Ocean Decade

Vision 2030

White Papers

Challenge 9:

Skills, knowledge, technology and participatory decision-making for all

The United Nations
Decade of Ocean Science
for Sustainable Development
(2021-2030)

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Ocean Decade Vision 2030 White Papers

Challenge 9: Skills, knowledge, technology, and participatory decision-making for all

Ensure comprehensive capacity development and equitable access to data, information, knowledge, technology, and participatory decision-making across all aspects of ocean science and for all stakeholders.

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The Intergovernmental Oceanographic Commission (IOC) of UNESCO, extends its sincere appreciation to the co-chairs and members of the Working Group for their leadership and commitment in the process of drafting and authoring the present document.

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length limitations for this document did not permit us to include all suggestions from community members and from the other groups mentioned above.

Contents

Acronyms

CDF	Ocean Decade Capacity Development Facility
ECOP	Early Career Ocean Professional
IOC	Intergovernmental Oceanographic Commission
LDCs	Least Developed Countries
LLDCs	Landlocked Developing Countries
ODA	Ocean Decade Actions
SIDS	Small Island Developing States
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

1. EXECUTIVE SUMMARY

1.1 Introduction and Scope of the White Paper

This White Paper has been prepared as part of the Vision 2030 process undertaken in the framework of the UN Decade of Ocean Science for Sustainable Development. The Vision 2030 process aims to achieve a common and tangible measure of success for each of the ten Ocean Decade Challenges by 2030. The process determines priority datasets, critical gaps in science and knowledge, and needs in capacity sharing, infrastructure, and technology required for each Challenge to ensure that it can be fulfilled by the end of the Ocean Decade in 2030.

The results of the process will contribute to the scoping of future Decade Actions, identification of resource mobilisation priorities, and ensuring the ongoing relevance of the Challenges over time. The process identifies achievable recommendations that can be implemented in the context of the Decade, or more broadly before 2030 to achieve the identified strategic ambition and indicators that will be used to measure progress.

This White Paper is one of ten White Papers all of which have been authored by an expert Working Group. The draft of this White Paper was presented at the 2024 Ocean Decade Conference, and additional input was sought before finalisation and publication.

1.2 Strategic Ambition of Ocean Decade Challenge 9

Challenge 9 aims to *ensure comprehensive capacity development and equitable access to data, information, knowledge, technology, and participatory decision-making across all aspects of ocean science and for all stakeholders.* It is based on the understanding that everyone has something to contribute through shared knowledge, resources, ideas, or partnerships. Challenge 9 therefore is focused on equity and justice in access to capacity, resources, and decision making.

By 2030, success for Ocean Decade Challenge 9 will be reached when:

a. **Technical, transdisciplinary, and transversal skills** required by scientists, resource users, educators, communicators, managers, and policymakers, to deliver the Decade's challenges, **are strengthened and evenly distributed** with an emphasis on least developed countries (LDCs) and Small Island Developing States (SIDS) and other under-represented groups.[1]

b. **Funding mechanisms, multi-directional partnerships, infrastructure, and technology** required to deliver the Decade's challenges across regions and communities **are enhanced and evenly distributed** with emphasis on promoting access to LDCs and SIDS and on promoting greater cooperation between regions.

c. **Users and stakeholders from currently under-represented groups** (i.e., women; ECOPs; Indigenous communities; LDCs and SIDS; people with disabilities; and others) **are well-represented and participatory** in ocean science, communication, management, decision making, and policy within the Decade framework.

d. **Wider promotion of ethically-driven actions and access to open-source software, ocean data, knowledge, and information** among different users of the ocean has been achieved, and **language barriers/restrictions have been mediated**, including sharing knowledge in forms that are well articulated by non-scientific audiences.

e. **Recognition for Indigenous and local knowledge and traditional beliefs that**

[1] We use the UN-designated terms "LDCs and SIDS" in this document. We acknowledge in this footnote that other terms such as "under-resourced countries" and especially "global south" are preferred by many citizens of LDCs and SIDS.

promote conservation receives backing by the Decade and is integrated into all the Decade challenges.

Success will include fulfilment of the following critical capacity development needs: skills enhancement; representation and meaningful participation; equitable funding; infrastructure; technology; access to data and information; publishing of research findings; better representation of scientists and knowledge from LDCs, SIDS and other under-represented groups in international publications and decision-making bodies and procedures; and promotion of the use of multiple languages in ocean science communication.

