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To cite this article: Leopoldo Cavaleri Gerhardinger, Tanya Brodie Rudolph, Françoise Gaill, Graham Mortyn, Eloise Littley, Adrien Vincent, Dannieli Firme Herbst, Patrizia Ziveri, Louise Jeanneau, Maria Laamanen, Marta Cavallé, Jay Marisca Gietzelt, Marion Glaser, Mouna Chambon, Juliette Jacquemont, Samiya Ahmed Selim, Cecile Brugere, Cristina Brito, Laura M. Pereira, Sandra Amezaga, Nicolás Fernández Muñoz, Lucas Becquet, Arnaud Lalo & André Carlo Colonese (2023) Bridging Shades of Blue: Co-constructing Knowledge with the International Panel for Ocean Sustainability, Coastal Management, 51:4, 244-264, DOI: [10.1080/08920753.2023.2244082](https://doi.org/10.1080/08920753.2023.2244082)

To link to this article: <https://doi.org/10.1080/08920753.2023.2244082>



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Published online: 26 Aug 2023.



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Bridging Shades of Blue: Co-constructing Knowledge with the International Panel for Ocean Sustainability

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ABSTRACT

The efficacy of global environmental assessments in informing and shaping ocean and coastal management is hampered by recognized gaps in global science endeavours. In order to bridge these gaps, and secure inclusive and equitable knowledge co-construction by ocean stakeholders, the International Panel for Ocean Sustainability (IPOS) is emerging. Here we present the outcomes of the “Bridging Shades of Blue Workshop” held in Spain 2023. A diverse group of Ocean knowledge holders, including policymakers, small-scale fishers, marine social scientists and ocean lawyers gathered to reflect on the key features, challenges, strategies, actors to be involved, as well as pathways to balance power for advancing an inclusive and equitable IPOS. As a result, six foundational dimensions of IPOS’s institutional identity were proposed as IPOS ID cards: 1) Diversifying Ocean Knowledge Systems, 2) Widening the Range of Methods for Ocean Knowledge Production, 3) Informing Decision-making, 4) Engaging at the Interfaces of Knowledge with Decision-making, 5) Communicating, Learning, and Sharing Knowledge, 6) Measuring Progress and Evaluating Success. We conclude by emphasizing IPOS’s potential role as a beacon for inclusive, equitable, and sustainable ocean governance.

KEYWORDS

Ocean sustainability; global environmental assessment; participatory mapping; IPOS; science-policy-society interface

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Introduction

Global environmental assessments produced by organisations such as the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the World Ocean Assessment (WOA), and the Global Environment Outlook (GEO), guide global policy. These collective scientific efforts are driven by a shared awareness of the pressing environmental challenges that our planet faces, and the imperative for sound evidence-based decisions to guide decision-making (Fawkes et al. 2021). However, there is a growing understanding that coverage of coastal and ocean ecosystems in current assessment mechanisms is insufficient to meet the global target of ocean sustainability (SDG 14) (Brodie Rudolph and Jacquemont 2023). There is a need to foster greater collaboration and develop strategies to mobilize and engage a broader spectrum of knowledge beyond academia (Gaill et al. 2022; Fawkes et al. 2021; Murphy et al. 2021).

To address this pressing need, an international group of authors, supported by several of Future Earth's Global Research Networks alongside an expanding number of countries and marine science institutions (CNRS 2023), has proposed a new organization: the International Panel for Ocean Sustainability (IPOS) (Gaill et al. 2022). The European Union's (EU) agenda on International Ocean Governance (IOG) supports the IPOS to enhance ocean knowledge, diplomacy, and literacy for a secure and sustainably managed ocean (United Nations Department of Economic and Social Affairs 2023; European Commission 2022). The 3rd UN Ocean Conference, in June 2025 in Nice, France, offers a timeframe to step up IPOS work.

In pursuit of this goal, a significant step forward was the “Bridging Shades of Blue” workshop held in Spain, from March 23 to 24, 2023, at the Institute of Environmental Science and Technology of the Autonomous University of Barcelona. It brought together 24 participants (Figure 1), including policymakers (individuals with authority to make decisions and implement policies, including elected officials, such as legislators, executives in government agencies, or leaders in non-governmental organizations) and other decision-makers, such as small-scale fishers, and marine social and natural scientists, most of whom were women (see Figure 2 for profiles of participants). Participants collaborated to outline their perspectives on key design features, challenges, strategies, actors to be involved, and pathways to balance power for advancing an inclusive and equitable IPOS.

Workshop methods

Overview

The workshop employed a co-design methodology, to generate six foundational dimensions of IPOS institutional identity including: (i) Diversifying Ocean knowledge systems to be covered; (ii) Widening the range of methods for ocean knowledge production; (iii) Informing decision-making; (iv) Engaging at the interfaces of knowledge with decision-making; (v) Communicating, learning, sharing knowledge; (vi) Measuring progress and evaluating success. These dimensions, reflected in six IPOS institutional identity cards (ID cards), encapsulate essential attributes for an inclusive, equitable



Figure 1. Bridging Shades of Blue workshop activities in Barcelona (March 2023).

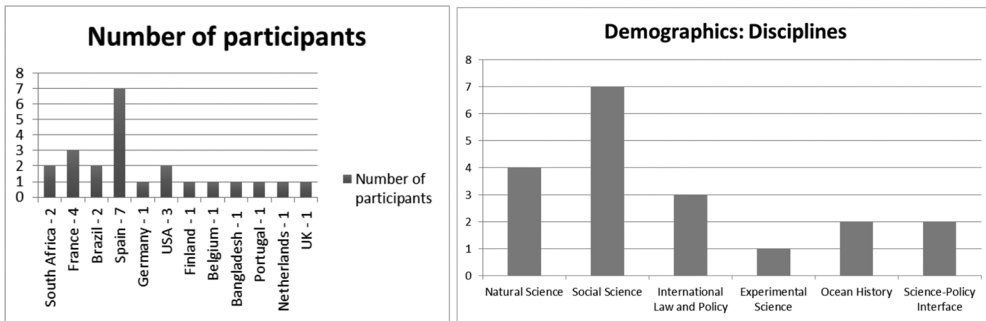


Figure 2. Profile of participants in the Bridging Shades of Blue workshop, including geographical representation (left) and disciplines (right).

