of the various CD projects and programmes. This makes it easy for citizens of different countries (e.g developing) to move to other countries and participate in the CD activities.
- We need to determine how to measure the success of the various capacity development activities
- It is important to understand intentions of CD promoters and the potentials of the programmes to make a difference.
- The programme activities and objectives should also be aligned with sustainable development goals as well as the long-term goals of the funding agencies.
- The success of various CD projects depend on what is given and received, the motivation and how the giver-receiver partnership is contextualized. There is therefore need to evaluate the process and outcome.
- Relevant policies should define partnerships in order to support sustainable and long-term CD initiatives for lasting connection, that help institutionalizing CD activities with programmatic approach.
- To leverage the best practices, principles should be set to guide establishment of partnerships as seen in the important role of best practices from declaration for small island developing states CD.

- There is also need to develop templates for staggering different elements of a CD activity, e.g. different concepts, varying levels (institutional, organizational, systemic), contexts, etc.

In conclusion, the workshop presented examples of CD programmes from which the public can draw methodologies and principles for further discussion into developing ocean best practices and efficient capacity development programmes. The panel session also gave recommendations towards identifying and promoting best practices in capacity development for sustainable ocean science. Different approaches such as stakeholder engagement, setting guiding principles for capacity development and publishing reports on success and failures of CD programmes were highlighted as priority factors in realizing sustainable ocean best practices and capacity development during this decade of ocean science and

Coastal Observations

1. Scope of Theme Session

Access to the resources needed to properly observe and monitor the coastal ocean is a major challenge faced by many countries and institutes around the world particularly in the context of pressures on energy resources and raw materials.



A wealth of valuable information can be gained from many regions through basic/traditional coastal oceanographic studies when conducted in conjunction with fixed-point coastal observing systems that are a component of existing and/or planned international programs. However, identical equipment and methods are also of great value in their own right, with applicability to diverse scientific and applied research questions and to coastal environments ranging from wetlands to estuaries to nearshore and open shelf settings.

A working group has been established under the IODE/IOC/GOOS Ocean Best Practices framework with the goal of identifying common and accepted best practices already in use within the community for observations of physical, chemical and biological parameters of the coastal ocean.

2. Date(s) and time(s) of Session(s):

Coastal Observation for all



Coastal Observations in Under-Resourced countries

Context

A fundamental issue faced by many countries and institutes is the access to equipment and expertise to properly observe and monitor the coastal ocean. These issues are compounded by the lack of standard operating procedures or best practices in conjunction with a common misconception that high-end equipment and facilities are needed.

In an attempt to tackle these issues, a task team has been set up under the IOC Ocean Best Practices framework. Starting in January 2022 and over the next 18 months, this task team aims to identify common and accepted best practices already used within the community for observations of physical, chemical and biological parameters of the coastal ocean, with a focus on the African continent. Identifying these practices will ultimately result in a package that is affordable to under-resourced countries, easily transportable, easy to use (i.e. can be taught to undergraduate students) and widely applicable (e.g. can be operated from a small coastal craft). In addition to this the package should also require no more than a bench space and minimal supporting infrastructure.

1	12-10-2022	4:00 PM UTC	6:00 PM UTC
2	13-10-2022	6:00 AM UTC	8:00 AM UTC
3	13-10-2022	11:00 AM UTC	13:00 AM UTC

Conveners:

Lucie Cocquempot: lucie.cocquempot@ifremer.fr

Tommy Bornman: tg.bornman@saeon.nrf.ac.za

Jethan d'Hotman: js.dhotman@saeon.nrf.ac.za

Samuel Obeng (ECOPs)

Theme Session Meeting recording(s) available at: <https://youtu.be/BiUhyR65sxQ>

Data Interoperability

1. Scope of Theme Session

Digital twins build on an observing system and predictive processes or data-driven models that users can interact with to support their needs.



The connection between the digital twin and the real one requires a well-formulated interface between the digital twin, environmental data, and the user. User interaction is therefore an essential function that is embedded in the design of digital twins, including visualisation, user-driven data transformation and data-science tools.

Thus, Digital Twins of the Ocean (DTO) will enable users to address ‘What if’ questions based on shared data and models. They empower a number of stakeholders to visualise and explore ocean knowledge and forecasts, and provide decision support for ocean sustainable development. The use of Digital Twins is wide and rapidly developing spanning a wide range of use cases from engineering to policy to science to operational services.

In this session we will discuss recent advancements from ongoing Digital Twin of the Ocean initiatives and their approach to data interoperability.

2. Date(s) and time(s) of Session(s):

Session 1	17.10.2022	17:00 - 18:30
Session 2	18.10.2022	06:00 - 07:30

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Both sessions				
Visbeck	Martin	GEOMAR	Germany	Co-lead
Kollert	Joana	GEOMAR	Germany	Co-lead
Brønner	Ute	SINTEF Ocean	Norway	Co-lead
Buttigieg	Pier-Luigi	GEOMAR/AWI	Germany	Speaker
Session 1				
Hogweg	Marten	ESRI	Netherlands	Speaker
Demargne	Louis	IOC - UNESCO	International	Speaker
Session 2				
Broekhuijsen	Jeroen	TNO	The Netherlands	Speaker
Krug	Marjolaine	Dept of Forestry, Fish. Environment, Cape Town	South Africa	Speaker
Buck	Justin	NOC	UK	Speaker
Schaap	Dick	MARIS	The Netherlands	Speaker

4. Theme Session Meeting recording(s) available at:

Session 1: <https://youtu.be/z9vrPIYIJ7o>

Session 2: <https://youtu.be/AACBdvzFbqM>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1WcffH70yH6jA0RR5IfFhrk959VZ3gp_L?usp=s
[hare link](#)

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

No

7. Recommendations from your Theme Session on needs for development of methods and best practices

Digital Twins have a wide scope of use and a broad interest in various sectors: from biodiversity management, to coastal protection or port management. Currently, a major challenge remains in the data interoperability and digital ecosystem needs of Digital Twins. Global environmental data must be made readily available on an easy access, user-friendly platform. Moreover, the plentiful observational and modeling environmental data is currently collected in a disparate patchwork of national and international projects. International digital standards need to be defined and applied, harmonizing the data sets and making them applicable to global Digital Twin applications.

Several pilot projects (BioDT, IMFe) are developing Digital Twins for specific cases; these are extremely valuable and necessary to explore best-practice cases and demonstrate the feasibility and current gaps in Digital Twins.

- Data capture apps to provide and ensure use of correct metadata when acquiring data (for digital twins)
- Prototype Digital Twin
- Build and sustain a community
- Support your digital twin with the appropriate infrastructure for necessary analysis (incl. Compute to data)
- Ensure best practices along the whole value chain of digital twins (of the ocean) and define this value chain properly
 - Observations
 - Forecasts
 - Allocation (Suitability of data)
 - Alternatives (what if scenarios)
 - Impacts (assessments)
 - Communication and decision making
- Regards dimensions within your best practices for data

- 1D, 2D, 3D, 4D
 - Now, short-term, long-term
- Tie best practices to purpose and target groups ('leave no one behind')
 - Non-open data
 - Non-experts
 - organisations
- 'Plumbing before building the sparkling fountain'
- Need to prove that your recommended best practices work across regions and communities
- **Recommendations for the community**
 - *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?:*

International cooperation and coordination through UN Decade Coordination Offices & Decade Collaborative Centres, strengthening open-access to data through projects such as Blue-Cloud, Trying & testing Digital Twin pilot projects (BioDT, IMFe)
 - *What are the challenges?:*

Creating a digital ecosystem that supports the needs of Digital Twins. Specifically, harmonizing, collecting and combining global environmental data and making it readily accessible
 - *Where are there gaps?*

Need to define global standards of data interoperability
 - *What are the success stories?*

There is tremendous political & scientific, and also some private sector interest in Digital Environmental Twins. EU-Projects such as DestinationEarth or BioDT, but also national efforts such as IMFe are showcasing the potential and feasibility of Digital Twins.
 - *If you have established best practices, where are they deposited?*
 - *What are the recommended steps to move forward?* See above
- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**
 - *How can OBPS help your community discover existing methodological documentation?*

By advertising Digital Twins (DT) pilot projects and setting up a network of exchange between DT projects. Seeing as Digital Twins are fairly new to the environmental community, at this stage the

exchange of ideas, case studies, knowledge gaps and best-practice examples is crucial.

- *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*

By bringing together national stakeholders and encouraging them to develop international standards from the beginning, rather than as an afterthought.

- *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*
- *What additional functions can the OBPS provide to encourage the broad use and updating of any best practices your community produces?*

Regular exchange with the community on status and progress on best practices.

- *Are there existing approaches for formal community endorsement of your best practices?*

Not to our knowledge.

- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*

The Iliad project (EU Green Deal funded project to develop a framework for digital twins of the ocean) is one of the projects that includes a dedicated (funded) task to gather and develop best practices for Digital Twin of the Ocean development. Endorsement would support and ensure collaboration with the rest of the DTO community.

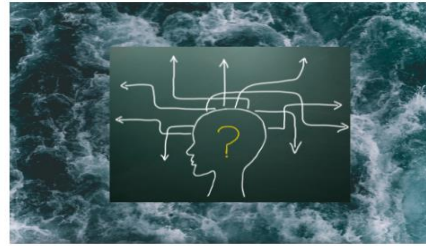
- *Are there any capacity development activities in best practices that are currently active or that you recommend?*

Not to our knowledge (Iliad?)

8. Future Collaborations

Other UN Decade projects related to ocean data or twins like COAST PREDICT the O2 one (don't remember the name), the Ocean Data Coordination Group (Decade), the Ocean Data Implementation Group (to be elected soon) and the newly established Ocean Data private sector group.

Decision Trees



1. Scope of Theme Session

The overarching goal of OBPS Workshop VI was “How can we develop a framework /method for establishing best practices in ocean observing, and for gaining endorsement of these practices from the community?” One way to approach this is through the creation of templates for various tools, such as decision trees, that can be easily integrated during the initial development of best practices. This working session introduced the community to the newly established Decision Tree Task team and engaged with the community in the use of decision trees as tools to accompany or coincide with best practices. The first hour of the session included a presentation introducing the tree task team and the review of example decision trees being actively developed by the OASIS, RVTEC, and IMOS best practices working groups. The second hour of the session included discussion on the use of decision trees as tools in best practice development.

2. Date(s) and time(s) of Session(s):

Decision Trees for Best Practices	10/13/2022	14:00
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Watkins-Brandt	Katie	Oregon State University	USA	Co-lead
Riihimaki	Laura	CIRES NOAA GML G-RAD	USA	Co-lead
van Dongen-Vogels	Virginie	AODN IMOS	Australia	Rapporteur
Hudak	Rebecca	WHOI R2R	USA	Rapporteur

4. Theme Session Meeting recording(s) available at:

<https://youtu.be/Tl8aAzGuu3M>

Presentation:

https://drive.google.com/file/d/10wQ9HqWivxHTEPvgRML8TfjFhm8NW2hA/view?usp=share_link

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1DIGCmwK-fJfISL8uwDzYRNnhkCmSeFCe?usp=share_link

6. Links to or collaborations with other Theme Sessions (*e.g., Did your session have exchanges with other Theme sessions established for this workshop?*):

While our session was mentioned during other sessions, no formal collaborations were established.

7. Recommendations from your Theme Session on needs for development of methods and best practices

Overall, the consensus was that there is a desire for and overwhelming support for the Decision Tree Task Teams plan for the development of a best practice for decision trees and templates based on purpose or application.

The Decision Trees for Best Practices session concluded with an open discussion on decision trees with highlights that included how to accurately tag, filter, and layer metadata information to easily guide the user to decision trees and subsequent best practices, establishment of a controlled vocabulary for decision trees and review of current terminology associated with decision trees, and using decision trees as a mechanism for convergence by bringing in representatives from other OBPS working groups actively developing best practices into the Task Team to develop decision trees in parallel. Again, the consensus was that decision trees in conjunction with or in parallel to best practice documents are useful and transparent tools to visualize complex processes to users who may not be experts in the topic and as useful tools that promote standardization and community adoption.

The biggest challenge for the Task Team will be membership, as participants emphasized the importance of the Task Team, several made it clear that their ability to commit was hindered by other engagements.

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*

Decision trees in conjunction with or in parallel to best practice documents would be useful and transparent tools to visualize complex processes to users who may not be experts in the topic and

as useful tools that promote standardization and community adoption.

- *What are the challenges?*

First and foremost, the current challenge is finding members to join the Decision Tree task team, many in the community alluded to over-commitment and the inability to join at this time.

- *Where are there gaps?*

NA

- *What are the success stories?*

IMOS presented the most mature decision trees developed for their application and detailed their endorsement process. This use case demonstrated not only community consensus on the importance of decision trees but also on the desire and need to implement trees to distill complex processes to the community.

- *If you have established best practices, where are they deposited?*

N/A

- *What are the recommended steps to move forward?*

The first step will be to establish the remaining task team members, reaching out to some of the other best practices working groups to solicit members (e-DNA, Marine Biodiversity, Seagrass, Ocean Decade, etc.). Additionally, following the review of current decision tree terminology, we will reach out to NERC to work toward establishing a controlled vocabulary for decision trees.

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

- *How can OBPS help your community discover existing methodological documentation?*

One of the main discussion points from our session was how to accurately tag, filter, and layer metadata information to easily guide the user to decision trees and subsequent best practices.

- *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*

Assisting in the endorsement process and once developed assist with promoting the use of decision trees to integrate or coincide with best practices would go a long way in community adoption.

- *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*

Our hope with the task team, is that we can expand the membership to ensure this is a more global effort of participation which will ultimately lead to global adoption. At current, our membership would benefit from additional international participation.