1.3 Key Recommendations to Achieve the Strategic Ambition

The following recommendations are identified to ensure that the strategic ambition is fulfilled, and success achieved for Ocean Decade Challenge No. 9. It is recommended that by 2030 the Decade will:

a. Establish baselines for tracking progress and achievements within the Challenge;

b. Support more Ocean Decade Actions (ODA) that will promote and assist with the development of human resources at individual and institutional levels required across the entire value chain, from creating supportive regional and international networks to develop capacity, to facilitating opportunities to conduct ocean science and observation, to including local/indigenous knowledge, through data and information management, to policy advice and representation;

c. Support efforts to increase representation of currently under-represented groups (women, early career ocean professionals, Indigenous communities) in the science, communication, management, policy areas, and decision-making of the ocean;

d. Advocate for policies that require bottom-up international collaboration and data/knowledge sharing as current top-down approaches could exacerbate the power dynamic between researchers from high income nations and those in under-represented groups, and could result in meaningless "check boxes" for inclusion;

e. Endorse and support ODA that improve global access to technology, physical infrastructure, data, information, and exchange of diverse ocean knowledge;

f. Endorse and support ODA that encourage development of innovative fit-for-purpose technology solutions;

g. Endorse and support ODA that seek to remove language barriers between different users of the ocean;

h. Promote participation in projects that ensure equitable distribution of funding within and across nations to invest in a truly global enterprise of ocean science and management;

i. Provide advice on bringing together policy and management specialists with scientists;

j. Relatedly, encourage constructive, multi-directional partnerships as well as regional and sub-regional coordination mechanisms, enabling equitable sharing of expertise, funding and other resources, and decision-making.

1.4 Key Milestones and Indicators for the Strategic Ambition

The key milestones and indicators used to measure the fulfilment of the strategic ambition should be calculated from the baseline identified by the Decade. Increases that successfully demonstrate improvement should be considered at the Ocean Decade conference. The proposed indicators of success may include:

a. Increased participation and recruitment of minority groups (women, ECOPs, actors with disabilities, LDCs and SIDS) into ocean-related fields by 2030.

b. Increased number of new ocean sustainability career supports, jobs and research opportunities created in LDCs and SIDS by 2030.

c. More LDCs and SIDS subscribing to networks and professional bodies, international consortia, and participating in international meetings by 2030.

d. Increase in the number of ECOPS, LDCs and SIDS led and/or co-authored published peer reviewed scientific literature by 2030.

e. Increase in special programmes, courses, or modules developed and implemented for training for different groups by scientists, resource users, educators/communicators, managers, and policymakers by 2030.

f. Availability of an inventory of existing ocean science infrastructure and technology in the LDCs and SIDS by 2025.

g. Availability of a plan for developing and evenly allocating infrastructure, technology, and funding by 2025.

h. Increase in infrastructure, technology, and funding to LDCs and SIDS by 2030.

i. Increase in numbers of low-cost technologies developed and implemented in LDCs and SIDS by 2030.

j. Availability of a policy within the Decade that supports open access to ocean data and information by 2025.

k. A compilation of standardised data formats, platforms and guidelines for responsible and open data governance by 2025.

l. Availability of language accessibility and free translation programmes for ocean data and information sharing by 2026.

m. An increase in the number of partnerships, public and private, established to promote even distribution of resources.

n. Increased opportunities for inclusive confidence-building and mentorship to overcome systemic barriers to leadership faced by underrepresented groups.

o. Enhanced recognition of different forms of knowledge that contribute to global ocean decision-making.

2. INTRODUCTION

2.1 Background and Context of the Challenge

Ocean science capacity in all its forms is unevenly distributed throughout the world. This includes personnel, equipment, research vessels, funding, research infrastructure, access to education and training, access to ocean data and modelling output, ocean software, scientific publications, access to employment opportunities, and more. Unequal distribution hinders progress in ocean science and sustainable management, exacerbating environmental challenges and their resulting impacts.

In particular, the human capacity to carry out ocean science is unequally distributed worldwide across locations, generations, and genders. The 2020 Global Ocean Science Report (GOSR) (IOC-UNESCO 2020) highlights ocean scientists' predominance in developed countries compared to many SIDS and LDCs. It also reveals a generational bias in many countries towards domination of ocean science by older generations, although many LDCs have a relatively young ocean researcher community. Female scientists comprise, on average, 38% of the researchers in ocean science, with significant variations across disciplines, levels of seniority, and between countries.

Capacity development is an essential tenet of the Ocean Decade and has been one of the critical pillars of the Intergovernmental Oceanographic Commission (IOC) action for several decades. It aims to achieve evenly distributed capacity across the globe, across generations, and across genders, thus reversing asymmetry in knowledge, skills, and access to technology. Increasingly recognised,

and particularly emphasised at the Ocean Decade Conference 2024, capacities come in different shapes and sizes and whilst some areas will benefit from development of, for example, infrastructure and technology, they may be rich in local knowledge which can be shared with others, even those privileged with more material capacities. The combined impact of capacity development and sharing efforts under the Ocean Decade must be exponentially greater than the sum of past and current individual efforts and thus accelerate a fundamental shift in how the ocean is perceived and managed. This increase will result both from a greater number of efforts, from enhanced coordination and focus of efforts, and from increased recognition of the diversity of capacities.

Ocean science is often understood as natural scientific research, which limits the representation of different approaches to understanding ocean systems and human-ocean interactions, particularly from social sciences and humanities, and marginalises traditional knowledge systems. Underlying this are large differences in acknowledging the ocean's value (and the need for ocean science) from the general public, and educational systems, up to the higher echelons of government. This contributes to the difference among countries in investing in ocean science and conservation.