IPOS. They reflect values of inclusivity, equity, credibility, and legitimacy, ensuring diverse perspectives and methods to bridge ocean interfaces with new co-production tools and approaches (Appendix A). The formative idea to create IPOS ID cards can be traced back to the EU-commissioned “*Global Environmental Assessments Seascape Assessment*,” hereafter GEA Seascape Assessment (Brodie Rudolph and Jacquemont 2023). Preliminary outcomes from the GEA Seascape Assessment were shared with workshop participants, laying the groundwork for stimulating deliberations and the ensuing development of IPOS ID cards. The ID cards inform the methodology and principles for the collective development of IPOS objectives and future projects, providing mechanisms to address global ocean assessment system challenges.

Workshop results subsequently anchored consultations in April 2023, involving members of international ocean cross-knowledge networks, and the IPOS scientific coalition. IPOS was also presented to IOC-UNESCO member states in June 2023 (IOC-UNESCO 2023), conducting further consultations with regional and global ocean actors, such as the International Council for the Exploration of the Sea (ICES), the North Pacific Marine Science Organization (PICES), and the Ocean Panel. These preliminary consultations aim to progressively craft an inclusive, equitable IPOS architecture.

The “Bridging Shades of Blue” workshop forms a critical juncture in IPOS’s development. Here we report its main outcomes, focusing on preliminary IPOS design features, mission, and vision statements, and potential networked strategies to shape future IPOS implementation at ocean interfaces through six dimensions (ID cards). Of note is the central principle of knowledge co-construction in IPOS (Gaill et al. 2022), distinguishing this initiative from other ocean-related global environmental assessment processes (Brodie Rudolph and Jacquemont 2023).

Presentation of preliminary results of the *Global Environmental Assessments (GEA) Seascape Assessment*

The initial findings of the GEA Seascape Assessment (Brodie Rudolph and Jacquemont 2023), unveiled during the opening of the Barcelona workshop, served as the framework for all ensuing discussions among the participants. The assessment evaluated 35 GEAs, including the IPCC AR6 Synthesis Report 2023, WOA I and II, IPBES Global Assessment 2019, GEO 6 2019, and the IOC State of the Ocean Report 2022, probing the connection

between ocean sustainability knowledge and policy action. The study was supplemented by 21 stakeholder interviews on their views (challenges and opportunities) about GEA processes. The preliminary Seascape Assessment analysis offered participants of the Barcelona workshop an integrated perspective of the ocean assessment system, establishing a common understanding of ocean complexities and sustainability.

Workshop participants consequently scrutinized these findings and the general GEA context, reflecting upon how and who synthesizes ocean knowledge in GEAs. The GEAs reviewed by IPOS revealed a terrestrial and climate bias, signaling the need for a cohesive, ocean-focused sustainability assessment framework. Furthermore, the GEA Seascape Assessment exposed limited interaction among leading assessment organizations (Pörtner et al. 2021) and fragmented ocean knowledge synthesis within most GEAs. Early workshop dialogues raised the necessity for a comprehensive reinterpretation of traditional “science to policy” or “science to society” interfaces to encompass diverse knowledge systems that are invisible within these terms in the global ocean governance framework (Orlove et al. 2022, 34). The revised term, “knowledge and decision-making interfaces,” adopted by participants, embraces a pluralistic perspective highlighting the need for interactions between diverse knowledge forms in ocean governance systems (e.g. Tengö et al. 2014).

The workshop also addressed the GEA Seascape Assessment interviewees’ vision for the ocean’s future. They advocated for enhanced ocean knowledge distribution and communication, suggesting succinct, subject-specific reports, a central information platform, and annual communication products. Cumulatively, these outputs would bolster understanding for decision-makers as well as public understanding about the interconnected role of the ocean in planetary health. Interviewees emphasized the need to transition from scientific to political language for effective policy implementation. They also encouraged a coordinated, transdisciplinary, inclusive approach to ocean knowledge co-creation, underscoring the need to fortify and co-create under-developed ocean knowledge and decision-making interfaces (Messerli et al. 2019). They proposed integrating overlooked perspectives, like community impact, and local knowledge into the IPOS.

Interactive sessions

Diverse break-out groups were conducted, so everyone could share views on all six foundational IPOS core design dimensions (ID cards) to steer engagement with diverse forms of ocean knowledge and decision-making interfaces (e.g. science to policy interfaces where global issues, such as climate, ocean, and biodiversity are discussed at UN intergovernmental forums). The objective was to conceive the design features for a value-enhancing, inclusive, and equitable IPOS, with participants collaboratively envisaging an “ideal” model for the panel represented by the six IPOS ID cards. Dialogues were followed by reporting plenary sessions to build agreed narratives (following Löhr, Weinhardt, and Sieber 2020; Schiele et al. 2022). Key attributes from these discussions are in [Appendix A](#).

Participatory mapping addressing key challenges

The workshop’s emerging co-designed IPOS features require robust and effective implementation strategies. Participants partook in four break-out discussions, using a participatory network mapping technique to identify who the important actors are, their existing and

still required relationships, and how influence is distributed amongst them to address the IPOS challenges (Glaser and Schröter 2021). Feedback was provided in plenary sessions to develop proposed networked strategies. Participants meticulously examined four crucial challenges, the results of which are detailed in [Appendix B](#). The primary aim was to boost IPOS's strategic planning and future assessments, fostering synergies within the UN Ocean assessments ecosystem and wider ocean knowledge holders.

IPOS ID cards: design features for inclusive and equitable ocean knowledge and decision-making interfaces

As the workshop unfolded into its second day, objectives shifted toward fine-tuning the drafted Identity Cards (see [Appendix A](#)). A graphic facilitator developed identity card illustrations, endorsed by participants. Participants also co-constructed preliminary Vision and Mission statements for the IPOS, to feed into future discussions.