- *What additional functions can the OBPS provide to encourage the broad use and updating of any best practices your community produces?*
- *Are there existing approaches for formal community endorsement of your best practices?*

Upon the development of decision tree templates for best practices, the endorsement of such templates, by GOOS, for example, would go a long way in promoting adoption by the community.

- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*

As previously mentioned, an endorsement by GOOS through the formal process, would go a long way in promoting community adoption.

- *Are there any capacity development activities in best practices that are currently active or that you recommend?*

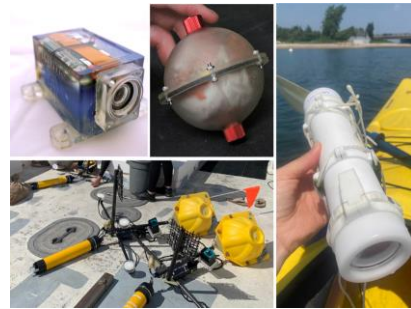
8. Future Collaborations

OBPS connected the Task Team with Virginie van Dongen-Vogels during the workshop session planning process and helped to establish collaboration and further, global representation with our group. Our hope is that OBPS may offer additional recommendations for members to join the Task Team.

Deep Ocean Observations

1. Scope of Theme Session

The session focussed on the development and implementation of low-cost ocean technology and addressed the themes of improving its accessibility and global dissemination. Our speakers encompassed representatives from academia, industry and non-profit communities, each to provide a lens through which low-cost deep-diving ocean sensors have been successfully developed. We focussed on the obstacles facing the adaptation of ocean technology and formed a discussion facing on how to enable use across a broader community of stakeholders.



2. Date(s) and time(s) of Session(s):

Technology Best Practices: Building Capacity of Deep Ocean Observing	October 13, 2022	1600-1800
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Smith	Leslie	Your Ocean Consulting	USA	Lead
Dominguez- Carrió	Carlos	University of the Azores	Portugal	Co-Lead
Phillips	Brennan	University of Rhode Island	USA	Co-Lead
de Silva	Christine	University of Rhode Island Juice Robotics	USA	Co-Lead
Sandoval	Jessica	Ocean Discovery League	USA	Co-Lead
Escobar	Elva	UNAM ICML	Mexico	Co-Lead

4. Theme Session Meeting recording(s) available at:

<https://youtu.be/X68sBwtODxo>

Presentation:

https://drive.google.com/file/d/1Bvk0U1gNbMGM1Z47nQVtk5x91PNw9Si2/view?usp=share_link

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1BLAnlIE7z9Ly9qjmtv6tFNTbxZKtPS1o?usp=share_link

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

Our session did not have exchanges with other Theme sessions.

7. Recommendations from your Theme Session on needs for development of methods and best practices

Please describe the key outcomes from your theme session:

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*
- *What are the challenges?*

Currently existing challenges to deep-sea ocean technology predominantly consist of financial, technical, and logistical barriers, creating considerable gaps in the representation of many coastal communities and countries to the larger oceanographic data set. The high costs associated with deep-sea technology are considerably prohibitive to entry into the field of deep-sea sensing and exploration. In addition to the cost of the technology, the method by which deep-sea work is conducted, for instance, by research vessel, greatly increases the cost of exploration. Successful deep-ocean exploration and research necessitates highly specialized technical knowledge, which further reduces the accessibility of deep-sea tools. The pocketed concentration of highly specialized knowledge furthers the divide of technical readiness and ability. Other challenges brought up include, reliable access to internet, lack of best practices standards, question of calibration of sensors for reliable data captured.

- *Where are there gaps?*

The predominant gap that exists for deep-ocean observations is the large lack of access to and thus knowledge regarding the deep-ocean. This gap centers on a need for increased accessibility, equity, and inclusivity towards the stakeholder communities.

- *What are the success stories?*

The speakers presented success stories for both the development of innovative low-cost technology and for its implementation and use by the community. Speaker Dr. Dominguez-Carrió presented a low-cost drift camera system that has produced a far more

comprehensive understanding of deep-sea habitats off of the coast of the Azores, in comparison with previous ROV and AUV trials. This was an example of a low-cost alternative to the current exploration technologies available, which was also published online with blueprints, to open innovation to the global community. Speaker Dr. Phillips presented a slew of low-cost sensors developed in academia to achieve deep depths. Phillips work included the use of material alternative to high-cost materials, such as titanium housings, by leveraging advances in 3D printing and resin casting to significantly reduce the cost to the fabrication of instrumentation.

eDNA

1. Scope of Theme Session

The UN Ocean Decade Project, Better Biomolecular Ocean Practices (BeBOP), is building a foundation towards better recording, transparency and findability of omics/eDNA practices which will eventually lead



users to being able to make better decisions on what is best practice. The work started in an earlier Ocean Best Practices System workshop and has been included in an OBPS Task team. During sessions this week, we evaluated our framework in the context of other efforts towards protocol harmonization and machine readability, discussed minimum necessary metadata to describe protocols, and how we might better share and evaluate eDNA field sampling programs moving forward.

2. Date(s) and time(s) of Session(s):

Harmonizing Omic Protocol Efforts for FAIR data	Oct 10th 2022	20:00
Protocol Metadata	Oct 11th 2022	20:00
Biological and Physical Challenges in the Field to Sampling eDNA	Oct 12th 2022	20:00

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Pitz	Kathleen	MBARI	USA	co-lead
Meyer	Raïssa	AWI	Germany	co-lead

Lacoursière-Roussel	Anaïs	Canada, Department of Fisheries & Oceans	Canada	co-lead
Pavloudi	Christina	George Washington University (GWU)	USA	co-lead
van de Kamp	Jodie	CSIRO / Australian Microbiome Initiative	Australia	co-lead

4. Theme Session Meeting recording(s) available at:

Recordings:

<https://drive.google.com/drive/folders/1F7R2eN3Fbg25zYxYjbVri1DBLr1ohqIg?usp=sharing>

Presentations:

https://drive.google.com/drive/folders/1TgdWceDK_sN7QZGvuybjhq1xLi3r2K0?usp=sharing

5. Location of Theme Session Meeting documents:

<https://drive.google.com/drive/u/0/folders/1XN09fVkyfEUbWEZ7pchMGHEM5SPHCK2X>

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

No

7. Recommendations from your Theme Session on needs for development of methods and best practices

Session 1

During the first eDNA session we presented the work completed since 2020 by the Omics/eDNA OBPS Task Team and the Better Biomolecular Ocean Practices (BeBOP) Project under the UN Ocean Decade. We discussed other initiatives working towards similar goals of omic methods and and protocol sharing as well as the main challenge across these efforts. Participants also identified which portions of the omic workflow they are currently most concerned with as well as gave feedback on areas of improvement for BeBOP

Session 2

In our second session we presented the draft version of MIOP, a checklist of Minimum Information about an Omic Protocol to support the findability and comparability of protocols. We had a fruitful discussion in which we

reviewed the current list of terms. Further, we discussed where additional terms may be necessary as a supplement to MIOP for different use cases or types of protocols. These additional 'packages' may be developed for each methodological category of protocols. Also, the formatting of the protocol markdown templates could be designed so that certain metadata fields can be automatically populated.

Session 3

During our third eDNA session we focused on eDNA experimental design. Many eDNA/omic studies take advantage of ongoing traditional specimen sampling/survey efforts and are constrained in temporal and spatial sampling by logistical limits. When considering starting a new eDNA study, we still lack the historical data necessary to best determine optimal sampling frequency or spatial coverage needed. In practice participants often consider the ecology of the organisms they wish to detect (e.g. seasonality of presence in system) and secondarily then consider the practicality of sampling the environment (e.g. cost, logistical challenges, effort). Overall, we discussed how eDNA reflects the presence of organisms in the environment but can be influenced by physical movement of eDNA. In the future we must consider how to adjust ecosystem surveys in order to maximize detection of organisms through eDNA molecules.

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*
 - BeBOP has established a robust framework for the open development, sharing, and evolution of omics/eDNA methods which consists of the use of collaboratively developed omics protocol templates and their use, version tracking, and sharing via our GitHub organization.
 - Through the OBPS workshop, BeBOP has reached out to members of the eDNA community from other initiatives around the globe, such as the Southern eDNA Society and the Latin America eDNA network, aimed to build synergies with these communities.
- *What are the challenges?*

- Development of Minimum Information about Omics Protocols (MIOP) requires consensus on what is considered 'minimum'
- Staying up-to-date on the most current studies showing improved methods
- Recognition that wet lab and technical differences, as well as unique region or site-specific environmental conditions, will prevent universal standardization of protocols
- Where are there gaps?
 - Currently protocols within BeBOP have focused on metabarcoding laboratory methods, there is a need for protocols describing other omics disciplines and parts of the omics workflow such as experimental design and legal aspects (particularly involving indigenous communities and tribes)
 - Further, there is still no mature and endorsed metadata specification for sharing metadata on omics protocols
- What are the success stories?
 - The BeBOP came out of the work of the OBPS omics/eDNA task team has continued its work since its first session at the OBPS workshop IV, and has created a framework that is broadly applicable across methodologies and workflows in omics, and has achieved recognition as an endorsed UN Ocean Decade Project under the Ocean Biomolecular Observing Network (OBON), linking to Ocean Practices for the Decade and other major efforts in the UN Ocean Decade and beyond
 - Initial protocols have been uploaded as working examples
 - An initial draft of the MIOP has been presented and discussed at the GSC 2022 meeting
 - Government working groups (e.g., DFO eDNA Working Group) see value in BeBOP's framework and plan to submit protocols to BeBOP's GitHub
- If you have established best practices, where are they deposited?
 - BeBOP's GitHub organization will host all protocols, including any best practices should they be identified. These will be persistently archived in Zenodo with PIDs and can be cross-archived in the OBPS system.
 - BeBOP is working towards developing best practice for recording, archiving and sharing protocols using standardized

templates and metadata towards achieving comparability and machine readability. These are collaboratively developed and hosted on BeBOP's GitHub organization.

- What are the recommended steps to move forward?
 - Increase participation and incorporation of protocols within BeBOP across a diverse range of methods/institutions
- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**
 - *How can OBPS help your community discover existing methodological documentation?*
 - Enable cross-searching between the OBPS search interface and BeBOP holdings (via ODIS/OIH)
 - *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*
 - Direct any groups dealing with eDNA/omics/biomolecular observations to BeBOP for improved coordination through OBON / Ocean Practices for the Decade
 - Endorsing/implementing omics protocol templates and metadata checklists for the dissemination of omics protocols on the OBPS
 - Dissemination of a policy brief regarding the utility and limitations of eDNA (and other omics) to policy makers and managers
 - *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*
 - More transparency on how methods were evaluated against one another in order to find the "best" one, against what criteria, for what purpose.
 - Improved interoperability with GitHub
 - *What additional functions can the OBPS provide to encourage the broad use and updating of any best practices your community produces?*
 - *Are there existing approaches for formal community endorsement of your best practices?*
 - No. Further, it's often hard to identify what makes a certain practice "the best" and under what conditions. Within some projects, efforts are made to optimize methods within some projects, however.
 - The success of GEOTRACES as a platform for developing ocean geochemical best practices may be a model for marine 'omics best

practice development and dissemination.

- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*
- Typically large projects with high visibility advocate for their methods as being the new “standard”/“best practice” - these can be marks of confidence, at least for projects with similar scope
- *Are there any capacity development activities in best practices that are currently active or that you recommend?*
- In order to determine best practices, it may require a large investment in methods comparison (such as what occurred under GEOTRACES)

8. Future Collaborations

During the workshop we connected with several other ongoing or spinning-up eDNA/omics groups which would like to use our infrastructure to share their protocols (e.g. Southern eDNA Society, EMBRC’s EMO BON network).

Our MIOP terms are being defined using a language compatible with the GSC infrastructure (MixS standard) so can be adopted in the future as a new standard check list. ODIS/OIH will also work with BeBOP to connect its protocol metadata to that of partners federated through ODIS (including the OBPS).

Environmental Plastics

1. Scope of Session

In this session we aimed to discuss how to pave the way for best practices implementation in citizen science observations of environmental plastic litter in coastal and marine ecosystems, while promoting equity, diversity and inclusion (EDI) for a wider meaningful impact. We have focused particularly on the following topics:

- Best practices for data acquisition and standardisation
- Best practices data management and open access of datasets



- How to communicate on research goals, milestones and outputs with the citizen scientists
- How to ensure that citizen science projects are inclusive and meaningful

2. Date(s) and time(s) of Session(s):

Tuesday 11 October 2023: 10.00-13.00 UTC

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Catarino	Ana	VLIZ	Belgium	Co-host
Edem	Mahu	University of Ghana	Ghana	Co-host
Krug	Lilian	POGO	Portugal	Co-host
Seeyave	Sophie	POGO	UK	Co-host

4. Theme Session Meeting recording(s) available at:

<https://youtu.be/VkRJRd7lwEc>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1ydanwRKncfUT4FL6NuyI-admeGDPI6J7?usp=share_link

○

6. Links to or collaborations with other Theme Sessions (e.g., Did

- *your session have*
- *exchanges with other Theme sessions established for this workshop?):*

7. Recommendations from your Theme Session on needs for development of methods and best practices

Citizen science has the potential to address data gap issues in assessing and quantifying plastic litter data in the environment, by using participants as “sensors”, and simultaneously increasing the public awareness towards plastic pollution. In citizen science projects, participants are included in one or more stages of the research process, and projects often lead to scientific outcomes. In this session we aimed to discuss how to pave the way for best practices implementation in citizen science observations of environmental plastic litter in coastal and marine ecosystems. Together with a group of experts from around the world, we discussed why is it a good idea to involve citizens in environmental/marine litter observations/monitoring, and how can citizens contribute to producing high quality data. We mentioned

what citizen science is not about, how it is not a clean-up activity, but rather a scientific activity aimed at data acquisition and at contributing to ocean literacy of the participants. We mentioned the benefits, e.g. access to data from a broader geographical area, contribution to education and ocean literacy, and challenges, e.g. funds, overcoming stereotypes from scientific peers, time required for communicating and adjusting procedures to the target groups, of citizen science for litter observations. The general opinion from all the experts is that citizens produce good quality data when surveying macroplastics, and meso/microplastics (larger, > 1 mm), that data is often FAIR and open access. The efforts of citizen scientists should be recognised and “honoured”, and their contribution in time and kind valorised. This effort should however always be complemented with the contribution of scientists, who can for instance do quality checks of the data, but also analyse it and promote it to the adequate stakeholders (policymakers, industries, etc). We all conclude that citizen science should be collaborative, that can be citizen driven and can welcome the public contribution at various levels, and that it can assist in improving the knowledge on plastic litter in the environment.