Ocean Decade Challenge 9, of the United Nations Decade of Ocean Science for Sustainable Development 2021-2030 (the 'Ocean Decade') seeks to achieve "Skills, knowledge and technology for all." We suggest a change in this wording to "Skills, knowledge, technology, and participatory decision-making for all." As a Foundational Challenge, Challenge 9 cuts across all other Ocean Decade challenges. All of the White Papers that address the other nine Challenges mention capacity development as a key requirement for meeting their goals; see Annex 1. Relevant capacity is a requirement for all countries to enable equitable participation in and benefit from activities implemented through the Ocean Decade. Challenge 9 also recognises justice and equitability in resource and capacity distribution.

CHALLENGE 9

Ensure comprehensive capacity development and equitable access to data, information, knowledge, technology, and participatory decision-making across all aspects of ocean science and for all stakeholders.

The Ocean Decade Implementation Plan[2] provides a **strategic framework for capacity development** initiatives during the decade (Table 1).

It lists **requirements** specifying that capacity development carried out as part of the Decade should:

- Be an integral part of each Ocean Decade Action. In this sense, the endorsement criteria of the Decade include a consideration of contributions toward capacity development, including in SIDS, LDCs and LLDCs.
- Be needs-driven, with investment in tools that can match the demand for capacity development to different opportunities.
- Optimise opportunities for exchange of knowledge, information and learning through the adoption of a capacity development exchange approach, where relevant.
- Be developed to respond to regional and national priorities, including, where relevant, through the use of capacity needs assessments for specific groups or geographies.

[2] https://oceandecade.org/publications/ocean-decade-implementation-plan/

- Respect cultural and geographical diversity, for example in terms of language, technology adopted (including digital technologies), remote learning and methods of learning.
- Privilege long-term partnerships that build on existing resources and networks and avoid ad-hoc, short- term efforts that are not part of a coordinated approach.
- Include a focus on mechanisms to accelerate the use of knowledge for societal well-being.
- Target both knowledge generators and knowledge users, including scientists, industry, managers (for example, protected area or fisheries managers), policymakers, decision-makers, innovators, and society.
- Address all facets of ocean science, i.e. all relevant natural and social science disciplines including a focus on inter- and transdisciplinary approaches, the infrastructure and technology that supports ocean science, the application of science for societal benefit, and the science-policy and science-innovation interfaces.
- Recognize, respect, and engage local and indigenous knowledge holders as both beneficiaries and providers of capacity development.
- Build on and strengthen existing national and regional networks and resources.
- Identify and overcome barriers to gender, geographical and generational balance, and mainstream accessibility to foster full and effective participation by persons with disabilities.

A strategic framework has also been included within the Decade Implementation Plan to guide capacity development efforts throughout the Ocean Decade (Table 1).

We note that ocean literacy contributes to capacity development and is defined as the understanding of human influence on the ocean and the ocean's influence on people. Ocean literacy is an important topic that is intertwined with capacity development. However, we do not further comment on ocean literacy in this Challenge 9 white paper due to space limitations; Challenge 10 covers ocean literacy in greater depth.

Table 1: *Strategic framework for capacity development initiatives during the Ocean Decade*

DESIRED RESULT	PRIORITY ACTIVITIES
Human resources developed at individual and institutional levels	• Academic and higher education opportunities, including through online and distance learning. • Continuous professional development. • Sharing of knowledge and expertise, including through community building. • Training, including training of trainers. • Integration of ocean science in curricula in primary and secondary schools, including information on ocean science careers. • Actively improving gender, generational, and geographic diversity. • In-depth training on co-design that includes decolonial practices.
Access to technology and physical infrastructure established or improved	• Facilitating access to technology and infrastructure (e.g. research facilities, instruments, research vessels, high-power computing, digital telecommunications). • Developing skills to lead and participate in technology and infrastructure development. • Promoting technical and technological cooperation and peer-to-peer exchange between stakeholders.

Global, regional, and subregional mechanisms strengthened	• Identifying specific national and regional capacity development needs through needs assessments. • Strengthening existing national and regional resources and networks for capacity development. • Supporting regional and subregional organisations to be leaders in, and amplifiers of, capacity development.
Development of ocean research policies in support of sustainable development promoted	• Supporting identification of ocean research priorities. • Supporting the development of national marine science management procedures and national policies. • Support co-design, ensuring funders understand the need for additional time and resources to ensure participation of the most relevant regional and subregional organisations. • Identify barriers to good decision making and develop research and initiatives to address this.
Awareness and understanding increased and exchanges facilitated on role and values of ocean	• Develop ocean literacy research and initiatives. • Tailored ocean literacy programmes that target the difficult to access stakeholders, including big industry, managers and policy makers. • Informal education, including through demonstrations, museums, zoos or aquariums, online outreach portals. • Public information and communication.
Sustained, long-term resource mobilisation reinforced	• Mobilising in-kind and financial support for capacity development initiatives as part of the Ocean Decade .
Diverse representation in decision-making spaces, redressing of imbalance through inclusive co-design, listening to all relevant voices	• Ensure that there is meaningful representation at decision-making spaces and people from diverse backgrounds can meaningfully contribute to decision-making, including regional and international policy. • Promote active participation of the most relevant researchers and participants, including access from LDCs and SIDS to co-creation activities at all levels by: - Understanding the barriers to participation, and methods to overcome them; - Balancing language, culture, power, geography, gender and accessibility in co-design processes and dialogues, including consideration of researcher positionality; - Creating / inspiring inclusive funding and governance frameworks; - Improving facilitation skills within teams striving for co-design.