ID Card 1: Diversifying of ocean knowledge systems to be covered

Participants advocated for an expansion of knowledge types in Global Environmental Assessments (GEAs). Aligning with recent research (Krug et al. 2020) and policy reports from IPBES, IPCC Working Group II, and GEO 6, participants agreed that it is necessary to make use of multiple sources of knowledge ([Figure 3](#)). They argued for the weaving together of a wider array of insights, including from Indigenous and

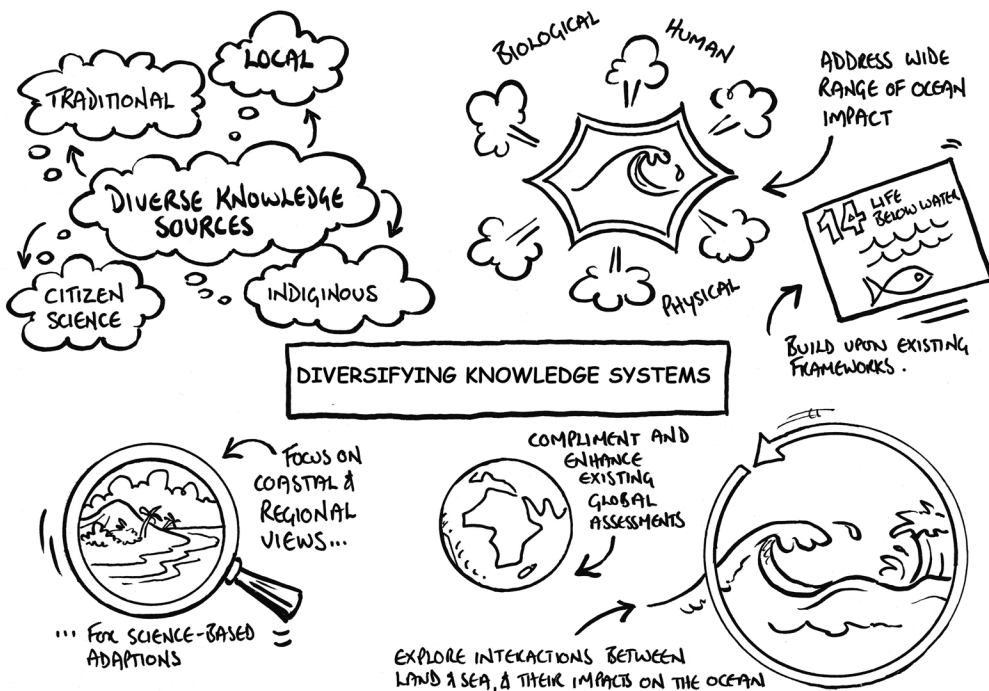


Figure 3. IPOS ID Card 1—Diversifying knowledge systems as a key dimension of the IPOS (correction of typos in the original artwork: *adaptations, *indigenous, *complement).

Local Knowledge (IOC-UNESCO 2023), citizen scientists, the private sector, and decision-makers, along with scientific research (Tengö et al. 2021). It is crucial to operationalize intersectional thinking in decision-making processes targeting environmental challenges emphasizing risks to marginalized groups, to deliver transformative solutions that achieve climate justice (Amorim-Maia et al. 2022).

They also stressed the necessity to assess human-driven ocean impacts beyond those of climate (Halpern et al. 2019). This includes pressures from fishing, coastal development, pollution, and deep-sea mining exploration, in a cultural context that considers the long-term social-ecological effects of ocean exploitation. The participants emphasized exploring resilience strategies and adaptation plans (Nishi et al. 2021). Considering underlying socioeconomic causes of pressures can lead to a more comprehensive view of ocean sustainability (Miloslavich et al. 2018).

In sum, valuing diverse knowledge sources is vital for the development of IPOS tools and methods, and for engaging effectively with various ocean interfaces (see Figure 10).

IPOS ID Card 2: Widening the range of methods for ocean knowledge production

Participants explored aspects of ocean knowledge production, including publication frequency, data sources, stakeholder involvement, and data gap management (Figure 4). The major GEA processes (the IPCC, WOA, IPBES, and GEO reports) produce publications approximately every 6 years, other reports are published annually (e.g., the WMO State of the Climate Report) while some special reports are published once (e.g.,

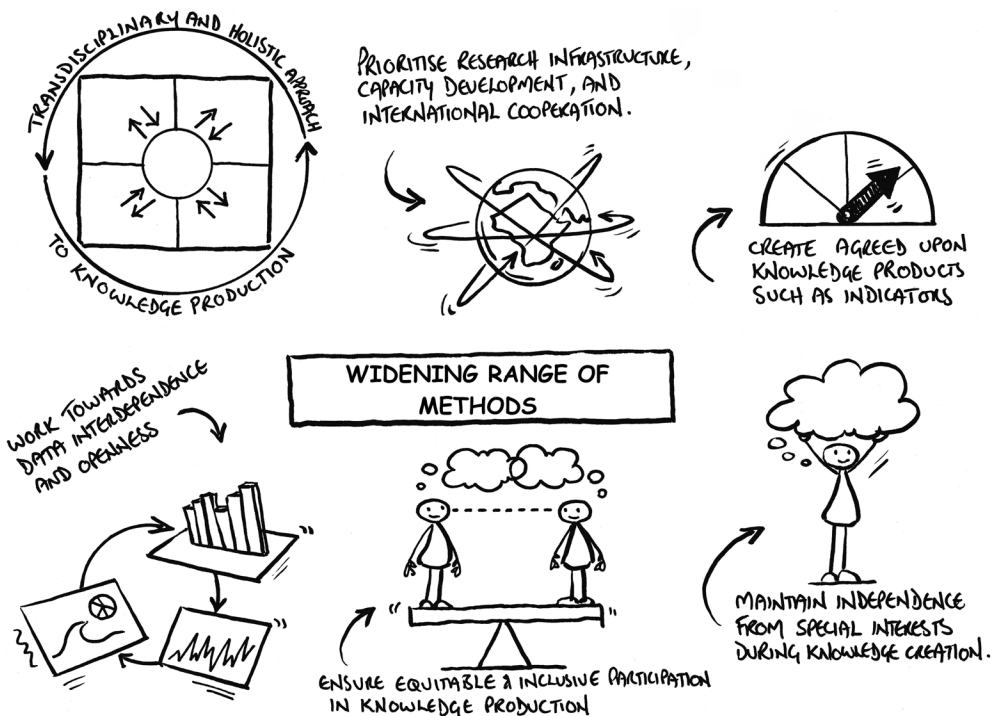


Figure 4. IPOS ID Card 2—Widening the range of methods for knowledge co-production by the IPOS.

the IPCC Special Report on the Ocean and Cryosphere). Participants suggested that the timing of knowledge delivery at ocean interfaces needed to better align with decision-making requirements. Managing and filling in data gaps was identified as a critical challenge. Consistent, globally accessible data was deemed necessary, with local communities and citizen scientists playing a key role in this process (see, for example, GEO 6's use of crowd-sourced citizen knowledge (UNEP 2019).