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving, and maturing best practices for your focus area(s)?*

Citizen science should be collaborative, that can be citizen driven and can welcome the public contribution at various levels, and that it can assist in improving the knowledge on plastic litter in the environment. Protocols should be accessible, provided in plain language to guarantee good quality data, which should be FAIR.

- *What are the challenges?*

Comparing sampling efficiency between citizens and technically trained experts.

- *Where are there gaps?*

Some activities do not have the deserved visibility, and perhaps the data is then not accessible for the right stakeholders (e.g. some geographical areas).

- *What are the success stories?*

Some successful citizen science programmes for plastic litter observations include Científicos de la Basura in Chile, Plastic Pirates

in various countries in Europe, COLLECT in west African countries and Malaysia.

- *If you have established best practices, where are they deposited?*
- *What are the recommended steps to move forward?*

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

- *How can OBPS help your community discover existing methodological documentation?*

By continuing to provide a platform where digital assets (e.g. protocols, etc) can be open access and FAIR. Also by supporting meetings between experts for plastic litter observations/monitoring.

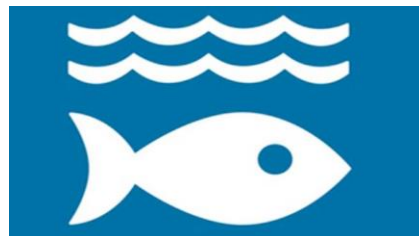
Fisheries and Aquaculture

1. Scope of Theme Session

The sessions will highlight existing best practices in Aquaculture production and Fisheries being implemented in different regions

of the globe. The development of best practices in Aquaculture and Fisheries is of the uttermost importance to promote the sustainability and competitiveness of the sectors while ensuring reliable food production in the long term. The session will stimulate sharing of knowledge between participants to exchange on existing best practices being implemented across systems and regions, contributing to develop and apply best practices that can be executed by researchers, producers and policy makers.

The session will outline examples of actions being developed and case studies that could provide opportunities for guidance and collaborative development and will conclude through an open discussion providing advice or guidelines to identify data and methodologies of interest and how these can be sustained and propagated.



Objectives & Outputs:

§ Focus on examples of how the implementation of best practices has contributed to increase production while fostering its sustainability.

§ Identify the challenges that have been encountered while developing these best practices

§ Identify key data and methodologies for data collection and management in order to develop best practices.

§ Indicate how the development of best practices can promote the development of production while ensuring environmental preservation.

§ Determine methods to motivate the community to exchange data through identified best practices in open repositories such as OBIS and what could be the benefits.

§ Facilitate the development of international policies

2. Date(s) and time(s) of Session(s):

Aquaculture	07/10/2022	07:00-09:00
Aquaculture	07/10/2022	15:00-16:30

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Courtois de Viçose	Gercende	ULPGC	Spain	Lead/Rapporteur
Pearlman	Jay	FourBridges	USA	Co-lead

4. Theme Session Meeting recording(s) available at:

https://youtu.be/HwZyk_3Cwig

5. Location of Theme Session Meeting documents:

<https://qiqochat.com/e/fnZlwHlSDQOWRrHPLLYJMvrB/breakout/11>

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

Fisheries

7. Recommendations from your Theme Session on needs for development of methods and best practices

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*
 - Harmonization of the type of data to be collected and recollection methodologies
 - Collaborations across stakeholders is key to discuss aquaculture challenges and establish solutions
- *What are the challenges?*
 - Variety of data considered in aquaculture, greatly variable between regions, species, production systems. Moreover including, scientific, social and economic data
 - Access to grey literature
 - Communicate information with various public
 - Data ownership
- *Where are there gaps?*
 - Interoperability of best practices repositories
 - Identification of the needs for best practices and standards according to species, regions and stakeholders
 - Low cost and easily accessible solutions for data collection and exchange
- *What are the success stories?*
 - Various existing repositories from projects, initiatives or institutions have been created to facilitate information about aquaculture production processes and existing protocols or global sector overview.
- *If you have established best practices, where are they deposited?*
 - *FAO, ICES, ISO*
- *What are the recommended steps to move forward?*
 - Need to implement ways to allow the exchange and integration of information between the existing repositories

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

- Identifying priority areas for aquaculture practices exchange is suggested to be a good starting point as well as overiewing

the needs for best practices and standards to be developed. Harmonization of the type of data to be collected as well as methodologies or protocols as also been suggested as key for the establishment of aquaculture best practices. Considering that various institutions, initiatives or projects have developed initiatives to provide access to aquaculture best practices or standards it has been mentioned that there is a need to implement ways allowing the exchange and integration of information between the existing repositories. Consequently, OBPS could act as a nexus to generate an overview of the existing information and bring together the existing standards and best practices repositories.

8. Future Collaborations

The workshop sessions on aquaculture allowed the sharing of experiences and practices highlighting a need for further exchange to determine the possible contribution OBPS to foster aquaculture best practices exchange. Consequently, an informal café discussion was scheduled to discuss the possible creation of a working group to establish possible strategies to facilitate the integration of information between existing repositories. This will be further discussed in a meeting scheduled to take place in November 2022.

Marine Biodiversity

1. Scope of Theme Session

This session aims to showcase and discuss best practices to sustain marine life observations in under-resourced regions of the world. Our main goal is to foster an open and diverse collaborative environment for sharing experiences and creating low-cost long-term coordinated efforts to monitor marine ecosystems. Each meeting day covered a different theme: 1) Field protocols; 2) Operational infrastructure; 3) Data management; 4) Capacity building and outreach; 5) Networking and collaboration). Participants gathered information about best practices that helps them sustain long-term monitoring of marine



biodiversity and ecosystems in their region, challenges faced when implementing and hosting these marine life observatories, and up-to-date strategies and tools that support the continuity of observations.

2. Date(s) and time(s) of Session(s):

Day 1 Field protocols	October, 12	8:00 to 10:00 a.m. 8:00 to 10:00 p.m.	<ul style="list-style-type: none"> ● Keynote Talk (30 min): Prof. Dr. Cesar Cordeiro (Universidade Estadual do Norte Fluminense) - Brazil <i>The Long-term Ecological Research of the Brazilian Oceanic Islands: a study case for field protocols</i> ● Round-discussion (45 min) ● Wrap-up (15 min)
Day 2 Operational infrastructure	October, 13	8:00 to 10:00 a.m. 8:00 to 10:00 p.m.	<ul style="list-style-type: none"> ● Keynote Talk (30 min): Dr. Rui Seabra (CIBIO-InBIO, Universidade do Porto) - Portugal <i>OceanLog - Atlantic-wide long-term collaborative temperature and biodiversity observation network</i> ● Round-discussion (45 min) ● Wrap-up (15 min)
Day 3 Data management	October, 14	8:00 to 10:00 a.m. 8:00 to 10:00 p.m.	<ul style="list-style-type: none"> ● Keynote Talk (30 min): Dr. Ana Carolina Mazzuco (Universidade Federal do Espírito Santo) Brazil, Ocean Biodiversity Information System - Brazil Node <i>On the search for applying the best data practices to sustain an under-resourced long-term marine biodiversity observatory</i> ● Round-discussion (45 min) ● Wrap-up (15 min)
Day 4 Capacity building and	October, 17	8:00 to 10:00 a.m. 8:00 to 10:00	<ul style="list-style-type: none"> ● Keynote Talk (30 min): Dr. Barbara Ramos (Universidade Federal de Alagoas) - Brazil

outreach		p.m.	<i>The Long-term Ecological Research Program Coral Coast (PELD APACC-AL)</i> <ul style="list-style-type: none"> ● Round-discussion (45 min) ● Wrap-up (15 min)
Day 5 Networking and collaboration	October, 18	8:00 to 10:00 a.m. 8:00 to 10:00 p.m.	<ul style="list-style-type: none"> ● Keynote Talk (30 min): Dr. Enrique Montes (UM/CIMAS & NOAA AOML) - USA <i>Marine Observation Network Pole to Pole of the Americas (MBON Pole to pole)</i> ● Round-discussion (45 min) ● Wrap-up (15 min)

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Mazzuco	Ana Carolina	the LTER Espírito Santo, Universidade Federal do Espírito Santo, (Brazil).	Brazil	Lead
Pinheiro	Barbara	the LTER Costa dos Corais-Alagoas, Universidade Federal de Alagoas	Brazil	Lead
Takahashi	Camila Keiko	Deep Blue Associação Ambiental	Brazil	Co-lead
Cordeiro	Cesar Augusto	The LTER Oceanic Islands, Universidade Estadual do Norte Fluminense	Brazil	Co-lead
Montes	Enrique	Cooperative Institute for Marine & Atmospheric Studies U. of Miami, NOAA Affiliate AOML	U.S.A.	Co-lead
Santi	Ioulia	European Marine Biological Resource Centre (EMBRC)	France	Co-lead (ECOP)

4. Theme Session Meeting recording(s) available at:

- (i) Marine Biodiversity - Operational Infrastructure (Session 1)
<https://youtu.be/rl-0NoXX-2k>
- (ii) Marine Biodiversity (Session 2) <https://youtu.be/jq-WRIS-MSo>
- (III) Marine Biodiversity - Data Management (Session 3)
<https://youtu.be/8sjVaOizOo4>

(iv) Marine Biodiversity - Data Management (Session 4)

<https://youtu.be/MKCZalcU6KU>

(v) Marine Biodiversity - Capacity Building and Outreach (Session 5)

<https://youtu.be/ga5K7WMsUis>

Recordings of individual presentations:

<https://drive.google.com/drive/folders/1rCYILPnvsojQnDtj2vjVrkOZDTGrdj30>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1d1_KjUDESx2A7vH5TE6LeSKGtDCtEhhC?usp=share_link

6. Links to or collaborations with other Theme Sessions (e.g., *Did your session have exchanges with other Theme sessions established for this workshop?*):

No

7. Recommendations from your Theme Session on needs for development of methods and best practices

- **Recommendations for the community**

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*

Overall, the participants identified that there is no specific documentation or collection of best practices applied to sustain long-term marine life observations in under-resourced conditions. Most knowledge relies on the experience of long-term ecological sites and monitoring programs and networks, and information is mainly shared among peers. The team highlighted the importance of raising this discussion and gathering materials in order to assist the implementation of novel observatories in the least developed areas of the world and improve the capacity of the existing ones.

- *What are the challenges? (per subject/theme)*

- 1) Field protocols:

- It may be difficult to introduce a new (maybe more efficient) method in a long-time observing site without breaking the time series, and the local staff may not agree on standards and practices.

- Protocols are not easily accessible.
- Standardization of data acquisition requires a lot of capacity building, especially for observatories that rely on citizen science.
- Some areas are remote and require to develop of new and specific sampling practices.
- Many countries lack regulations to manage marine biodiversity observations.
- Oceanographic campaigns and the best practices associated are becoming an expensive investment.

2) Operational Infrastructure:

- It is difficult to access habitats beyond coastal areas.
- Continuous and steady funding for observatory efforts is not always achieved.
- The local staff is often overloaded with work, and not always trained or high-skilled to sustain marine biodiversity monitoring.

3) Data management:

- Ensure the security of data infrastructure from the sea to the cloud.
- Issues with data ownership and accessibility principles and policies.
- Language is still a barrier to data standardization.
- Data management work overload is constantly expanding.
- Too many new systems and platforms, which may become useless with time.
- Lack of clear and easy-to-understand guidelines.
- Most scientists and observatories do not know how to do proper data management.
- Data standards can be expensive to implement.

4) Communication and outreach:

- Oceanography is considered a new discipline in many countries.
- Capacity building and outreach may not be considered a priority in some observatories
- Lack of communication experts in the program's core team
- Language and translating science to a simple narrative

- Long-term marine biodiversity monitoring and ocean literacy networks are not always aligned
- Lack of basic infrastructure to access educational materials and information (e.g., no electric power or internet)
- Some communities lack connectivity and a sense of belonging to the ocean (e.g., do not know how to swim or are scared of the ocean).

5) Networking and collaboration:

- Long-term monitoring can be subject to 'partner fatigue' .

○ *What are the success stories?*

Some examples from the session participants were pointed out as successful marine biodiversity observatories relying on very limited resources, such as the Brazilian coastal and marine LTERs and the South African Environmental Observation Network. Both cases have been able to produce high-quality data about biodiversity patterns and ecosystem functioning, provide information and indicators for managing marine habitats and species, and engage and educate the local community about the importance of marine life.

○ *If you have established best practices, where are they deposited?*

Most of the methodologies and frameworks carried out by these long-term under-resourced marine observatories are not documented as best practices specific for conditions with limited resources. Information about monitoring methodologies is often described only in scientific manuscripts and/or published in local reports.

○ *What are the recommended steps to move forward?*

The group suggested a list of the two main best practices that are adequate and highly replicated in these under-resourced regions of the ocean. Here listed by area/theme:

1) Up-to-date low-cost pathways and tools for observing marine life in coastal habitats:

- Underwater imaging and remote sensing.
- Simplified and standardized field protocols.

2) Key strategies to enhance operational capacity and develop high-skilled teams in the least-developed areas of the ocean:

- Partner and train local communities.
- Co-design and share existing infrastructure and task teams.