What will be truly transformative for Challenge 9 is that the Decade will aim to combine the existing capacity development initiatives of multiple UN organisations, UN Decade-endorsed activities, and the activities of other organisations, which will collectively promote truly cross-sectoral and inter-sectoral collaboration, essential to address the global ocean challenges.

2.2 Overview of Current Work in the Ocean Decade

The Ocean Decade Implementation Plan[3] states that Ocean Decade capacity development efforts will focus on, but will not be limited to, LDCs, SIDS and LLDCs. The resource needs for SIDS, LDCs and LLDCs to participate in capacity development efforts will be addressed as part of resource mobilisation efforts. The Ocean

[3] https://oceandecade.org/publications/ocean-decade-implementation-plan/

Decade has endorsed a large number of programmes, projects, and other decade actions seeking to support skills development for women, early career ocean professionals (ECOPs) and marginalised communities, to promote findability, accessibility, interoperability, and reusability of ocean data and knowledge, and to promote access to the ocean by all. At present, roughly 15 percent of the Decade Actions within the UN Ocean Decade relate primarily to Challenge 9, though all endorsed programmes must demonstrate how they address capacity development, and systematically report on capacity development initiatives.

A Capacity Development Facility (CDF) 2-year project was started in 2023 to identify and address the capacity development needs of partners involved in Ocean Decade Actions, build on the strengths and expertise of IOC-UNESCO in capacity development, and build connections among experts across the globe with a particular emphasis on stimulating engagement and strengthening support to ECOPs, SIDS, and LDCs. The establishment of the CDF highlights the foundational nature of Challenge 9 and the importance of supporting capacity development to achieve all other challenges within the Ocean Decade.

2.3 Capacity Development work by IOC-UNESCO

The IOC CD strategy, developed by the IOC Group of Experts on Capacity Development (GE-CD) focuses on six outputs that are fully mappable to those referred to in Table 1, above.

IOC implements capacity development through its regional subsidiary bodies (RSBs) that cover the Caribbean and Adjacent Regions (IOCARIBE), Africa and Adjacent Island States (IOCAFRICA), Western Pacific (WESTPAC), and Central Indian Ocean (IOCINDIO). These bodies also collaborate closely with the IOC's global programmes to ensure equitable participation of the regions in the IOC global programmes. The WESTPAC region furthermore developed a number of "Regional Network of Training and Research Centers on Marine Science" (RTRCs).

To deliver continuous professional development, the IOC has developed the **Ocean Teacher Global Academy (OTGA)** (https://www.oceanteacher.org) that provides a comprehensive internet-based training platform that supports classroom training, blended training, and online (distance) learning.

In order to facilitate matching between CD offer and demand, IOC has also developed the Ocean CD-hub "Gateway to Ocean-related Capacity Development opportunities around the world."

2.4 Importance and Relevance of the Challenge for Sustainable Development

Sustainable use and development of ocean resources requires an understanding of the past, present, and future state of the ocean, and its use by people. This includes advocating for actions that make the ocean beneficial to all generations, with the overarching goal of enhancing the health and resilience of the ocean. To achieve this, it is crucial to address capacity needs across scientific, technological, institutional, financial, societal, and educational domains. Therefore, establishing equitable knowledge capacity across all sectors and geography is essential for sustainable development.

Capacity development efforts must focus on the capacity to do the science, as well as on the capacity to influence the design of the science and participate in co-design efforts. Projects that are effectively co-designed will help the community to avoid ``parachute science." Effective capacity sharing must address the capacity to understand scientific evidence and to use it to develop solutions for sustainable development. This also implies an increased capacity to understand why ocean science is vital for achieving the SDGs, as well as capacity development targeting a wide range of sustainable development solutions (for example, evidence-based policymaking, innovation, technology, indigenous-led community management, etc.). In this sense, capacity development targets include not only

scientists but must also include the users of knowledge, such as governments, policymakers, managers, innovators, communities or other stakeholders.