Participants suggested a holistic, interdisciplinary (integrating multiple disciplines across the physical and social sciences and humanities), and transdisciplinary (including expertise beyond academia) approach (Messerli et al. 2019) for IPOS, emphasizing the convergence of disciplines in evidence-based approaches (Tengö et al. 2014). Decolonizing methods, and plural valuations of and relations to nature, including economic, social, historical, and cultural shared values (Jacobs et al. 2020; de Vos 2020), should be centered on the transformative co-production of knowledge and power relations to enhance their impact on decision-making (Solé and Ariza 2019; Herbst, Gerhardinger, and Hanazaki 2020).

Additionally, improvements in research infrastructure, capacity development, and international collaborations were underscored (Polejack and Coelho 2021). Furthermore, participants highlighted the necessity for equitable and inclusive participation in the IPOS, independence from political agendas as well as collaboration with other assessments. The need for open, interoperable, and ethically sourced data was also emphasized (Tanhua et al. 2019). Finally, participants advocated for the creation of common knowledge products built upon Essential Biological Variables or Essential Ocean Variables (Miloslavich et al. 2018) to enable data comparability and establish baselines to measure policy intervention success within a flexible assessment framework (Muhl et al. 2022).

IPOS ID Card 3: Informing decision-making

This IPOS dimension revolved around policy recommendations formulated in GEAs. We considered whether outcomes from GEAs should be tailored to different regions or stakeholder groups, and how to ensure they are actionable (Figure 5).

Participants suggested a post-normal science framework for IPOS—which is a useful problem-solving strategy when “*facts [are] uncertain, values in dispute, stakes high and decisions urgent*” (Funtowicz and Ravetz 1993)—conditions often present in policy-relevant research. It is crucial to recognize the limitations of traditional scientific methods when dealing with complex, high-stakes issues, particularly while advocating for the inclusion of diverse perspectives and knowledge forms in decision-making (Jentoft and Chuenpagdee 2009). Therefore, when dealing with complexity, the IPOS could, with its diverse ocean knowledge holders, facilitate the co-design of sustainability pathways and scenarios for ocean systems (Pereira et al. 2020; Gerhardinger et al. 2022). IPOS would become an “honest broker” of knowledge, producing recommendations to expand or clarify the scope of choices available to decision-makers based on a multiple evidence base (Pielke and Roger 2007, 17).

Participants also stressed the importance of considering equity and inclusion in the production of recommendations, with special attention to the Global South and more broadly to marginalized communities (Hornidge, Partelow, and Knopf 2023). They encouraged the IPOS to address research gaps and provide case studies using both bottom-up and top-down approaches to building knowledge-based recommendations.

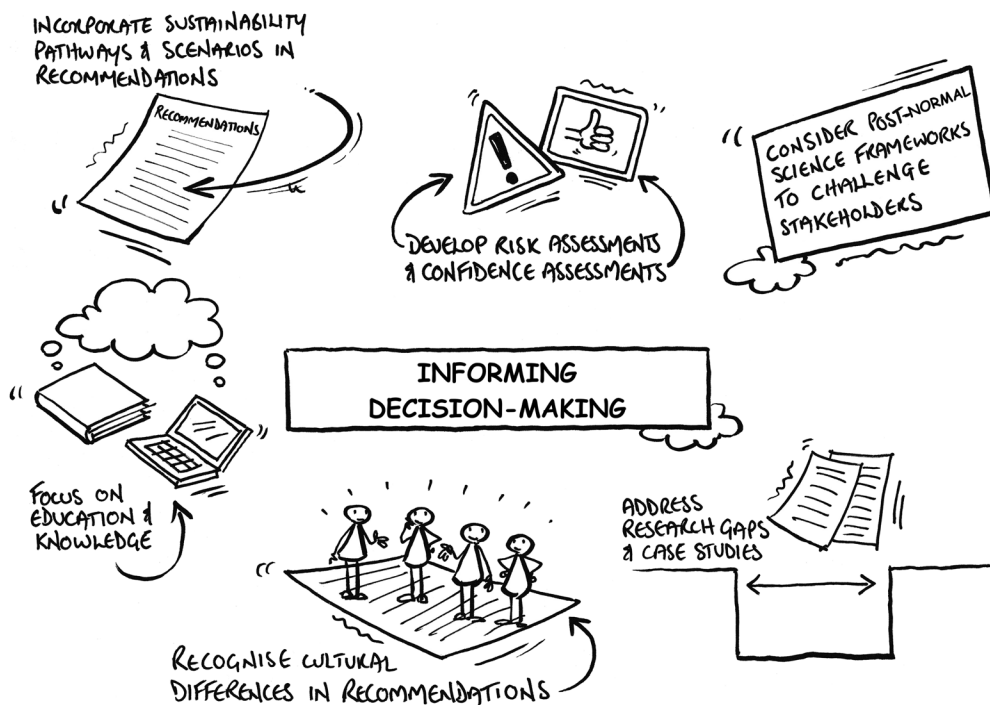


Figure 5. IPOS ID Card 3—Informing decision-making methods and approaches for the IPOS in relation to the types of recommendations to be formulated.

IPOS ID Card 4: Engaging at the interfaces of knowledge with decision-making

Discussions on this IPOS dimension centered on how to effectively engage policymakers and decision-makers in various aspects of these global scientific endeavors which are designed to underpin global policy. The GEA Seascape Assessment highlighted some of the potential mechanisms for engagement, including the co-production of new assessment terms of reference (i.e., what the assessment will cover and how it will do so), report production, and co-presentation of key findings.

The inclusion of policymakers in defining GEA reports' scope is crucial, and often intensively negotiated. Where policymakers' perspectives and priorities are part of ongoing debates, an opportunity for a sense of ownership in the outcome is generated for policymakers. In the absence of engagement, there is a risk that the knowledge generated and presented is not taken up and that decisions are made without utilizing a balanced evidence base created by the assessment process, resulting in wasted time and resources. For instance, negotiated summaries for policymakers can involve policy-makers and motivate them to familiarize themselves with the assessment results.

Continued post-report publication dialogue is vital. Organizations like the IPCC and the International Resource Panel (IRP) demonstrate the effectiveness of such science-policy interactions through follow-up activities like workshops and online forums (Gaill et al. 2022, Brodie Rudolph and Jacquemont 2023).

Workshop participants stressed the IPOS's role in fostering two-way communications between scientists, knowledge- and rights-holders, policymakers, and decision-makers. They suggested adopting successful communication models like the IPCC's plain language confidence level assignment to ensure comprehension by policymakers (Kause et al. 2022) (Figure 6).