3) Best practices to improve data access and sharing using low-cost operational facilities:

- Cloud system and international-shared servers and data infrastructure.
- Benefit from international networks to support capacity building for biodiversity data mobilization.

4) Low-cost initiatives of communication and public outreach that effectively promote observation and conservation of marine life:

- Work with schools including both students and teachers.
- Use social media and low-cost free access audio-visual tools.

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

- *How can OBPS help your community discover existing methodological documentation?*

The participants highlighted that OBPS and associated initiatives could contribute by fostering open, diverse, and including space for networking, discussion, and information collection about the best practices specific to under-resourced marine life observatories.

- *How can the OBPS support your community in aligning related methods and, eventually, converging them into more global best practices?*

This topic was not specifically discussed by the participants, which mainly focused on addressing the practices, challenges, and solutions. However, there was a suggestion of the OBPS SG about publishing a paper about those experiences and showcasing model examples to guide similar initiatives.

- *What additional functions can the OBPS provide to support your community in evolving methods into global best practices?*

As highlighted above, keeping this discussion as a priority topic will help the community to engage and organize the content and information about the practices within those marine life observatories. The community would also benefit from having a more diverse group to share knowledge and to formalize practices in platforms that could be accessed at global scales.

- *What additional functions can the OBPS provide to encourage the broad use and updating of any best practices your community produces?*

Advertising across different ocean communities.

- Are there existing approaches for formal community endorsement of your best practices?

No

- Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?

Yes, the international LTER (long-term ecological research) programme and the Marine Biodiversity Observation Networks (MBON).

- Are there any capacity development activities in best practices that are currently active or that you recommend?

The Brazilian coastal and marine LTERs are promoting a series of annual workshops to discuss and document those practices. These events are usually held face-to-face and planned to target national systems, but could be easily replicated and applied to other regions of the world of limited development and resources.

Please list any other recommendations to emerge from your Theme Session.

We believe that addressing and developing best practices for marine biodiversity observatories in under-resourced regions of the world are meaningful and urgent. Unfortunately, these limited conditions are true for most areas of the ocean and, eventually, many observatories could eventually face a reduction of funding and operational capacity at any time. Provide specific framework would help the ocean community to adapt to limited situations as well as to amplify and sustain marine biodiversity monitoring networks regardless of the availability of abundant resources

Marine Life

1. Scope of Theme Session

The co-design of biological and ecological observing, data formatting, forecasting, and knowledge generation and sharing is fundamental to the United Nations Decade of Ocean Science for Sustainable Development (Ocean Decade). The session discussed needs, design, and use of marine conservation areas at different scales, building from local applications, to



regional strategies, to understanding what is needed for “30x30” (a call for conserving 30 percent of the world’s habitats by 2030). We developed a GOOS Co-design exemplar with an emphasis on stakeholder engagement and capacity development to advance conservation and sustainable development requirements. This seeks to assess need, design, and use of marine conservation areas at different nested geographic scales, building from local applications, to regional strategies, to understanding what is needed globally. The effort goes beyond “problematizing” and outlines activities for Ocean Decade programs for documenting requirements, collecting observations, forecasting, and assessing policy results.

2. Date(s) and time(s) of Session(s):

	11 October 2022	14:00-15:45 pm EDT
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Muller-Karger	Frank	University of S. Florida	USA	co-lead
Lang	Kaitlen	NOAA	USA	co-lead/rapporteur
Canonica	Gabrielle	NOAA IOOS	USA	co-lead
Snarez	Inana	AIRCentre/MRON	Portugal	rapporteur
Fillingham	Kathleen	UCAR	USA	rapporteur

4. Theme Session Meeting recording(s) available at:

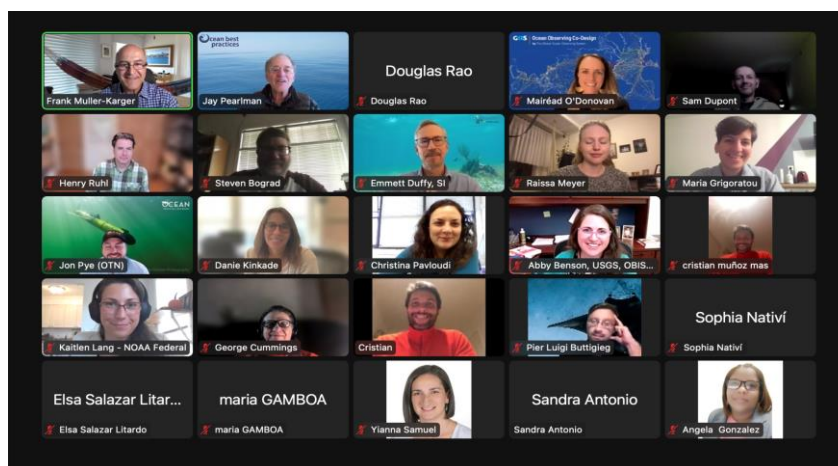
<https://youtu.be/LUZ3w-W4Hh0>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1iM0b8rolUNSOTTMk4nKQw2Gm_yBFhUvi?usp=sharing

Session Description and Notes:

<https://docs.google.com/document/d/1ydxtslkbvyfwCEFndBtZweiFzaCEpZ0nwj1qu6Cvc4E/edit?usp=sharing>



6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

No

7. Recommendations from your Theme Session on needs for development of methods and best practices

• Recommendations for the community

Use co-design as a continuous, collaborative, iterative process involving all stakeholders. Include a value chain for needed ocean observing. The co-design process provides the steps plan, working directly with local stakeholders, not for science but to understand what science may be needed if they have a serious problem to solve.

Outline the challenges in the co-design process and work on solutions:

- Resourcing
- Engaging with users and true engagement
- Moving beyond traditional measures of scientific success/output
- Understanding value on observing and solutions
- Solutions may focus on a subset of multidisciplinary Essential Ocean Variables, including some physical, biogeochemical, and biology/ecology EOVS; co-locating these multidisciplinary observations increases the value of information manyfold as it helps both explain ecological change and to improve models and forecasting.
- Sustaining collaborations and delivering solutions

- The co-design process should examine pros and cons of an activity; specifically there are many value chains for different communities, and some of them conflict. What brings value to one community can harm another. Best practices should be implemented to benefit people broadly, not narrowly, weighing benefits and losses.
- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**
 - OBPS can help the community document and share specifications of requirements and solutions that GOOS may offer.
 - OBPS may help GOOS make methods and solutions visible to decision-makers, to those running GOOS Regional Alliances, and help GOOS collect feedback
 - OBPS may help popularize co-design among different observing systems and networks, including the GOOS Regional Alliances, SOOS, national systems, etc.
 - OBPS may work with IOC to reach member countries and help them implement and sponsor local co-design approaches.
 - OBPS can help adopt time-tested methods that users in a range of places and applications have found useful.
 - OBPS can help ocean observers understand what "value chains" are and how to use them, perhaps using these value chains as models:
 - OBPS:
<https://workshop5.oceanbestpractices.org/mapping-value>
 - VALUABLES Consortium (satellite data values):
<https://www.rff.org/valuable/>
 - OBPS may continue to find methods that allow broader application of methods across the value chain and that are affordable for those with less resources
 - There needs to be more focus among modelers and forecasters on biology, living resources, and biodiversity changes. This includes links between land and ocean, and ocean areas from the coast to the interior, surface to bottom.
 - OBPS needs to facilitate discussion on co-design around the world
 - OBPS needs to facilitate inclusion, equity, diversity in working groups and programs

8. Future Collaborations

Marine life is fundamental to the well-being of communities everywhere. The Ocean Decade provides only a temporary platform to advance programs of co-design that support social and economic needs. OBPS and the Ocean Decade need to have a vision that goes beyond 2030 to ensure the positive partnerships, strategies and outcomes that we are planning today are permanently implemented around the world.

Ocean Policy and Best Practices

1. Scope of Theme Session

This session plans to examine the links between marine scientific practice on the one hand and policies on the other. Such links occur in many different ways. Scientific results can form the foundation for particular ocean policies. In turn, ocean-related policies require science to deliver on policy objectives.



The establishment of best practices is one method of improving this interaction between ocean science and policy. Best practices can function not only as standards of how to conduct particular sustainable ocean observations, but also illustrations of how to place the observations in the context of ocean policies.

The development of best practices should take into account the normative value of obligations to use best environmental practices and capabilities to achieve results, and best practices of how to bring the scientific results to policy and decision-makers. This session hopes to shed light on these issues from scientific, legal, and policy perspectives.

2. Dates and times of Session parts:

How policy deals with best practices from science	October 13th	8 – 10
How science brings its best practices to policy- & decision-makers	October 17th	Noon - 14

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

van Doorn	Erik	GEOMAR Helmholtz Centre for Ocean Research Kiel	Germany	convener
Eparkhina	Dina	EuroGOOS	Belgium	convener
Veloso	Paula F.	EuroSea	Portugal	convener
Tanhua	Toste	GEOMAR Helmholtz Centre for Ocean Research Kiel	Germany	moderator

4. Theme Session Meeting recording(s) available at:

<https://youtu.be/yRkEee2k1Jc> (13 Oct 2022)

<https://youtu.be/aUEl5u5o-00> (17 Oct 2022)

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1NIB5KJHWLgmHL-BZFm0RDExktUARYJUI?usp=share_link

SESSION 1: How policy deals with best practice from science (13 October 2022 – 10AM CEST)

1. Introduction

2. Perspectives from the experts

a. International legal framework for ocean observing & the role of international organisations - Yoshinobu Takei, Keio University, Japan

A clear distinction has to be made between the legal regime that regulates remote sensing of the ocean – air law and the law of outer space – and the one that regulates these of research vessel and other marine observing platforms – the law of the sea. Within the former, certain principles have been developed that are applicable remote sensing of the ocean in the 1980s. With the latter, Part XIII of the 1982 United Nations Convention on the Law of the Sea (LOSC) deals with marine scientific research in different maritime zones. The rules in this part are considered to be customary international law but it is not clear if that applies generally to ocean observing as well. Depending on the zone in which the ocean observing takes place, the observing needs either explicit or implicit consent from the coastal state. In general, states should promote marine scientific research. Exceptions to the rules exist as soon as the connection with the exploitation of natural resources

surfaces. Environmental impacts of ocean observing are also dealt with in the LOSC. Other international conventions contain also rules concerning ocean observing and the Argo Notification Scheme is a special example of an enabling regime. The International Maritime Organization works on the safety of navigation of unmanned vehicles.

Hydrographic surveys also need to be distinguished from marine scientific research as they are generally considered to concern the freedom of navigation. Ocean observing might sometimes fall under hydrographic surveys. More contentious is operational oceanography, which the World Meteorological Organization (WMO) and the United States, for example, consider to be outside the framework of marine scientific research but the European Union does not agree.

Within the United Nations system, its General Assembly, the Secretariat's Division for Ocean Affairs and the Law of the Sea, the WMO, UNESCO's Intergovernmental Oceanographic Commission (IOC) and the LOSC's state parties meeting deal, among others, with ocean observing. The IOC and the International Council for the Exploration of the Sea make use of the special rules for ocean observing within international organisations. Region-specific solutions might only work when participants are seriously determined.

b. Best practices for integrating results from ocean observing into policy - Iain Shepherd, European Commission, Directorate-General Maritime Affairs and Fisheries

The relationship between policy and science depends often on what the truth is. When it comes to fisheries science, the European Union spends more on the collection of data than on research. Fisheries managers do not like wide bands of uncertainty. Collection of data in general should not just be left to governments. The question remains what policymakers consider a useful dataset. It also depends on what we believe. The relationship between bottom trawling and carbon has been claimed to be both under- as well as overestimated. For blue carbon, policymakers would need more measurements and more consistency between these.

3. Discussion with participants

The complexity of ocean observing has to do with the multiple disciplines that are involved in the collection of both in situ as well as remote observations. On top of that, there are multiple numerical models as well as multiple spatiotemporal models. There exist gaps in coverage and some processes are insufficiently observed. Most observations cannot be used to their full extent and sometimes, a duplication of efforts occurs. Thus, one needs agreement on a common agenda and principles as well as clear design and implementation and robust governance.

Part XIII of the LOSC is incompatible with the operational reality of ocean observing. For instance, advance notice is incompatible with sustained ocean observing for some platforms because it is difficult to plan far ahead. Participants of a workshop at the IOC in February 2020 dealt with ocean observing within national jurisdiction and developed solution spaces. Significantly, ocean observing is legally not always marine scientific research. States have developed a practice over the last four decades that marine meteorological data does not fall under Part XIII of the LOSC. Hurricanes need to be forecasted to save human lives. The measurement of Essential Climate Variables of the Global Ocean Observing System might also save lives.

People who conduct citizen science would fall under the legislation of the coastal state or the flag state. The phenomenon does however tie in with the fact that Part XIII of the LOSC is incompatible with the operational reality. The International Hydrographic Organization deals with crowd-sourced bathymetry.

SESSION 2: How science brings its best practice to the policy & decision-makers (17 October – 2PM CEST)

1. Introduction

2. Perspectives from the experts

- a. **Best practices within the Intergovernmental Panel on Climate Change** - Hans-Otto Pörtner, Alfred Wegener Institute for Polar and Marine Research, Germany

The sixth cycle of the Intergovernmental Panel on Climate Change (IPCC) has been the most difficult but also the most successful. The management challenges are large: Special Reports have about 120

authors and reports from the working groups around 300. They contain respectively a thousand and 3,000 pages. Yet policymakers do take them into account. The increasing co-operation with the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services helps in this regard. There is however no feedback from the policymakers on the output of the IPCC, including the summary for policymakers. Although the 2015 Paris Agreement has helped enormously with the agenda setting, there are still gaps in implementation. Yet now, there are media centres on every continent. The reports from the IPCC working groups have generally taken over other UN news but it is still difficult to measure its success. The key might however be the interplay between the 1992 United Nations Framework Convention on Climate Change, including through its Conferences of the Parties, and the IPCC. The legal development is important. The IPCC's message is supposed to be policy-neutral and the Panel should not join the activist arena. But scientists are also citizens and might get impatient. That is when one starts to use stronger words. It is already late to take action.