2.5 Methodology for Strategic Ambition Setting

Working Group 9 is composed of people from diverse backgrounds (natural sciences, social sciences, policy, law, technology, practice, etc.), geographic areas, genders, ages, and career stages. The co-chairs were asked to chair this group by the Ocean Decade Coordination Unit. The other Working Group members were chosen with input from co-chairs and especially from some members of the IOC Capacity Development Group of Experts on Capacity Development (GE-CD). Brief descriptions of the experiences of Working Group members in capacity sharing activities are given at the end of this document. The varied background of Working Group 9 is a core element of its methodology, as the Group recognizes that many of the challenges that fall under Challenge 9 of the Decade stem from a lack of representation and opportunities for participation in global ocean sustainability initiatives. Working Group 9 met regularly to discuss potential needs and solutions for Challenge 9.

To identify and map how to achieve the goal of Challenge 9 of the Decade, the Working Group conducted discussions and consultations. The suggested solutions were based on the collective expertise of the group. Following this internal discussion process, the reflections and proposed priority areas of the white paper were shared with the Decade's Capacity Development Facility. Insights from past surveys, including the 2017 and 2020 Global Ocean Science Reports (IOC-UNESCO 2017, 2020), the 2020 and 2022 IOC capacity assessment survey reports, and from the Capacity Development Facility, contributed to the reflections of this White Paper. The team sought inputs from other Ocean Decade WGs on their identified CD needs, either through conversations with WG co-chairs, text taken out of the other WG white papers, or both (see Annex 1). WG9 members attended events to gather feedback, including, the Indian Ocean Regional Decade Conference 2024, a prelude to the Barcelona conference; and the 'Empowering science, policy and society through co-design for sustainable ocean development' Ocean Decade Conference 2024 Satellite event, the findings of which have been used as evidence in this report (Whyte et al., 2024).

In addition, discussions were held with the IOC CD unit as well as with members of the IOC GE-CD to optimise the alignment of the IOC CD strategy and existing IOC CD activities as described above. Finally, most of the WG9 members attended the UN Ocean Decade conference in Barcelona, where the white paper was presented and discussed. Additional feedback from the conference was incorporated into the paper.

3. STRATEGIC AMBITION SETTING

3.1 Analysis of User Needs and Priorities

To set the strategic ambition, Working Group 9 identified a list of users and their needs and priority issues (Table 2), recognizing the relevance of cross-disciplinary and -sectoral users. The users are classified into Scientists, Resource Users, Educators/Communicators, and Managers/Policymakers (which includes decision makers). Additionally, national institutions and their managers will require capacity development, e.g., to improve infrastructure, institutional management skills, and the application of actionable science to guide policy

Table 2: *Analysis of User Needs and Priority Issues*

NEEDS	PRIORITY ISSUES
SCIENTISTS (WITHIN ACADEMIA, INDUSTRY, COMMUNITIES, AND OTHER SECTORS)	
Representation (geography, gender, age); career development; job security; funding; networking; recognition; infrastructure for observation and laboratory work (vessels, boats, equipment); computing and user interface software resources; internet access; membership in professional bodies; access to publications and best practices, including interdisciplinarity, social science, co-design, and positionality; international partnerships; the inclusion of local and traditional knowledge; and skills to lobby national government bodies to fund local science.	Disparities in geographical, gender, generational, funding, observational and laboratory infrastructure, internet access, and computing resources in developed countries, LDCs, and SIDS. Limited access to data and information in LDCs and SIDS. High cost of publishing open access. Underrepresentation of LDCs and SIDS scientists in publications, meetings, advisory boards, and committees. Emphasis on natural ocean science means social science and traditional and Indigenous knowledge can be overlooked or delegitimised.
RESOURCE USERS (INDIVIDUALS AND COMMUNITIES)	
Knowledge about the status of ocean resources; sustainable use and sharing; multiple user conflicts and resolution; conservation tools; access to best practices in resource use, co-creation and facilitation; enactment of the human right to participate in environmental decision-making, incorporating local and traditional knowledge, and empowering marginalised communities through inclusive co-design and enhanced civic literacy.	Limited knowledge about marine resources, multiple user conflicts. Limited knowledge and access to best practices in resource use and protection, and social engagement. Poor access to participation of users in marginalised communities in decision-making.
EDUCATORS AND COMMUNICATORS	
Communication skills across different stakeholder groups such as industry and business; translation services; publishing in multiple languages; digital and media literacy; cultural competence and awareness; best practices in education and teaching methodologies, including ocean literacy for nurturing ocean values; and curriculum development to include traditional knowledge.	Limited educational resources and opportunities in some areas, limited awareness of cultural needs in others. Global language divide and high cost of translation. Unrecognised biases that lead to unequal participation and representation of communities. Limited access to best practices in teaching and curriculum development. Need to engage with big industry and business.
MANAGERS AND POLICYMAKERS (INCLUDING GOVERNMENT WORKERS, INTERNATIONAL ORGANISATIONS, INDIGENOUS GROUPS, COASTAL MANAGERS, CIVIL SOCIETY AND INVESTORS)	
Basic knowledge of the ocean; policy formulation, analysis, and implementation skills; dialogue, negotiation, conflict resolution, and stakeholder engagement skills; understanding of international laws and agreements; funding and investment priorities, ocean financing and economic literacy; policy monitoring; evaluating systems; incorporation of traditional and indigenous knowledge in policy; cultural competence training; and knowledge from social science and co-designed research to support wider representation and understanding of social impacts.	Poor knowledge about the ocean, and inadequate skills in policy formulation, analysis, and implementation. Poor understanding of priority areas to fund and invest in. Inability to resolve resource use conflicts, limited skills in dialoguing, negotiation, and stakeholder engagement. Limited knowledge of social scientific evidence, global ocean equity, and awareness of local cultures and needs.