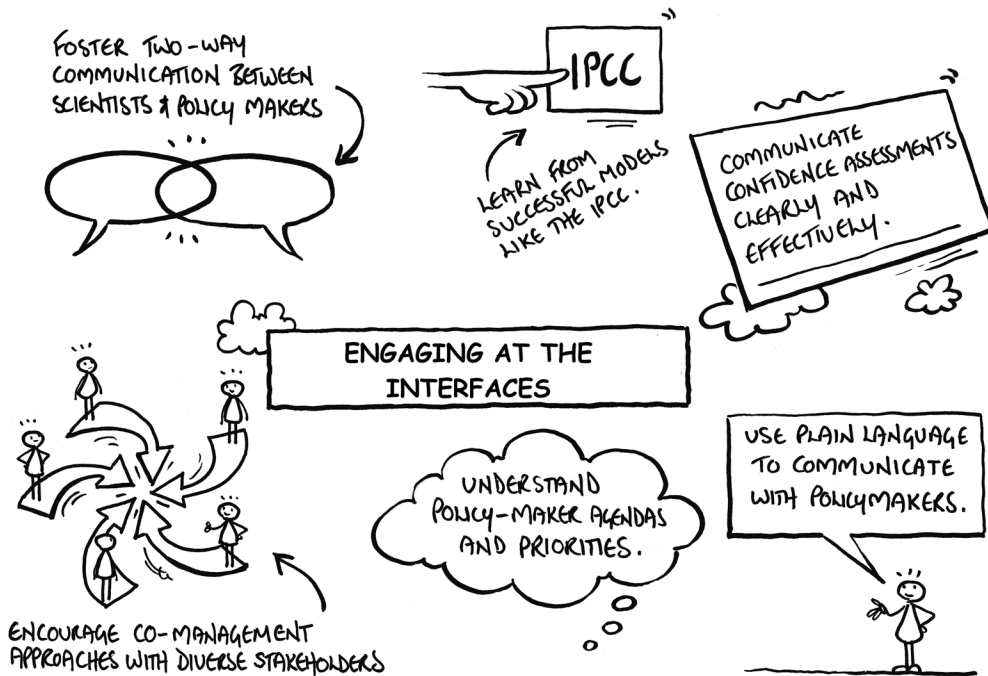


Figure 6. IPOS ID Card 4—Engaging with decision-making interfaces in the IPOS.

Participants emphasized acknowledging policymakers as key agenda setters, knowledge users, and contributors (Cvitanovic et al. 2015). They recommended co-management strategies and diverse stakeholder involvement, including small-scale fishers and local communities (Voorberg and Van der Veer 2020), to ensure a holistic approach. This can enhance IPOS's engagement with policy- and decision-makers, facilitating communication and decision-making.

IPOS ID Card 5: Communicating, learning, and sharing knowledge

The fifth discussion focused on effectively sharing knowledge with the public, emphasizing accessibility, participation, and diverse communication methods (Seys et al. 2022, 34). Participants saw IPOS as a knowledge hub, moving beyond the one-way science communication and knowledge deficit paradigm (Reincke, Bredenoord, and van Mil 2020) toward a comprehensive approach for enhancing ocean literacy and facilitating multilateral knowledge exchange (Figure 7). For instance, combining IOC-UNESCO's (2022) Critical Ocean Literacy focus on diverse perspectives and active participation, with the UNESCO-defined Media and Information Literacy emphasis on critical engagement with information (Singh

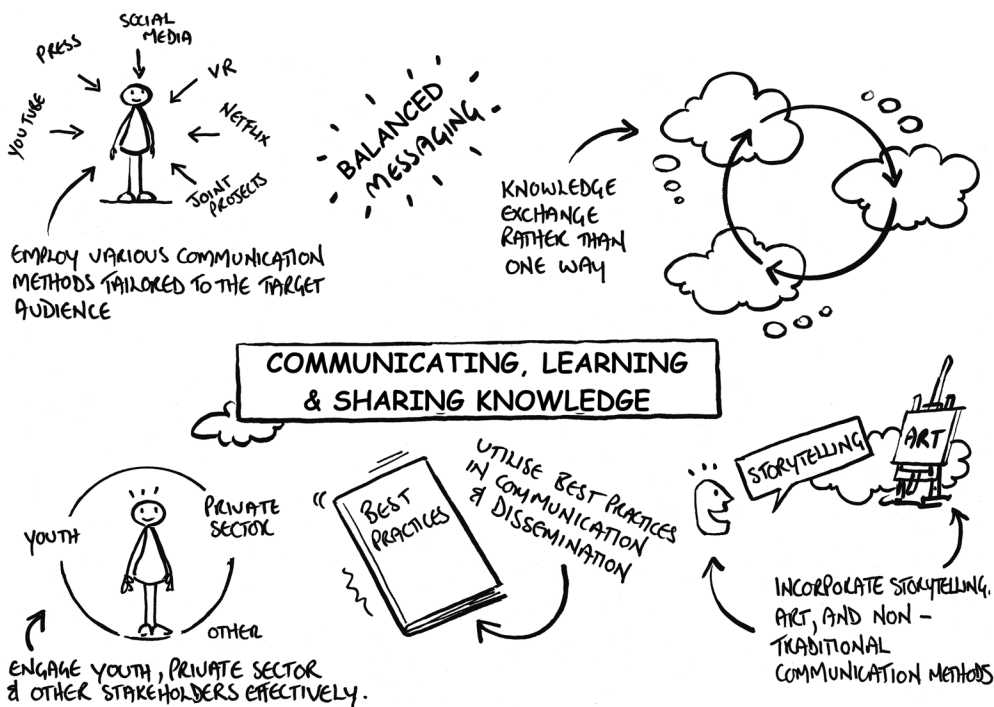


Figure 7. IPOS ID Card 5—Communicating, learning, and sharing knowledge by the International Panel for Ocean Sustainability (IPOS).

et al. 2016), can foster a holistic vision of ocean literacy. This comprehensive approach enhances collaborations, engages underrepresented groups, and promotes sustainable decisions by effectively empowering individuals to understand and address ocean-related issues.

Participants stressed potential biases in communication processes, suggesting tailored methods for underserved communities. This includes extending policymakers' summaries to diverse communication modalities, such as oral traditions, art, or multimedia tools, catering to the needs of different stakeholders. For instance, storytelling would engage local communities, while graphical economic outcome analyses could benefit the private sector.