- b. **EuroSea experience in co-developing oceanographic services: towards global best practices for ocean prediction** – Enrique Alvarez, Mercator Ocean International, France

This project deals with monitoring occurring now in one port in Italy, Spain as well as in Colombia. All information is available on websites, based on the instrumentation. This real-time monitoring is extremely useful in managing ports, for example in the case of an oil spill. The first thing that managers now do in the morning is checking the website with new data. Yet there is no easy and robust method to do this right from the start; it is not optimal. There is a need for specialists. The plan is to go from the oceans forecasts we have to the ocean forecasts we want. There are still gaps but there are also opportunities as the digital twin of the ocean and the United Nations Decade of Ocean Science for Sustainable Development, for instance CoastPredict. This will all help to work towards a solution, where a crucial pillar is the community.

- c. **EuroSea experience in co-developing aquaculture monitoring tools with industry** - Inger Graves, Xylem, Norway

Xylem supports the aquaculture industry in two places, one in Spain and one in Ireland, through the deployment of buoys that measure core variables, such as temperature and salinity but also waves. It is crucial to establish what the critical problems for the industry are. There is a constant dialogue about this. Jellyfish were a problem, for instance. The first step in the process is to get real-time data to the website. Step two is then to get these data to Copernicus. The participants say what they need and what not. There is also a dashboard available because different users have different needs. Although there is thus obvious stakeholder involvement, there is no direct interaction with policy. Industry has more the role of an enabler. Industry deals with intermediate problems whereas science deals with the long term. Monitoring occurs in order to improve the welfare of the fish.

d. What ocean best practices can learn from private sector regulation of standards & certification – Alexander Turra, University of São Paulo, Brazil

Operation Clean Sweep (OCS) is a global process with some Brazilian aspects. In the plastic-producing industry, there is much loss of pellets. They enter the environment and eventually also the ocean. In Santos Bay, close to Sao Paulo, pellets have been found up to two metres deep in the sediment. OCS has no additional costs for companies; costs are internalised by the plastic sector. There is much interaction with stakeholders. In Brazil, there exists an audited, transparent and certified programme. There is no incentive for greenwashing and best practices are formulated. Measures can be simple and inexpensive. There exists a five-step plan for the Zero Pellet programme of OCS. It might take up to two years to get from the first to the last step.

3. Discussion with the session participants

A lead author of an IPCC report needs to allocate about one-fifth of her or his time to that. For a co-chair of a working group, that is about half her or his time. Yet one does get publications out of the IPCC work, possibly also in better journals.

Within the IPCC, there is a complex, multi-perspective view of best practices. There are best practices in communication but communication in general requires talent. Best practices also involve calibration. Companies

do give input to Ocean Best Practices. Best practices are never ending, ever evolving processes. This can lead to harmonisation. There exists best practices for citizen science.

Operational Forecasting

1. Scope of Theme Session

Operational ocean forecasting systems combine models and observations to forecast the ocean state. Predictions may be at local, regional or global scale, and for physics, biogeochemistry, ice or waves. Systems should provide reliable and accurate information, allowing end users to make decisions for societal and/or economic benefit. Best practices can help with sharing expertise, providing information and confidence to users, and better integration with the observing community and other members of the operational value chain. This session welcomes contributions on all aspects of best practices for ocean forecasting, and has two goals in particular. Firstly, to ensure that best practices fully account for the needs of local communities around the world, particularly those who do not yet have access to reliable ocean predictions, but who could potentially benefit the most from them. Secondly, to inform the definition of best practices on ocean forecasting system reporting. This includes permitting comparison of ocean forecasting systems as well as presentation of this information to users and stakeholders.



2. Date(s) and time(s) of Session(s):

Operational Forecasting 1	13 October 2022	11:00 – 13:00	https://docs.google.com/document/d/1YV3CrLDhWDi-OANqY6Izb-cDrrgSDzD2/edit
Operational Forecasting 2	14 October 2022	11:00 – 13:00	https://docs.google.com/document/d/1YV3CrLDhWDi-OANqY6Izb-cDrrgSDzD2/edit

		cDrrgSDzD2/edit
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Ford	David	Met Office	UK	Lead
Davidson	Fraser	Canada; Fisheries and Oceans Canada	Canada	Co-lead
Folorunsho	Regina	Nigerian Institute for Oceanography and Marine Research	Nigeria	Co-lead

4. Theme Session Meeting recording(s) available at:

https://youtu.be/fl_IPh8jIC4 (13 Oct 2022)

<https://youtu.be/e7h-EzcBpCU> (14 Oct 2022)

5. Location of Theme Session Meeting documents:

Session description and schedule:

<https://docs.google.com/document/d/1YV3CrLDhWDi-OANqY6Izb-cDrrgSDzD2/edit>

Presentations:

https://drive.google.com/drive/folders/1Djo4jldTbjCRNVI2pN0yihV0hQe8Yyb_h

6. links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

None made at this workshop, but links could be made with e.g.
Capacity Development and Best Practices in the Ocean Decade

7. Recommendations from your Theme Session on needs for development of methods and best practices

● Recommendations for the community

- *What steps have been defined for adapting, creating, evolving and maturing best practices for your focus area(s)?*

- OceanPredict to evolve system reporting, in conversation with OceanPrediction Decade Collaborative Center (DCC), ETOOFS, OBPS, and others
- Operationalisation of OceanPredict Class 4 intercomparison

- Investigate the integration of ocean information within WMO Cascading Forecasting System
- Creation of Operational Readiness Level defined by DCC in collaboration with ETOOFS and OceanPredict
- What are the challenges?
 - Resources!
 - Ensuring services are useful to end users and provided in a way they can access and trust
- Where are there gaps?
 - Formal Best Practices across the operational value chain
 - Consistently providing useful information to local communities
 - Joining up existing initiatives (e.g. OceanPredict, Copernicus Marine Service, WMO, GMES & Africa)
- *What are the success stories?*
 - Copernicus Marine Service
 - Provision of warnings under GMES & Africa
 - WMO Cascading Forecasting System is a success story for weather forecasting which can be built on for ocean forecasting
 - Efficiently downscaling global forecasts for use in South African waters
- *If you have established best practices, where are they deposited?*
 - Not yet!
- *What are the recommended steps to move forward?*
 - DCC has kick-off meeting in January, and work should build from there
 - OceanPredict Operational Systems Working Group to lead on development of Best Practices, starting with system reporting
 - Workshop participants to stay in touch and build collaborations
- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**
 - OBPS should be involved in conversations with relevant groups
- *Are there existing approaches for formal community*

endorsement of your best practices?

- These are being developed, but ETOOFS has led on initiatives such as
https://www.goosocean.org/index.php?option=com_ocean&task=viewDocumentRecord&docID=30656
- *Are there any groups within your community whose endorsement of a method/standard/etc would inspire confidence/trust across the community? Why?*
 - ETOOFS – the relevant Expert Team
 - Copernicus Marine Service – coordinate a lot of ocean forecasting activities in Europe, with data used around the world
 - OceanPredict – major collaboration between ocean forecasting centres
 - DCC – still spinning up, but should coordinate activity under the Ocean Decade
- *Are there any capacity development activities in best practices that are currently active or that you recommend?*
 - Work under GMES & Africa, and WMO

8. Future Collaborations

Build on collaboration between relevant groups, including OBPS, OceanPredict, ETOOFS, DCC, WMO, GMES & Africa, individual agencies

Organizational Cooperation

Organizational best practices to foster cooperation between disciplines, institutions, platforms and networks



1. Scope of Theme Session

The integration of multi-platform in-situ and remote observations with numerical models is one key challenge today in ocean science, given the well-established, platform-driven ocean observing networks and forecasting systems. Despite significant advances over the last two decades in more cooperation across the ocean observing activities, the ocean observing system still suffers from organizational silos due to independent and often disconnected initiatives, and the absence of a well-established overall governance framework. The goal of this session is to share initial advances and receive feedback from the community on the possible ways to generate systemic and behavioral transformation and create the enabling conditions for the ocean observing system to become more federated.

2. Date(s) and time(s) of Session(s):

Session 1	13/10/22	09:00 - 11:00 UTC
Session 2	13/10/22	15:00 - 17:00 UTC

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Révelard	Adèle	SOCIB	Spain	Lead
Cocquempot	Lucie	Ifremer	France	Co-lead

4. Theme Session Meeting recording(s) available at:

- (i) Organisational Cooperation (Session 1)
<https://youtu.be/LR1Lm54OFJ0>
- (ii) Organisational Cooperation (Session 2a)
<https://youtu.be/4yjjejnMoS4>
- (iii) Organisational Cooperation (Session 2b)
<https://youtu.be/BsXlyLOrMkw>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/u/0/folders/1gk_fj_eo315sm5Zqeacfc5uwS2SpOSE1

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6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

None

7. Recommendations from your Theme Session on needs for development of methods and best practices

The session began with the presentation by Adèle Révelard (SOCIB) on her initial advances and findings from the EuroSea project on the possible ways to create the enabling conditions for the ocean observing system at large to become more transdisciplinary and federated. Adèle proposed to take inspiration from the Collective Impact Organization model, which encompasses both top-down planning and alignment with community-based learning and engagement. The proposed actions implied innovative actions at the governance, funding and management levels in order to generate systemic and behavioral changes.

The second talk was given by Lucie Cocquempot (Ifremer), who shared her initial reflections on how to improve coordination between ocean observing activities at the institutional level, taking Ifremer as a case study. It was interesting to see that very similar challenges and issues occur at the institutional, national, regional and international levels, and that similar findings are reached. At the institutional level, Lucie also came to the conclusion that both top-down and bottom-up approaches should be simultaneously in place in order to take the benefit of both of them.

The following open discussion with participants highlighted the following conclusions:

- A hybrid management model, encompassing both top-down and community-based management approaches, would be needed in order to foster cooperation and collaboration within the ocean observing system at large and within institutions
- Need for cultural change in order to make our organization more agile and less afraid of change
- The lack of strong leadership was perceived as one of the principal difficulties for implementing a collective impact approach
- Training researchers in management, ethics, and coordination skills is crucial
- A new culture should be adopted where it is ok to fail
- There is a strong need to change the way we assess success and careers
- The reform of the research assessment system might help to move towards a more “integrative culture”, but this will not be sufficient

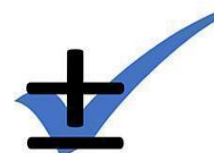
- A fully integrated ocean observing system should be data centric, rather than policy centric
- We need to develop new tools and indicators to measure the added-value of collaboration

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

OBPS, because of its transversal nature, is an ideal network to discuss and advance on the possible ways to move towards a more integrated ocean observing system.

QC of Chemical Ocean Profiles

Towards reproducible community-adopted QC best practices for chemical EOVs



1. Scope of Theme Session

The scope of these theme session was to get to know which are the most important QC test that the community should run for chemical variables in order to build global standard procedures that could be formally documented thorough a best-practices guide. In order to do this, during the session, we analysed the different metrics applied for QC testing of chemical data in different global databases (i.e, GLODAP and WOD), presenting online-available tools for QC (i.e., AtlantOS) and evaluated the difference between the results obtained in chemical variables from the different databases.

2. Date(s) and time(s) of Session(s):

QC of Chemical Ocean Profile Data	13/10/2022	14:00 – 15:30	The time of the session was extended half an hour (until ~ 16:00 UTC) to allow for a more in-depth debate.
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Garcia	Hernan	NOAA	USA	lead
Baldry	Kimberlee	AusSeabed / IMAS-UTAS	Australia	co-lead
Pardo	Paula C.	IIM-CSIC	Spain	co-lead ECOP

4. Theme Session Meeting recording(s) available at:

No recordings available for this session.

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1-mPWlseiE-3D-p3uZT6jqQKeeJ5wfgWP?usp=share_link

List of Speakers:

Baldry	Kimberlee	AusSeabed / IMAS-UTAS	Australia
Lange	Nico	GEOMAR	Germany
Velo	Anton	IIM-CSIC	Spain
Garcia	Hernan	NOAA	US
Boyer	Tim	NOAA	US

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

It didn't.

7. Recommendations from your Theme Session on needs for development of methods and best practices

- **Recommendations for the community**
 - Report uncertainty in all data created by the international community.
 - Need for a common agreement on what precision, accuracy and uncertainty mean.
 - Carefully consider which data are “real” when running global QC tests.
 - Avoid QC tests that distort the natural variability of data.
 - Need for establishing minimum QC tests on chemical data.
 - Moving forward means to create a best-practices guide on chemical variables, or, at least, for one chemical EOVS such as oxygen.

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**
 - Recommending contribution to the creation of best-practices guide.
 - Support on the publication of best-practices guide for oxygen measurements.

8. Future Collaborations

During the debate, Dr. Hernan Garcia proposed to create a best-practices document for oxygen measurements. Participants were recommended to spread the message and contact Dr. Garcia or any of the session conveners in order to proceed with this future publication.

Seagrass Monitoring

Best Practices in Seagrass Monitoring:
Towards Global and Long-term Monitoring
System



1. Scope of Theme Session

The session covered the three main topics regarding seagrass monitoring by three distinguished speakers. Dr Masahiro Nakaoka briefly introduced the general seagrass ecosystem which covers their ecosystem services and value, their threats and ends with the emphasis of developing good practices for monitoring, research, and conversation management forming the ideal triangle of ecosystem management. Our second speaker, Dr Anchana Prathap, focuses her talk on monitoring and assessment of blue carbon in the seagrass system. Her examples of work done in Thailand on seagrass biomass, diversity, and carbon in sediment set a good example on how simple tools can be used to monitor carbon storage within the seagrass system. Lastly, Dr Miguel Fortes introduced and shared his examples of setting up community practices as a best approach to seagrass monitoring. He brought up the important issues of having good values such as respect, mutual understanding, participatory and localized approach towards sustaining a good monitoring. A discussion was done at the end of the workshop with recommendations given.