3.2 Definition of the Strategic Ambition for the Challenge

Challenge 9's strategic ambition is to build and develop comprehensive capacities required to understand and address the other nine challenges of the Ocean Decade. The desired outcomes of the Decade cannot be achieved if the existing gaps in skills, knowledge, and technology among the various users identified by the Challenge are not bridged. The strategic ambition has the following key objectives:

- Identify and map existing capacity (i.e. skills, infrastructure for ocean observation, technology including open-source software) within the Ocean Decade framework to establish target baselines for measuring progress.
- Develop and/or enhance technical, transdisciplinary and transversal skills required by scientists, resource users, educators, communicators, managers, and policymakers to study and sustainably manage the ocean.
- Promote co-leadership and representation of under-represented groups (i.e., women, ECOPs, people with disabilities, indigenous communities, scientists from LDCs and SIDS, and others) in the science, communication, management, decision making, and policy areas of the ocean.
- Create career development, employment, networking, and recognition opportunities for groups in LDCs and SIDS.
- Develop and/or enhance existing funding methods, infrastructure, and technology in LDCs, SIDS and other under-represented communities.
- Promote even distribution of funding, infrastructure, and technology (including open-source software) required to study and sustainably manage the ocean and encourage LDCs and SIDS to invest in ocean science.
- Remove barriers/restrictions to accessing ocean data, knowledge, and information among all users of the ocean, as well strengthen the capacity to use that information.
- Promote the translation of scientific data for different users including the use of data aggregation, visualisation, storytelling, etc.
- Promote constructive, multi-directional partnerships to find common user objectives that fulfil the needs of all.
- Encourage innovative solutions through technology for studying and sustainably managing the ocean.

3.2.1 Knowledge and Data Sharing

To achieve equitable knowledge and data sharing, the community needs open-access platforms and repositories where all researchers can share their findings and data freely. Open-access repositories that follow international standards for measuring and assessing coastal ecosystems will ensure that data sharing is not hindered. Technology and knowledge transfer across disciplines and among regions can be facilitated through partnerships, collaborative projects, and the sharing of best practices in data collection, analysis, and interpretation. Encouraging local scientists and those with traditional knowledge to participate in joint, co-designed research will improve equitability and strengthen research outcomes.

3.2.2 Partnerships

Partnerships and resources are essential for achieving the strategic ambition for this Challenge. Intersectoral coordination is key to forging partnerships, especially across various sectors involved as Decade actions. This allows integration amongst various sectors to cultivate the trust needed to promote shared management and decision making.

International cooperation

Inter-regional, sea basin, and international cooperation should be encouraged and

supported. Cross-cutting capacity development connects diverse stakeholders to ensure a joint effort in solving the Ocean Decade Challenges. However, collaborative, and transparent decision-making can be ensured only through guidelines and policies that address power discrepancies. Working groups should be created to facilitate the exchange of knowledge and practices among researchers at global and regional levels. Support should be given to regional initiatives and organisations in marine sciences. Operation of regional and multinational agreements such as Agenda 2030, BBNJ, and the Paris Agreement is critical for enhancing partnerships, funding, expertise, and technology.

Interdisciplinary and transdisciplinary Partnerships

Collaboration within and across natural and social scientific disciplines, as well as integration with practical expertise and traditional knowledge through transdisciplinary co-production, should be at the core of the Ocean Decade's efforts to identify efficient and equitable solutions to the Challenges. Such partnerships promote holistic approaches to understanding and managing marine ecosystems.

Intersectoral Partnerships

Collaboration among various sectors, including government agencies, academia, industry, non-governmental organisations (NGOs), and local communities, are essential for innovation and knowledge exchange to address capacity issues. Such partnerships leverage the strengths and resources of multiple sectors to promote comprehensive understanding and sustainable development of the ocean.

Donor and funding bodies

Cooperation among funding organisations and organisers of capacity development opportunities (training, workshops, courses, scholarships, participation in conferences/networks) should be fostered so that the LDCs and other under-represented groups have easy access to funders. The UN Ocean Decade may take on the role of aggregator of available funding opportunities.

Promoting Public-Private partnerships

The Decade should implement mechanisms for public-private partnerships to support capacity sharing, particularly to promote opportunities in LDCs and SIDS. The DCU should prioritise actions that foster researcher involvement from diverse sectors, encouraging funding agencies to allocate resources accordingly. The Decade should promote collaboration between research institutions and private industries to provide expertise and resources for technological innovations and encourage training programmes.