A balanced approach combining positive messaging with engagement and recognition of conflicts and historical injustices was called for. Traditional communication methods, such as summaries for policymakers and infographics, should be made accessible to a wider range of audiences (Strand, Rivers, and Snow 2022). Broad stakeholder involvement, including youth, women, and the private sector, was emphasized to ensure information access and understanding.

IPOS ID Card 6: Measuring progress and evaluating success

Assessing the impact of GEAs is vital for understanding their effectiveness. Methods include measuring policy uptake, tracking recommendation integration into

decision-making, and observing ocean health improvements. Evaluation tools like the Ocean Health Index (OHI) (Halpern 2020) and the International Science Council's (ISC) policy impact tool provide guidance for this.

Cases of success, such as the Kuruwitu Locally Managed Marine Area in Kenya or the EU's and US's rebounding fish stocks (Duarte et al. 2020), reflect the value of effective policy tools, collaborations, and funding. Furthermore, measurable indicators like Essential Biological Variables and Essential Ocean Variables (Miloslavich et al. 2018; Pereira et al. 2013) offer tangible policy impact measures.

Globally, GEA influence is evident in political processes, such as the IPCC's role in the inclusion of greenhouse gas emission mitigation targets in Nationally Determined Contributions (NDCs).

Aligned with UNEP-UNESCO recommendations, the IPOS should adopt best practices to produce GEAs (IOC-UNESCO 2009), ensuring recognition, credibility, and equitable processes (see also Brodie Rudolph and Jacquemont 2023, for an updated compendium of best practices). Recommendations should be based on rigorous information, providing actionable guidance. IPOS should also account for qualitative aspects, including tangible and intangible aspects of well-being. An inclusive approach recognizing intersectionality and representation (Meyer-Gutbrod, Pierson, and Behl 2023) can make IPOS an example of inclusive and equitable ocean knowledge and decision-making (Figure 8).

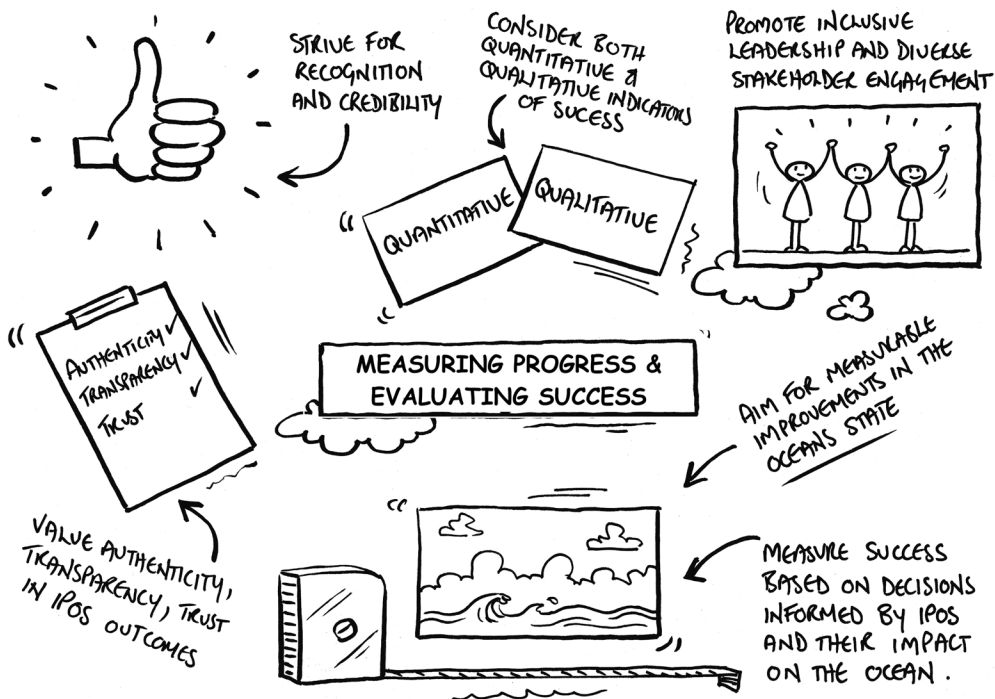


Figure 8. IPOS ID Card 6—Measuring progress and evaluating success methodologies for the International Panel for Ocean Sustainability (IPOS).



Figure 9. Participatory network mapping session during Bridging Shades of Blue workshop, co-constructing networked strategies for the implementation of the IPOS.

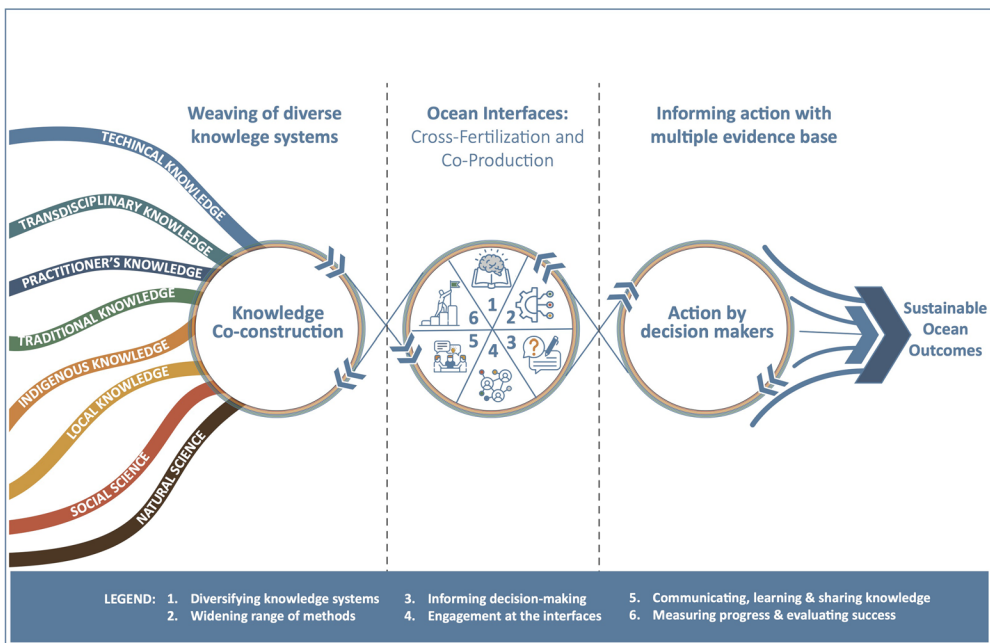


Figure 10. A new ocean mechanism weaving together diverse knowledge systems through six foundational dimensions to inform action across ocean interfaces (Tengö et al. 2014; Gaill et al. 2022; Brodie Rudolph and Jacquemont 2023).