2. Date(s) and time(s) of Session(s):

Seagrass Monitoring	7th October 2022	0100 am UTC
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3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Woo	Abe	CEMACS, USM	Malaysia	Lead
Tan	Aileen	CEMACS, USM	Malaysia	Co-lead
Pratthep	Anchana	Prince of Songkla University	Thailand	Co-lead
Fortes	Miguel	University of the Philippines	Philippines	Co-lead
Jaya-Ram	Annette	CEMACS, USM	Malaysia	Technical

Workshop goal:

This workshop aspires to introduce protocols for seagrass monitoring that have been adopted in seagrass areas across different countries. The protocol aims to be part of the ocean best practices system to establish a standardized and comparable data of biodiversity, patterns and changes to the seagrass area over a wide area of the global coasts. The protocol should be simple and easy to be adopted by both researchers and citizen scientists to create a long-term monitoring of the coastal areas. In addition, to biodiversity monitoring, additional best practices on blue carbon measurement will also be shared during the workshop to estimate the total blue carbon storage in the seagrass area. These best practices will be able to deliver comparable data and global pattern changes of biodiversity and carbon storage in the seagrass area for stakeholders, policy makers and public to make informed decision making for successful management and sustainability of coastal areas. The framework will also provide researchers with up-to-date and long-term data to accelerate research and predictions on changes of the coastal ecosystem.

4. Theme Session Meeting recording(s) available at:

https://youtu.be/Mieft_qIzDg

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1NwfptqZC7lwnbZM3_M0VrfhpDEJsT40t?usp=share_link

6. Links to or collaborations with other Theme Sessions (e.g., Did your session have exchanges with other Theme sessions established for this workshop?):

None

7. Recommendations from your Theme Session on needs for development of methods and best practices

- **Recommendations for the community**

In order to establish best practices for seagrass monitoring across the region and globe requires extensive communication and workshops attended by experts and more important the younger researchers for capacity building and consensus. The current methods and practices for seagrass monitoring needs to be co-designed taking account of many more stakeholders apart from academics. And also, the continuity and sustainability of the existing monitoring network only lasts for a short period with constant changes of methods led by different parties. Apart from these challenges, the current monitoring system lacks standardization, organization and database for data storage as well as connecting the science of seagrass monitoring to actual workable policy. Two network have been quite successful being the recognized seagrass monitoring standards thus far namely: SeagrassNET (<https://www.seagrassnet.org/>) and Coordinated Global Research Assessment of Seagrass System (C-GRASS) (<https://scor-int.org/group/158/>). Newer monitoring system in seagrass ecosystem is the Coastal Blue Carbon assessment methodology established by IUCN (<https://www.iucn.org/content/coastal-blue-carbon-manual>). The workshop recommends strengthening the engagement of existing networks and revitalizing the connection after years of neglect. A new branch of seagrass monitoring network should include blue carbon assessment as it is one of the most important topics revolving around seagrass currently.

- **Recommendations for the IOC's Ocean Best Practice System (OBPS)**

Existing networks and methods may differ slightly making data incomparable sometimes from different localities. Parameters collected also suffer great inconsistencies due to disparities of equipment capabilities and experts in different countries. OBPS would be a great platform to unify these different methods and networks to create global best practices for seagrass and blue carbon monitoring. A continued capacity building among young researchers in seagrass monitoring is

lacking and needed to establish sustainable monitoring system

8. Future Collaborations

Establishing of Blue Carbon Assessment and Monitoring in seagrass ecosystem starting from southeast asia and expanding them into a global network with appropriate best practices both in scientific methodology and best practices working with the community and other stakeholders.

Time Series Observations

Link to meeting recording:

https://youtu.be/WHfRzP_QYxM

Link to chat:

<https://drive.google.com/file/d/1XYSdPBRojaoXgzbB3vvxoX4GPIvHzyPA/view?usp=sharing>



2. Date and Time (UTC): 1300-1500 GMT (9:00-11:00 Eastern)

Topic: FAIR Data solutions that span marine ecosystem observing networks

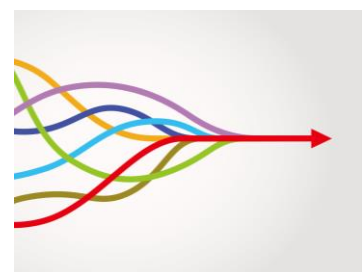
Transparency and Traceability

Linking Best Practices with Standards

– approaches and needs

1. Scope of Theme Session

Lead: Johannes Karstensen



Best practices are designed to reconcile the achievement of practical goals, within resource limitations, to bring about the best possible outcomes in a defined scenario.

In close complement, **Standards** are designed to ensure comparability, metrological consistency (reproducibility + traceability + uncertainty evaluations), and support interoperability and data exchange.

Standards interact with best practices (as well as other methods) in a variety of ways, but typically through calibration of equipment or, secondarily, through validation of outcomes.

When methods are developed and performed with reference to standards - be they reference materials, common vocabularies, or data specifications - a methodological process of high rigor and transferability is formed, which is a cornerstone of any robust best practice.

In this session, participants will discuss how to increase the synergies between standards and methods.

- What are the opportunities to use (C)RM or ISO guides in marine BPs?
- Do we have an overview about current use of Standards (e.g. ISO, CRM) in marine science?
- How can the exchange between marine BP creators and Metrology be improved?
- How can the standards organizations draft practices, which are similar to ocean best practices be merged into the OBPS processes?

The session format included keynote presentations to introduce the session Topics and inspiring discussions among all session participants. Next steps to move the synergy between BP and Standards forward will be identified.

2. Date(s) and time(s) of Session(s):

Linking Best Practices with Standards	11. October	12:00-15:00
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Agenda

12:00 UTC Introduction (J. Karstensen, OBPS & GEOMAR)

12:05 UTC The Metrology & Standards context

- Regina A Easley (MIST, US) Notes about reference material in an metrology context
- Piotr Zaborowski (OGC, US) - Between innovations, standards and operations; OGC practices and initiatives

12:40 UTC Secondary Standard

- Maribel García-Ibáñez (CSIC, Spain & IOCCP) - Search for a global solution for (C)RM availability for measurements of the marine inorganic carbon system
- Tobias Steinhoff (ICOS, Norway/EU) - The global shortage of carbon (C)RM during the Pandemic and how the European Greenhouse Gas Infrastructure ICOS-OTC addressed it

13:15-13:35 Break

13:35 UTC Creating a “Standard & BP framework” in Projects & Organizations

- Rajesh Nair (OGS, Italy), Jaume Piera (CSIC, Spain) Supporting the linking of standards and best practices in marine measurement in Europe: the MINKE initiative
- Iwao Ueki (JAMSTEC, Japan) - Japanese activities for making guidelines for oceanographic observations and development of CRMs for nutrients

14:15 UTC Open discussion + room for flash presentations

15:00 End of session

3. Lead, Co-leads, Rapporteur(s) Present at Session(s)

Nair	Rajesh	OGS	IT	Presenter
McDonagh	Elaine		NO	
Petihakis	George		GR	
Waldmann	Christoph		DE	
Karstensen	Johannes		DE	
Steinhoff	Tobias		DE	Presenter
Pearlman	Jay		US	
Ueki	Iwao	JAMSTEC	JP	Presenter
García-Ibáñez	Maribel	ICM-CSIC and IOCCP	ES	Presenter
Zaborowski	Piotr	OGC	PL/BE	Presenter

4. Theme Session Meeting recording(s) available at:

<https://youtu.be/FsHqSC6cpjM>

5. Location of Theme Session Meeting documents:

https://drive.google.com/drive/folders/1YagMLRN-9A6ThPklzfebOuuEiRZ_QKbK?usp=share_link

6. Links to or collaborations with other Theme Sessions (e.g., *Did your session have exchanges with other Theme sessions established for this workshop?*):

No

7. Recommendations from your Theme Session on needs for development of methods and best practices

The session "Standards and Best Practices" attracted about 25 participants from Asian, Europe and the Americas. Regina Easley (MIST) and Piotr Zaborowski (OGC) introduced the Metrology & Standards aspects for the session. In a second block, Maribel García-Ibáñez (CSIC & IOCCP) and Tobias Steinhoff (GEOMAR & ICOS) reported about the approaches taken ad-hoc during the pandemic to develop reference material (RM) for carbon observations. The shortcoming in RM prompted for action which now leads to the establishment of three global hubs that then produce comparable RM and thus significantly save costs and time and promote sustainability. Also, this approach may be used as a Blue print for other RM's (e.g. nutrients). The final two presentations were by Rajesh Nair (OGS) and Iwao Ueki (JAMSTEC) on projects (MINKE) and organisational (Oceanographic Society of Japan) approaches to create a framework for making extensive use of Standards and Best Practices. In the following discussion session, the themes were around the needs to improve and fund a standardization framework for ocean observations e.g. via a stronger link within nations ocean observing and metrological agencies. The increasing need to serve national targets and actions into global assessment (e.g. SDG's, carbon and GHG national action plans within the Paris Agreement) require trustworthy information that are only achievable via application of global RM and following global Best Practices. Finally, the need for equitable access to reference material was emphasized, again with reference to the UN Decade, the SDGs and the national climate action plans.

- **Recommendations for the community:** see text above
 - **Recommendations for the IOC's Ocean Best Practice System (OBPS)** see text above
-

3. PLENARY 2 (a and b) 19 October 2022

In the final Plenary, the participants focused on the workshop goals: to guide the development of best practices and operating practices, to promote their documentation, and to share them widely using the Ocean Best Practices System. Some groups are more advanced in this process than others.

In both Plenary 2a and 2b, a poll requested participants to identify words/phrases representing their priorities and recommendations to OBPS for next steps. The Word Clouds below reflect the similarities in both.

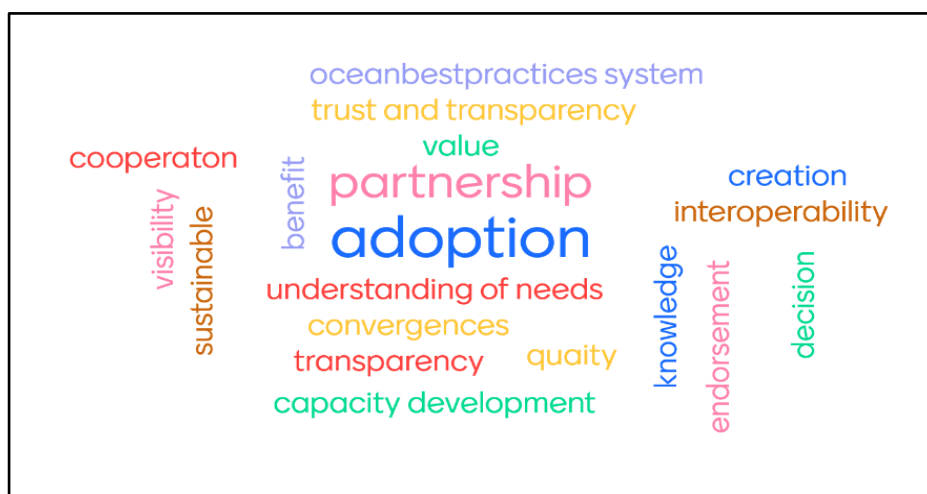


Figure 3: Plenary 2a Word cloud

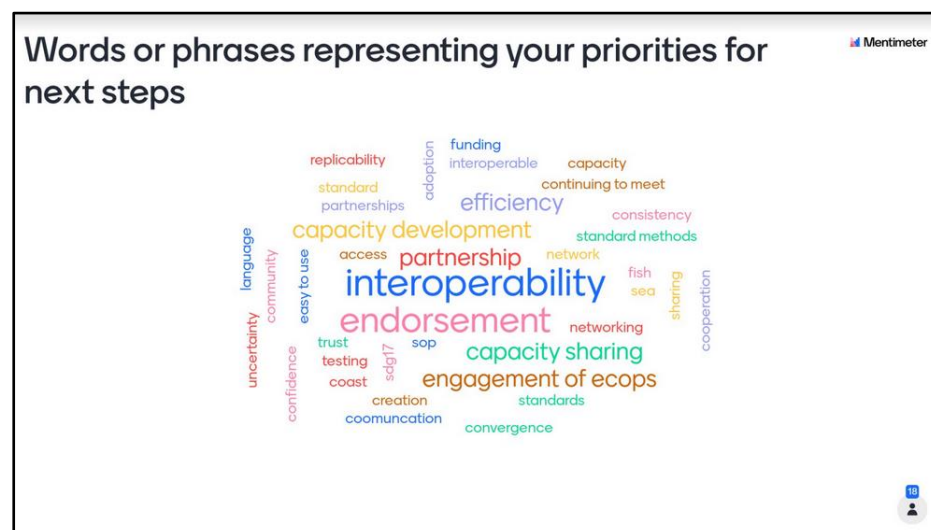


Figure 4: Plenary 2b Word cloud

OBPS Workshop VI Summary: Key recommendations, common outcomes, and lessons learned **Paul Van Ruth**

The workshop provided an opportunity for interested stakeholders to discuss best practices in the marine environment, with a goal of developing a framework/method for establishing best practices in ocean observing, and for gaining endorsement for the practices from the community. There was wide recognition of the benefits of establishing and using best practices, including:

- They promote efficient and effective operations
- They improve system interoperability
- They improve data comparability, which increases accessibility and ease of use
- They provide certainty, which may promote sensor/hardware development
- They build trust, leading to higher funding success and streamlined regulatory approval
- They enable new people to engage in marine observing with a high probability of collecting useful data

Theme sessions provided focused forums to explore opportunities to advance the development of best practices. Through these forums a common ambition emerged to move toward global procedures and standards that can be formally documented through best practices guides. There were several key recommendations:

- Best practices should be implemented for broad benefit, considering the value chain for the required observations and weighing benefits and losses
- Best practices should be developed using co-design as a continuous, collaborative, iterative process involving all stakeholders
- Best practices should be standardised at necessary temporal and spatial scales
- A single best practice rarely is applicable globally and may need to be adapted locally to infrastructure availability and societal needs
- Decision trees should be used in conjunction with best practices
- Best practices should be accessible and provided in plain language to promote good quality data which should be FAIR
- The capabilities and practices of existing initiatives/programs provide valuable starting points for best practices
- Operational needs in modelling and forecasting should be considered in developing best practices - we need better, more collaborative links between industry, science, management and operations

Theme sessions also provided opportunities to consider how to best use the OBPS to encourage wider distribution and use of these standardised protocols. Key recommendations from these discussions include:

- Ensure long-term stewardship of best practices after groups that develop them dissolve
- Help networks of communities link and develop strategies for interoperability
- Work on approaches to accurately tag, filter, and layer metadata information to easily guide users
- Continue to provide a platform where digital assets such as protocols can be open access and following FAIR principles, and provide guidance on the possible endorsement processes available to the community
- Promote Community-Based Monitoring (CBM) and Citizen Science (CS)

All groups engaged in conversation on formal endorsement of a particular practice. Some groups have strategies implemented for endorsement to ensure interoperability and trust. These examples were an important element of the workshop and serve as role models for other groups interested in promoting such standardisation.