3.2.3 Approach to capacity development and exchanges

Skills development

The Decade should endorse actions that promote the training and empowerment of scientists from under-represented groups, as well as actions that support long-term exchanges between scientists in different regions. Scientists can learn from each other through such interaction: not only technical skills but also the cultural exchange of knowledge needed to navigate complex global problems. Long-term, sustained exchanges build the trust that is needed to engage in large and complicated projects. Training sessions should introduce user-friendly approaches and community engagement best practices. Virtual training has the advantage of having a lower carbon footprint and (often) a lower cost, but differences in time zones around the world present a perennially complex problem for online training. Many recognise that in-person engagement is often more interesting and helpful for building personal connections than virtual engagement.

Technology and Infrastructure

Technology and tools needed for ocean science illustrate how unequal infrastructure underscores many of the inequities in shared ocean knowledge. Such tools include the

internet – crucial for modern-day scientific research but relatively slow in many regions making both research and participation in virtual events difficult; research vessels – lacking in many regions; computing infrastructure – necessary for both data analysis and ocean modelling; and instrumentation. There is a need for the development of low-cost, easy-to-use, and easy-to-maintain instruments (e.g., Boss and Pagniello, 2021; Marcelli et al., 2021) for coastal observations in under-resourced countries. While oceanographic research and engineering groups conduct projects in this area, relatively few projects are by commercial instrument manufacturers. Mechanisms for technological advances, including competitions, research projects, partnerships with vessels of opportunity, and citizen science/educational initiatives, should be scaled up to ensure that a wide range of technologies are readily available to scientists in LDCs and SIDS to purchase, deploy, maintain, calibrate, and build themselves. Private industry could establish local research equipment vendors and remote offices to empower regions to build and maintain their own equipment expanding those companies' global reach while assisting capacity development.

The usefulness of ocean models, which are relatively cheap compared to observations, should not be overlooked. Similarly, satellite platforms for observing the ocean, while expensive to develop initially, offer high-quality observations that are free to the global public after they become operational. Models and satellites thus offer a valuable source of information at a comparatively low cost.

Funding

Lack of funding is a significant obstacle to implementing research projects in regions that lack resources. Such funding should be prioritised by policy makers and grantors, while ensuring that projects address the specific long-term needs of local communities. In addition to sustained support from the global north (e.g. funding agencies, philanthropy, and development banks) to LLDCS, LDCs, SIDS and other developing countries through funding, training, and capacity-building initiatives, there is a need to advocate for national/local policies that prioritise the funding of ocean science. Because cost is a significant barrier to publishing in international journals, financial support should be provided for authors in under-resourced countries.

Equitable Participation

Working Group 9 acknowledges that knowledge and data sharing include learning from and working with traditional and indigenous groups to develop a holistic view of sustainable ocean management. Sharing knowledge and data through international cooperation and networking is essential to deliver on the equity aspect of Challenge 9, and to deliver on the UN human right to access to information, public participation, and access to justice and effective remedies in relation to a healthy and sustainable environment[4], recognised as marine citizenship rights (Buchan et al., 2023). This can be achieved by advocating for inclusive policies that require global collaboration, and sharing of both scientific knowledge and data, and of traditional and Indigenous approaches to understanding and managing the marine environment. An inclusive participatory approach must be incorporated into policy frameworks, funding initiatives, and collaborative efforts to significantly reduce inequities in ocean science and foster a more inclusive and diverse research landscape.

3.3 Integration, Synergies, and Interdependencies with Other Challenges

Strong capacity sharing is required for all of the Decade challenges to be met successfully. Text from the White Papers by the other Ocean Decade Challenges that link to Working Group

[4] See https://www.ohchr.org/en/documents/thematic-reports/ahrc4353-good-practices-right-safe-clean-healthy-and-sustainable.

9 is provided in a table in Annex 1. Many themes emerge from the other White Papers that reflect the ideas herein. Those themes address the need for capacity sharing in the following situations: to create, manage, use, and disseminate datasets, model outputs, and ocean forecasts; in ocean policy and community groups as well as in ocean science; in data management and sharing; the need for effectively co-designed capacity development; the need for analyses of capacity gaps; the need for more widely distributed funding; and the need for more international partnerships and cooperation.

4. MILESTONES AND INDICATORS

4.1 Key Milestones and Indicators to Measure Progress and Success

Success will be reached when resources and knowledge are evenly distributed across all coastal communities so that all stakeholders can study the ocean and understand and manage it sustainably. While some dramatic changes are possible, e.g. allocating more resources to LLDCs, LDCs, SIDS, and diverse groups (women, ECOPs, people with disabilities), shifts in established practices may take time. A practical way to identify milestones in progress toward equitable distribution of research and knowledge is to have policymakers (governments, quasi-governmental organisations, and educational institutions) measure their success individually and share them with the Decade community. Achievements in some areas will naturally diminish barriers in others. Four steps are recommended for policymakers to address global inequities related to knowledge and data sharing: establish a baseline; track data; weigh the data; and implement changes. Specific milestones for the Ocean Decade are identified in Table 3 below.