The future: forging networked ocean knowledge pathways for IPOS

After two days of collaborative effort, participants articulated a draft vision and mission for the IPOS, visualizing it as an entity promoting a connected, inclusive, and healthy global ocean ecosystem. The mission emphasizes uniting diverse partners, building a comprehensive knowledge base, promoting science-policy dialogue, and directing restorative decisions, with the objective of ensuring the well-being of all species and future human generations (Box 1).

Box 1. Draft vision and mission statements for the IPOS.**IPOS vision**

We envision a connected and inclusive global ocean ecosystem of actors that fosters diverse, equitable, and sustainable relationships, providing a collective knowledge foundation to nurture science-policy-society dialogue and guide just, restorative decision-making, honoring the ocean's inherent rights and value for the well-being of all generations and species.

IPOS mission

The International Panel for Ocean Sustainability, by uniting diverse partners and fostering collaborations, aims to create a comprehensive, holistic, and inclusive knowledge base that complements existing assessment efforts, identifies gaps, and drives action to support decision-makers in ensuring thriving human communities and a healthy ocean.

The IPOS is at a crossroads, with multiple challenges requiring inclusive strategies and balanced power-sharing. The workshop delivered strategic responses to implementation challenges ([Appendix B](#)), in response to which the IPOS must forge pathways to networked action. Key actors for IPOS development must extend beyond the EU, to the Global South, UN agencies (e.g., DOALOS and IOC), NGOs, scientists, under-represented groups (ocean rights holders, such as small-scale fishers), and the private sector, all united for sustainable ocean outcomes.

Power sharing in IPOS development and operation is crucial for inclusivity and equity, all voices need to be valued, culture and human rights respected, and the roles of government and the scientific community recognized.

Building alliances, supporting networks, and targeted knowledge co-construction processes and methods are vital, for instance by advancing ocean sustainability in real-world labs (Dalton et al. 2020; Gerhardinger et al. 2020; Franke et al. 2023). IPOS needs to initiate the development of knowledge-weaving and communication functions, establish its governance structure, and enhance the connection between knowledge and decision-making. Real-world labs could provide an operational collaborative platform for marine scientists and decision-makers to work together on the design, production, and evaluation of knowledge co-construction for urgent ocean sustainability issues.

The design features represented by the IPOS ID Cards can serve as a roadmap for the IPOS, assisting in tracking progress and ocean knowledge holders' involvement.

The co-constructed Vision and Mission demonstrate our commitment to inclusive global ocean knowledge building and governance. Addressing the outlined challenges and engaging key actors, the IPOS will efficiently promote inclusive, and equitable ocean sustainability-related decision-making.

Acknowledgments

We also acknowledge the co-sponsoring of the workshop by the Marine and Environmental Biogeosciences-SGR project, The Oceanography Society, and the Ocean Sustainability Foundation) hosted by the "CNRS Foundation". We thank James Durno for the graphic facilitation, and Richard D. Norris, Nikki Harasta, Kilaparti Ramakrishna, Brian O'Riordan and Andrei Polejack for their constructive contributions during our workshop.

Funding

We also acknowledge the co-sponsoring the ICTA-UAB "María de Maeztu" Programme for Units of Excellence of the Spanish Ministry of Science and Innovation (CEX2019-000940-M). We also acknowledge the co-sponsoring the ERC Consolidator project TRADITION, which is funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and

innovation program under Grant Agreement No 817911. This work was also funded by EarlyFoods (Evolution and impact of early food production systems, 2021 SGR 00527). The Seascape Assessment was funded through the European Maritime Fisheries and Aquaculture Fund (MARE/2022/VLVP/0025) and the CNRS Foundation.

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Appendix A: Summary of key design features for advancing an inclusive and equitable International Panel for Ocean Sustainability proposed by participants of the Bridging Shades of Blue workshop (Barcelona, March 2023)

| Dimension of IPOS's interaction with ocean interfaces | Key design features |
|---|---|
| 1. Diversifying of Ocean knowledge systems to be covered | <p>1.1. Diversified knowledge base: Incorporate a wide array of evidence and insights from multiple bases, including traditional, Indigenous, local, citizen scientists, private sector, and decision-makers for a robust understanding of the ocean.</p> <p>1.2. Human–ocean interplay: Acknowledge and assess human-driven ocean impacts, from climate to fishing, coastal development, pollution, and deep-sea mining exploration, within a cultural context.</p> <p>1.3. Intersectional emphasis: Operationalize intersectional thinking in decision-making processes, targeting environmental challenges and emphasizing risks to marginalized groups.</p> <p>1.4. Resilience and adaptation: Prioritize exploration of resilience strategies and adaptation plans, with consideration of socio-economic causes of pressures.</p> <p>1.5. Knowledge development and dissemination: Exchange ocean knowledge to foster IPOS tool and method development and to engage effectively with various ocean interfaces.</p> |
| 2. Widening the range of methods for ocean knowledge production | <p>2.1. Dynamic publication frequency: Consider the timing of knowledge delivery to align with decision-making requirements, factoring in the varying timelines of different GEA processes and reports.</p> <p>2.2. Knowledge gap management: Address the challenge of managing and filling data gaps, and strive for consistent, globally accessible data, with a key role played by local communities and citizen scientists.</p> <p>2.3. Holistic Approach: Foster a holistic, interdisciplinary, and transdisciplinary approach for IPOS, emphasizing the convergence of distinct disciplines in multiple evidence-based approaches.</p> <p>2.4. Empowering plural valuations: Center on decolonizing methods and plural valuations of nature, including economic, social, historical, and cultural shared values in the transformative co-production of knowledge.</p> <p>2.5. Infrastructure and collaboration: Prioritize improvements in research infrastructure, capacity development, international collaborations, and the creation of common knowledge products for enhanced knowledge production.</p> |