Another discussion involved the desire to provide support in different languages to facilitate local engagement with OBPS and adoption of best practices. Many different sectors of stakeholders, in operations, research, management, industry, and indeed, the general public, want sets of standard operating practices that have been vetted, endorsed, and made widely available for use. OBPS can help by bringing best practices and standards into a harmonised format that serves everyone. The key lesson provided through OBPS Workshop VI is that best practice protocols should service communities in different countries, and be simple and easy to be adopted by all ocean stakeholders.

Annex 1: Participants



Figure 5: Some of the 600 active participants

There were 587 participants attending the two weeks of the workshop. These represented academic, government, operational agency, non-governmental and citizen or civil organizations.

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Abdulfatai	Mujeeb Akanbi		Germany
Abdullah	Nursyahida	Universiti Malaysia Sarawak	Malaysia
AbouElmaaty	Esraa		Egypt
Abu-Libda	Osame		Jordan
Acharya	Raja	India Meteorological Department	India
Achour	Issam	UNEP/MAP : SPA/RAC	Tunisia
Adeaga	Olusegun	University of Lagos	Nigeria
Adeoye	Olusola	Nature Cares Resource Centre	Nigeria
Afolabi	Lateef Adesola	University of Cape Coast	Ghana
Agbo Tettey Soli	Michael	University of Ghana	Ghana
Ait Ahmed Ouhamou	Mohammed	General Directorate of Meteorology	Morocco
Akande	Samuel	Federal University of Technology Akure	Nigeria
Akpan	Anthony	NGO PAVE	Nigeria

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Alam	Wahidul	University of Chittagong	Bangladesh
Alassane	Dia	Association rim océan	Mauritania
Alaton	Veronique	Action-Ocean	France
Alayon	Stephen	West Visayas State University	Phillipines
Allen	Rohan	DEFRA	United Kingdom
Almaktary	Shaker	local Administration, Yemeni Islands sector	Yemen
Almeida	Sara	Instituto Hidrográfico	Portugal
Anderson	Nathann	NOAA	United States of America
Ando	Kentaro	JAMSTEC	Japan
Annasawmy	Pavanee	UBO	France
Antonio	Sandra	National Autonomous University of Mexico	Mexico
Anuar	Saiqah	Universiti Malaysia Terengganu	Malaysia
Arbic	Brian	University of Michigan	United States of America
Arifin	Zainal	National Research and Innovation Agency, RC for Oceanography	Indonesia
Arteaga Bengoa	Jose Luis Raul	Advanced Conservation Strategies	Peru
Ashton	Gail	Smithsonian Environmental Research Center	United States of America
Assemian	Clement	Centre de Recherches Océanologiques d'Abidjan	Cote D'ivoire
Astorch-Cardona	Aina	MIO	France
Atkinson	Rob	OGC	Australia
Atuga	Gilbert	Kenya Marine and Fisheries Research Institute	Kenya
Avakova	Mariam		United States of America
Ayliffe	James	National Oceanography Centre	United Kingdom
Ayuningtiyas	Widya	BMKG	Indonesia
Azani	Audia	Indonesian Agency of Meteorology Climatology and Geophysics	Indonesia
Azeroual			Morocco
Azevedo Correia de Souza	Joao	MetOcean Solutions, a division of Meteorological Service of New Zealand	New Zealand
Babayan	Tatevik	American University in Armenia	United States of America
Balakrishnan	Kesavakumar	National Institute of Ocean Technology	United States of America
Balcorta	Cacilia	Universidad del Mar	Mexico
Baldry	Kimerlee	Geoscience	Australia
Bangladesh?	Bangabandhu	Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh	Bangladesh

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Barahona	Martha	Instituto Oceanografico y Antartico de la Armada-INOCAR del Ecuador	Ecuador
Bastianini	Mauro	CNR ISMAR	United States of America
Bate	Garba	Federal University Dutse	Nigeria
Bates	Tim	NOAA	United States of America
Bayler	Eric	NOAA/NESDIS/STAR	United States of America
Beja	Joana	VLIZ	Belgium
Belgacem	Malek		Italy
Bellabad	Fahima	Enssmal	Algeria
Belton	Christina		United States of America
Benedetti	Lisa		United States of America
Benson	Abby	OBIS, GBIF	United States of America
Benway	Heather	Woods Hole Oceanographic Institution	United States of America
Bergamo	Gabriela		Brazil
Berghoff	Carla	INIDEP	Argentina
Berre	Arne	SINTEF Digital	Norway
Bessa	Filipa	University of Coimbra - MARE	Portugal
Biddle	Matt	NOAA	United States of America
Bidlot	Jean	ECMWF	United Kingdom
Blomquist	Byron	NOAA	United States of America
Boamah	Samuel	Hohai University	Ghana
Bograd	Steven		United States of America
Bonnet Dunbar	Martha	Instituto de Ciencias Marinas de Andalucía (ICMAN-CSIC)	Spain
Bonou	Frederic	IRHOB	Benin
Bordon	Isabella		United States of America
Bornman	Thomas	South African Environmental Observation Network	South Africa
Boss	Emmanuel	University of Maine	United States of America
Bourma	Evi	Hellenic Centre for Marine Research	Greece
Bouthir	FZ		Morocco
Bowers	Holly	NOAA	United States of America
Boyer	Tim	NOAA National Centers for Environmental Information	United States of America
Britz	Peter		Netherlands
Broekhuijsen	Jeroen	TNO	Netherlands
Brønner	Ute	SINTEF Ocean	Norway
Brown	Shannon	UW CICOES/NOAA PMEL	United States of America

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Buck	Justin	National Oceanography Centre (NOC), British Oceanographic Data Centre (BODC)	United Kingdom
Buckenmeyer	Ariane	Swedish Museum of Natural History	Sweden
Bushnell	Mark	IOOS	United States of America
Buttigieg	Pier Luigi	AWI	Germany
Bye	Bente	Swedish Museum of Natural History	Sweden
Cabrera	Olivia	UP	Philippines
Cabrera	Patricia	Flanders Marine Institute	Belgium
Cadic	Cadic		
Cañedo	Rosa		Peri
Canonico	Gebrielle	NOAA	United States of America
Capt	Jeff		
Cardillo	Pamela	ERINN Innovation	Ireland
Carvalho	Andrea		Brazil
Castro Rodas	Divar	Instituto Oceanografico y Antartico de la Armada-INOCAR del Ecuador	Ecuador
Chaganti	Subba	University of Michigan	United States of America
Chaudhuri	Dhurjati	Formerly Rubber Research Institute of India	India
Chauvet	Pauline	SLGO	Canada
Chercham	Carolyn		United States of America
Chopin	Thierry	UNIVERSITY OF NEW BRUNSWICK	Canada
Cioffi	Lucas	QiqoChat	United States of America
Cipollone	Andrea	CMCC	Italy
Clementi	Emanuela	CMCC	Italy
Cocquempot	Lucie	IFREMER	France
Conrad	Kacie	Fisheries and Oceans Canada	Canada
Conroy	Jack	NOAA	United States of America
Cook	Heath		United States of America
Copeland	Adam	University of Maine	United States of America
Courson	Cédric	University of Paris, Astromabe Expeditions	France
Courtois de Viçose	Gercende	University of Paris, Astromabe Expeditions	France
Coutinho de Lima	Adriano	AIR Centre	Portugal
Cowie	Greg	University of Edinburgh	Scotland
Cox	Annie	Umea Marine Sciences Centre	Sweden
Cox	Christopher	NOAA	United States of America
Craft	Rob	NOC	United Kingdom
Craine	Joseph	Jonah Ventures	United States of America
Crockford	Taylor	WHOI	United States of America

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Cronin	Meghan	PMEL	United States of America
Cullis	Jeffrey	CIOOS Atlantic	Canada
Cummings	George	MesoAM SDG17 Coalition Program, Mission Blue, Reef Life Foundation, Ensynox, man	United States of America
Cusack	Caroline		Ireland
d'Hotman	Jethan		South Africa
Daly	Eoghan	Marine Institute, Ireland	Ireland
Daly	Margaret	Stanford University	United States of America
Danielsen	Finn	NORDECO	Denmark
Daraghmeh	Nauras		United States of America
Das	Swayamprabha		United States of America
Davidson	Fraser	ECCC	Canada
Davis	Beth	UC Berkeley	United States of America
De Brauwier	Maarten	CSIRO	Australia
De Raedemaeker	Fien	Flanders Marine Institute (VLIZ)	Belgium
de Silva	Christine	Juice Robotics	United States of America
Debo Montero	Yessica	DIHIDRONAV	Peru
del Valle	Daniella	CONICET - INIDEP	Argentina
xxDelaney	Conor	EMODnet	United States of America
Delgado	Claudia	IOC-UNESCO	Belgium
Demargne	I		
Derkye	Adom	Ghana Meteorological Agency	Ghana
Diack	Ibrahima		Senegal
Diwa-Acallar	Johanna		
Dominguez-Carri�	Carlos	University of the Azores	Portugal
Drevillon	Marie	Mercator Ocean International	France
Duffy	Emmett	Smithsonian Institution	United States of America
Dukhovskoy	Dmitry	NOAA	United States of America
Dunbar	Martha	Instituto de Ciencias Marinas de Andaluc�a (ICMAN-CSIC)	Spain
Dupont	Sam	University of Gothenburg	Sweden
Dzamefe	Hanson	Fisheries commission	Ghana
Easley	Regina	NIST	United States of America
Easty	Imatiak Ahmed	Noakhali Science and Technolgy University	Bangladesh
Echaaria	Khadija	General direction of meteorology	Morocco
Edelist	Dori		Israel
Edholm	Johan	University of Gothenburg	Sweden
Ediang	Okuku	Nigerian Meteorological Agency	Nigeria

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Edson	James	NOAA	United States of America
Edward	Josephine Joice	Lady Marine Consultancy Firm	Namibia
Einberg	Heli	University of Tartu	Estonia
Ekpe	Sonigitu	Cross River State Ministry of Environment	Nigeria
Elabboubi	Bouchta		
Elegbede	Isa		
Ellenbroek	Anton	FAO of the UN	Italy
Emenyonu	Uchenna	Federal University of Technology Owerri	Nigeria
Eparkhina	Dina	EuroGOOS	Belgium
Equbal	Jawed	National Centre for Coastal Research	India
Erenbjerg	Sissal	fiskaaling	United States of America
Escobar	Elva	UNAM ICML	Mexico
Evans	Andy	NAVY	United States of America
Exter	Katrina	VLIZ	Belgium
Eyre	Jack Reeves	NOAA	United States of America
Fairall	Chris	NOAA	United States of America
Faki	Masoud	TANZANIA METEOROLOGICAL AUTHORITY	Tanzania, United Republic of
Fanjul	Enrique	Mercator Ocean International	France
Fernandez	Jorge	INIDEP	Argentina
Fernandez	Vincente	EUROGOOS	United States of America
Ferreira de Carvalho	Andreia	Mercator Ocean International	France
Fitzsimmons	Shayla	CIOOS Atlantic	Canada
Fleming	Kevin	NLA International Ltd	United Kingdom
Foli	Bennet	University of Ghana Regional Marine Centre	Ghana
Folorunsho	Regina	Nigerian Institute for Oceanography and Marine Research	Nigeria
Fondo	Esther		Kenya
Ford	David	Met Office	United Kingdom
Formel	Stephen	OBIS, GBIF	United States of America
França	Roberta	UFGD	Brazil
Francis	Grant	Ocean Networks	Canada
Gagné	Nellie	Fisheries and Oceans Canada, Moncton, NB	Canada
Gamboa	Maria	INSTITUTO OCEANOGRAFICO Y ANTARTICO	Ecuador