| Dimension of IPOS's interaction with ocean interfaces | Key design features |
|---|---|
| 3. Informing decision-making | <p>3.1. Post-normal science framework: Embrace a post-normal science framework, a paradigm that addresses complex, high-stakes issues by going beyond traditional scientific methods and advocating for the inclusion of diverse perspectives and knowledge forms.</p> <p>3.2. Co-design of sustainability pathways: Facilitate the co-design of sustainability pathways and scenarios for ocean ecosystems, positioning IPOS as an “honest broker” of knowledge that expands or clarifies the scope of choices for decision-makers.</p> <p>3.3. Equity and inclusion: Ensure equity and inclusion in the production of recommendations, with special attention to the Global South and the voices of marginalized communities.</p> <p>3.4. Addressing research gaps: Address research gaps and provide case studies using both bottom-up and top-down approaches for more comprehensive, inclusive recommendations.</p> <p>3.5. Audience-centric recommendations: Create recommendations that are tailored to the needs, interests, and contexts of diverse audiences, thereby enhancing their relevance and applicability.</p> |
| 4. Engaging at the interfaces of knowledge with decision-making | <p>4.1. Inclusive scoping: Engage policymakers and decision-makers in defining new assessment terms of reference, encouraging ownership of the outcomes.</p> <p>4.2. Policy integration: Create coauthored summaries to encourage familiarity with assessment results among policymakers of participating states.</p> <p>4.3. Continued dialogue: Maintain an ongoing dialogue with policymakers post-report publication, modeled after successful science-policy organizations.</p> <p>4.4. User-centered approach: Recognize policymakers as key knowledge users and contributors, and respect their agendas and priorities.</p> <p>4.5. Stakeholder co-management: Advocate for co-management strategies involving diverse stakeholders, ensuring comprehensive, inclusive decision-making processes.</p> |
| 5. Communicating, learning, and sharing knowledge | <p>5.1. Knowledge hub role: Convene ocean sustainability real-world laboratories, steer and pilot innovative experiments for integrating diverse perspectives and facilitating a multi-directional exchange of knowledge.</p> <p>5.2. Communication diversity: Adopt a variety of communication methods, including oral traditions, art, and multimedia tools, to cater to diverse audience needs.</p> <p>5.3. Balanced messaging: Recognize and engage with conflicts and historical injustices while balancing with overall positive messaging.</p> <p>5.4. Broad stakeholder engagement: Include a wide range of stakeholders, from youth to private sector representatives, promoting inclusivity in information access and understanding.</p> <p>5.5. Integrated literacy approach: Combine UNESCO's Critical Ocean Literacy with Media and Information Literacy approaches to enhance public understanding and engagement with ocean-related issues. This holistic literacy approach facilitates informed discourse and promotes sustainable decision-making processes.</p> |

| Dimension of IPOS's interaction with ocean interfaces | Key design features |
|---|---|
| 6. Measuring progress and evaluating success | <p>6.1. Impact evaluation: Measure policy uptake, track recommendation integration into decision-making, and assess improvements in ocean health using established tools.</p> <p>6.2. Policy effectiveness documentation: Document successful policy tools, collaborations, and funding strategies as evidence of impact.</p> <p>6.3. Indicators evolution: Evolve measurable indicators like Essential Biological Variables and Essential Ocean Variables to offer tangible measures of policy impact.</p> <p>6.4. Informed guidance: Base recommendations on rigorous, actionable information to aid decision-making processes.</p> <p>6.5. Intersectional approach: Recognize intersectionality and representation in defining success, accounting for tangible and intangible aspects of well-being.</p> <p>6.6. Equitable co-leadership: Foster co-leadership of knowledge co-construction, that encourages participation from a diverse range of stakeholders, promoting equity in decision-making processes.</p> |

Appendix B: Key challenges for implementation and proposed networked strategies for the International Panel for Ocean Sustainability proposed by participants of the Bridging Shades of Blue workshop (Barcelona, March 2023)

| Key challenges for implementation | Proposed networked strategies |
|--|---|
| <p>1. Moving beyond boundaries: Expanding the scope of assessments</p> | <p>1.1. Holistic integration: Merge economic, social, and well-being aspects into assessments, incorporating diverse knowledge types for a comprehensive understanding of the ocean's social-ecological complex.</p> <p>1.2. Interdisciplinary synthesis: Unite natural and social sciences, incorporating social and economic considerations to address civilization threats effectively and holistically.</p> <p>1.3. Inclusive communication: Tailor communication methods to various audiences, diversifying the approach for different stakeholders and enhancing inclusive knowledge production, data sharing, and consensus-building.</p> |
| <p>2. Synergistic positioning: IPOS within the UN Ocean Assessment system</p> | <p>2.1. Enhanced collaboration: Enhance cooperation with UN bodies, streamline data sharing, promote ocean sustainability (SDG14), and foster alliances with UN bodies for synergistic positioning.</p> <p>2.2. Effective evaluation and engagement: Establish effective procedures for evaluating oceanic features, functions, and future scenarios, and engage states, the UN, and other relevant agencies, emphasizing involvement from Small Island and Large Ocean states and Global South countries.</p> <p>2.3. Strategic alliances: Develop a strategic approach to coalition-building, leveraging support from the EU, states, and other relevant intergovernmental organizations, and explore partnerships and contributions.</p> |
| <p>3. Strengthening structures: Defining IPOS's governance framework</p> | <p>3.1. Governance evolution: Form an inclusive, operational, credible, and globally accepted IPOS governance framework that distinguishes between international and intergovernmental entities, fostering political negotiations and relationships with diverse actors to ensure broad buy-in.</p> <p>3.2. Inclusive operations: Implement mechanisms that ensure transparency, accountability, and fairness in decision-making, secure inclusive funding, and resource allocation, and establish a task force for ocean knowledge co-creation.</p> <p>3.3. Network and equity enhancement: Enhance the IPOS actors' network for Real World Laboratories, leverage upcoming meetings for political support, link culture and equity to human rights, and prioritize inclusivity in resource allocation.</p> |

| Key challenges for implementation | Proposed networked strategies |
|---|---|
| 4. Broadening horizons: Engaging with diverse ocean knowledge holders | 4.1. Diverse and equitable engagement: Actively involve diverse sectors, balance power dynamics among knowledge holders, involve youth, indigenous communities, women, artisanal fishers, coastal development sectors, government, science, NGOs, and the private sector, particularly those underrepresented in digital communities, to foster global inclusivity. 4.2. Stakeholder inclusion: Use stakeholder mapping and active mobilization to amplify underrepresented voices, improve social reach, and strengthen networks and events, including ocean economy actors, social scientists, multiple disciplines, and bodies with a strong connection to Indigenous and culturally diverse communities. 4.3. Inclusive decision-making: Define a clear vision and mission for IPOS distinct from UN bodies, empower underrepresented actors, and cultivate a space where varying perspectives are recognized and respected. |