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Gan	Yi-Ming	SCAR Antarctic Biodiversity Portal	Belgium
Gana	Slim	Sea-Gust	Tunisia
Garcia	Hernan	NCEI; World Data Service for Oceanography of the World Data System.	United States of America
Garcia	Carlos	Brazilian Coastal Monitoring System (SiMCosta)	Brazil
García-Ibáñez	Maribel	Institut de Ciències del Mar (ICM, CSIC)	Spain
Gerlach	Dana	BCO-DMO	United States of America
Gille	Sarah	Scripps Institution of Oceanography, University of California San Diego	United States of America
Giner	Caterina		Spain
Giroux	Marissa	ORISE/ US EPA	United States of America
Giusta	Elena	ISPRA	Italy
Gjerde	Kristina	IUCN	United States of America
Goncalves	Magali	Breda University of applies sciences	Netherlands
Gonzalez	Angela	Dominican Council for Fisheries and Aquaculture	Dominican Republic
Goodwin	Kelly	NOAA	INSTITUTO OCEANOGRAFICO Y ANTARTICO
Gordon	Nuette	University of Seychelles	Seychelles
Graves	Inger	Xylem	Norway
Grey	Erin	University of Maine	United States of America
Grigoratou	Maria Eugenia Molina	Mercator Ocean International	France
Guilhon	Maila		
Gutierrez	Jayson	VLIZ	Belgium
Guzmán	Alexandra	Smithsonian Institute	Panama
Gyuk	Nehemiah John	Nigerian Institute for Oceanography and Marine Research	Nigeria
Hanser	Brittany		
Harden-Davies	Harriet		United Kingdom
Haugan	Peter	IMR	Norway
Hemming	Michael	UNSW	Australia
Henderson	Kate	Ocean Decade Collaborative Center for the Northeast Pacific	Canada
Hermes	Juliet	SAEON	South Africa
Heslop	Emma	IOC-UNESCO	France
Hessing-Lewis	Margot	Hakai Institute	Canada

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Hoerstmann	Cora	AWI	Germany
Hogeweg	Marten	ESRI	United States of America
Hood	Maria		France
Hossain	Rayhan	University of Dhaka	Bangladesh
Houtman	Bob	U.S. National Science Foundation	United States of America
Humran	Mohammed	The Union of Arab Academics	Yemen
Hunter	Maggie	U.S. Geological Survey	United States of America
Hwai	Tan		
I Catarino	Ana	VLIZ	Belgium
Iasonos	Achilles		Cyprus
Ibrahim	Zakaruyau	Nigerian Institute for Oceanography and Marine Research	Nigeria
Ikhsan	Natrah	Universiti Putra Malaysia	Malaysia
Ilechukwu	Ifenna	Madonna University, Nigeria	Nigeria
imbayi	Linet	KMFRI	Kenya
Jack	Maria		Italy
Jaipal	Rashmi	Bloomfield College	United States of America
Jakoboski	Julie	MetOcean Solutions (Meteorological Service of NZ)	New Zealand
Jaya Ram	Annette	Universiti Sains Malaysia	Malaysia
Jeffery	Nick	Fisheries and Oceans Canada	Canada
Jenkyns	Reyna		Canada
Jeve	Jeffrey	Marine Science Insitute	Philippines
Jewell	Matt		
Jiang	Chunhua	East China Normal University	China
Jimenez	Juana	VLIZ	Belgium
Johannesen	Ellen	ICES/WMU	Denmark
Johnson	Noor	University of Colorado Boulder	United States of America
Jorgensen	Bailey	Raymond M. Alf Museum of Paleontology	United States of America
Joseph	Treesa	SINTEF OCEAN	Norway
Juma	Gabriel Akoko	AWI	Germany
Jurin	Ivana	Kali tuna	United States of America
Kai	Kombo	Tanzania Meteorological Authority (TMA)	Tanzania
Kalapatapu	balabhaskar	TBMICS	India
Kam	Kitty		Canada
Kampel	Milton	National Institute for Space Research (INPE)	Brazil
Karan	Diana	Pwani university	Kenya
Karstensen	Johannes	GEOMAR	Germany
Kay	Susan	Met Office, UK	United Kingdom

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Bonou	Frederic	IRHOB	Benin
Kellogg	Colleen	Hakai Institute	Canada
Kelvin	Asante		
Khatib	Laura	NGO Guardians of the Blue	Lebanon
Kholeif	Suzan	NIOF	Egypt
Kiessling	Tim	Kiel Science Factory at Kiel University	Germany
Kim	Changsoo		Korea
Kinkade	Danie	BCO-DMO	United States of America
Kluckner	Sigmund		Austria
Koagouw	Wulan	National Research and Innovation Agency - Republic of Indonesia	Indonesia
Koellner	Manuela	Federal Maritime and Hydrographic Agency,	Germany
Kokkos	Nikolaos	Democritus University of Thrace	Greece
Kollert	Joana	GEOMAR	Germany
Kostianaia	Evgeniia	UNESCO	Russia
Köstner	Nicole	GEOMAR	Germany
Krug	Lilian	Partnership for Observation of the Global Ocean (POGO)	Portugal
Krug	Marjolaine	Dept of Forestry, Fisheries and Environment	South Africa
Kulkarni	Balasaheb	Society for coastal resources conservation, protection and climate change	India
Kumar	Pravin	World Wildlife Fund-India	India
Lake	Sam	Southern Ocean Observing Systems (SOOS)	United States of America
Lambert	Arno	IOC/IODE	Belgium
Lang	Kaitlen	NOAA	United States of America
Lange	Nico	GEOMAR	Germany
Lanza	Diego	Fundación Islas de la Bahía	Honduras
Lavender	Samantha	Pixalytics Ltd	United Kingdom
Le	Jennifer	Bureau of Ocean Energy Management	
Le Henaff	Matthiue	NOAA	United States of America
Lea	Lea		
Leaw	Cheu Pin	University of Malaya	Malaysia
Lee	Li Keat	Institute of Ocean and Earth Sciences, University of Malaya	Malaysia
Lee	Olivia	University of Alaska Fairbanks	United States of America

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Léllis	Felipe	National Oceanographic Data Center of Brazil	Brazil
Levin	Lisa	Scripps Institution of Oceanography, UCSD	United States of America
Li	Jing	CLIVAR	United States of America
Lindemann	Chris	University of Bergen	Norway
Lipizer	Marina	OGS	Italy
Lips	Inga	EuroGOOS	Belgium
Lipsky	Christine	National Park Service	United States of America
Litardo	Elsa		
Lobelle	Delphine		Netherlands
Lopez	Ana Lara	IMAS	Australia
Lopez	Patricia	NOC	United Kingdom
Loughlin	Christine	Marine Institute	United States of America
Lowder	Kaitlyn	Ocean Fundation	United States of America
Istolp?	Istolp		
Lumpkin	Rick	NOAA	United States of America
Lusyana		National Research and Innovation Agency	Indonesia
Luftiharon	Muhammad		
Lux	Muriel	Mercator Ocean International	France
Maan	Jyotsna		United States of America
Maarouf	Mustapha	PLOCAN	United States of America
Madlener	Anna		
Mahinay	Jay-ar Pol	DA-BFAR	Philippines
Mahu	Edem	University of Ghana	Ghana
Makwela	Mapula	University of the Western Cape	South Africa
Mann	Nicki	DFO	Canada
Manneela	Sunanda		India
Mar	Ale		
Marandino	Christa	GEOMAR	Germany
Marinez	Marinez		
Marki	Alexandra	Federal Maritime and Hydrographic Agency (BSH)	Germany
Martinez	Linsey	Universidad Nacional Autónoma de Honduras	Honduras
Martins	Filipa	BIOPOLIS/CIBIO-InBIO, UP	Portugal
Martins	Uche		
Masina	Simona	CMCC	Italy
Maximenko	Nikolai	University of Hawaii at Manoa	United States of America

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Mazumder	Annwasha	National Forensic science University	India
Mazzuco	Ana Carolina	Universidade Federal do Espírito Santo	Brazil
McGlone	Emilie		
McGuinn	Robert	Northern Gulf Institute (a NOAA Cooperative Institute)	United States of America
McKenna	Jeff	Ocean InfoHub	Canada
Medsalah			
Melo	Ricardo	MARE - Marine and Environmental Sciences	Portugal
Meloni	Daniela	ENEA	Italy
Melsom	Arne	Norwegian Meteorological Institute	Norway
Mendes	Elisa	IRD	France
Mendonça	Ana	Instituto Hidrográfico	Portugal
Mercer	Louise	Northumbria University	United Kingdom
Meyer	Chris	Smithsonian Institution	United States of America
Meyer	Raissa	AWI	Germany
Miguel Piecho-Santos	Antonia	IPMA-Instituto Português do Mar e da Atmosfera	Portugal
Miskin-Hymas	Charlotte	British Oceanographic Data Centre	United Kingdom
Mohamed Taha	Hala		Egypt
Mohamud	Ahmed Mohamed	Somali secure fisheries	Somalia
Mohd-Din	Monaliza	University of Malaya	Malaysia
Montes	Enrique	CIMAS/AOML	United States of America
Morrison	Melissa		
Mottola	Patrizia	MOLD S.R.L. - with green project River Cleaning	Italy
Moustahfid	Hhssan	NOAA	United States of America
Moutinho	Jose Luiz	AirCentre	Portugal
Muller	Brigitte		
Muller-Karger	Frank	University of South Florida	United States of America
Muniz Piniella	Angel	European Marine Board	Belgium
Muñoz Mas	Cristian	IMR	Norway
Mwaala	Diina	Ministry of Fisheries and Marine Sciences	Namibia
Mwaitega	Sihaba	Tanzania Fisheries Research Institute (TAFIRI)	Tanzania
Mwamburi	Samuel	Kenya Marine And Fisheries Research Institute	Kenya
Mwangata	Janet	Kenya Marine and Fisheries Research Institute, KMFRI.	Kenya
Mwashinga	Edwin	IOC-UNESCO	Kenya
Mylne	Ken	Met Office	United Kingdom

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Nacorda	Hildie	University of the Philippines Los Baños	Philippines
Nadiradze	Kakha	AFRD Georgia	Georgia
Nagarajah	Rajkumar		Sri Lanka
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Zinzindohoue	Gerard		
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Zohra	Fatima		
Zubicaray	Mikel	CTAQUA	Spain

Annex 2: Workshop Committee



Frank Muller-Karger, Univ S Florida	Rebecca Zitoun, GEOMAR, Germany
Paul Van Ruth, IMOS, Hobart	Pauline Simpson, IOC-UNESCO, Belgium
Jay Pearlman, IEEE France	Aileen Tan Shau Hwai, Univ Malaysia
Ben Roberts, Conversation Collaborative, USA	Olusola Adeoye, Nature Cares Resource Centre, Nigeria
	Francoise Pearlman, Fourbridges, USA

Annex 3: Agenda

3 hours	Wed 05 Oct 2022	3 hours	Wed 05 Oct 2022
Time UTC	Plenary 1a Time Zone 1 (Moderator: Jay Pearlman, IEEE)	Time UTC	Plenary 1b Time Zone 2 (Moderator: Frank Muller-Karger, USF)
03.00	Welcome (Frank Muller-Karger, USF; Ben Roberts, Conversation Collaborative)	14.00	Welcome (Frank Muller-Karger, USF; Ben Roberts, Conversation Collaborative)
03.05	Keynote 1 : History, Vision, and Impact of BP and OBPS (Rachel Przeslawski, NSW Department of Primary Industries)	14:05	Keynote 1 : History, Vision, and Impact of BP and OBPS (Johannes Karstensen, GEOMAR)

03.25	Keynote 2 : Best Practices in Australia's Integrated Marine Observing System (Paul Van Ruth, IMOS)	14.25	Keynote 2 : Best Practices in Australia's Integrated Marine Observing System (Paul Van Ruth, IMOS)
03.45	Dialogue of Ocean Community Priorities (Participatory mixer: Ben Roberts)	14.45	Dialogue of Ocean Community Priorities (Participatory mixer: Ben Roberts)
04.25	BREAK (10 mins)	15.25	BREAK (10 mins)
04.35	Keynote 3: BP in the Ocean Decade (Vladimir Ryabinin, Executive Secretary, Intergovernmental Oceanographic Commission/IOC-UNESCO) (Ashwini Sathnur, UNESCO, ECOP/OBPS)	15.35	Keynote 3: BP in the Ocean Decade (Sara Venturini, Group on Earth Observations/GEO Climate Coordinator and Ocean and Water Coordinator) (Ellen Johannesen ICES, World Maritime University/ ECOP)
04.55	Capacity Development Panel (Development of curriculum; Globalization of BP and the role of Capacity Development) (Juliet Hermes, SAEON, Virginie van Dongen-Vogels, AIMS, ECOPs; Suchana Apple Chavanich, Ph.D., Chulalongkorn University Talen Rimmer, University of Victoria Johanna Diwa, IODE)	15.55	Capacity Development Panel (Development of BP/interoperability and the role of curriculum for formal education settings) (Steve Diggs, SIO; Josephine Edwards, Lady Marine Consultancy; Neelu Singh, NPI)
05.35	Theme Sessions Guidance (Jay Pearlman)	16.35	Theme Sessions Guidance (Jay Pearlman)
05.40	Meeting Technology (Ben Roberts)	16.40	Meeting Technology (Ben Roberts)
06.00	Close of Plenary 1a	17.00	Close of Plenary 1b

Theme Sessions (self organized)

06-16 Oct 2022

1.5 hours	Wed 19 Oct 2022	1.5 hours	Wed 19 Oct 2022
TimeUTC	Plenary 2a Time Zone 1 (Moderator: Paul Van Ruth, IMOS)	Time UTC	Plenary 2b Time Zone 2 (Moderator: Frank Muller-Karger, USF)

03.00	Workshop Summary of Theme Session reports - key recommendations, common outcomes, lessons learned (Paul Van Ruth)	14.00	Workshop Summary of Theme Session reports - key recommendations, common outcomes, lessons learned (Frank Muller-Karger)
03.35	Community discussion of workshop outcomes and next steps, and potential follow up activities (Paul van Ruther)	14.35	Community discussion of workshop outcomes and next steps and potential follow up activities (Frank Muller-Karger)
04.25	Close of Workshop (Jay Pearlman)	15.25	Close of Workshop (Jay Pearlman)

[end]