Table 3: *Summary of Milestones and Indicators for the Challenge*

MILESTONES	INDICATORS
Increased participation and recruitment of minority groups (women, ECOPs, actors with disabilities, LDCs and SIDS) into ocean-related fields by 2030.	Numbers of women, ECOPs, and actors with disabilities recruited into ocean-related fields.
Increased number of new ocean sustainability science career supports, jobs, entrepreneurial and research opportunities created in LDCs and SIDS by 2030.	Number of young people mentored, number of jobs and research opportunities created.
More LDCs and SIDS subscribing to networks and professional bodies and participating in international meetings by 2030.	Numbers of practitioners in LCDs and SIDS subscribing to networks and professional bodies.
Increase in the number of ECOPS, LDCs and SIDS led and/or co-authored published peer reviewed scientific literature by 2030.	Number of peer-reviewed publications led or co-authored by ECOPs.
Increase in special programmes, courses, or modules developed and implemented for training for different groups by scientists, resource users, educators/communicators, managers, and policymakers by 2030.	Number of specialized programmes developed and implemented. Number of people trained.
Availability of an inventory of existing ocean science infrastructure and technology in the LDCs and SIDS by 2025.	Inventory of existing ocean science infrastructure and technology in LDCs and SIDS.
Availability of a plan for developing and evenly allocating infrastructure, technology and funding by 2025.	Availability of Infrastructure allocation plan.
Increase in infrastructure, technology and funding to LDCs and SIDS by 2030.	Number of new infrastructures, technology, and funding in LDCs and SIDS.
Increase in numbers of low-cost technologies developed and implemented in LDCs and SIDS by 2030.	Number of low-cost technologies developed and adopted.
Availability of a policy that promotes open access to ocean data and information by 2025.	Policy on open access to ocean data and information.
A compilation of standardized data formats, platforms, and guidelines for responsible and open data governance available by 2025.	A publicly available documentation of standardized data formats, platforms, and guidelines.
Availability of language accessibility and free translation programmes for ocean data and information sharing by 2026.	Language accessibility and translation services developed.
An increase in the number of partnerships, public and private, established to promote even distribution of resources.	Number of partnerships established.
Increase in the participation of LDCs, SIDS, and Indigenous and other under-represented communities in international consortia by 2025.	Number of practitioners from LCDs, SIDS, and Indigenous in international consortia.
Increased opportunities for inclusive confidence-building and mentorship to overcome systemic barriers to leadership faced by underrepresented groups.	Number of leadership and mentoring workshops that address systemic personal-professional barriers to career progression, such as confidence.
Enhanced recognition of different forms of knowledge that contribute to global ocean decision-making.	Availability of a policy that promotes recognition of different forms of knowledge about the ocean. Meaningful participation of indigenous people and local knowledge holders in decision making.

Increased training for members of underrepresented groups in grantsmanship and project management.	Number of grantsmanship and project management opportunities and success stories in underrepresented regions that are led by and co-designed by underrepresented groups.

5. CONCLUSION

Capacity sharing cuts across different sectors, with unique capacity needs for different ocean users, including researchers and scientists, resource users, educators/communicators, and managers/policymakers. The critical capacity gaps identified here include: geographical, gender, cultural, and generational disparities; unequal distribution of funding, ocean observation equipment, laboratory infrastructure, and computing resources; technological and digital divides between higher- and under-resourced nations; limited access to or capacity to manage data and information; high cost of publishing research, and the related underrepresentation of scientists from LDCs and SIDS in international journals and meetings; and language barriers in scientific sharing, advisory panels, and planning committees. Additionally, all resource users of the ocean need the following: knowledge about the state of marine resources, understanding of traditional knowledge related to resource use; access to best practices in resource use and protection, and the capacity to protect marine resources of all communities. Educators, communicators, managers, and policymakers require essential skills and tools to deliver their duties more effectively.

It is recommended that the Ocean Decade targets comprehensive capacity development in ocean science and related disciplines worldwide. The Ocean Decade will promote and expand existing Decade Actions and IOC capacity development programs and actions in place, as well as endorsing new Actions arising from the Decade challenges, to address inequalities in ocean science and resource sharing capacity The Ocean Decade should include the following actions:

a. Establish baselines for tracking progress and achievements within the Challenge;

b. Support more Ocean Decade Actions (ODA) that will promote and assist with the development of human resources at individual and institutional levels required across the entire value chain, from creating supportive regional and international networks to develop capacity, to facilitating opportunities to conduct ocean science and observation, to including local/indigenous knowledge, through data and information management, to policy advice and representation;

c. Support efforts to increase representation of currently under-represented groups (women, early career ocean professionals, Indigenous communities) in the science, communication, management, policy areas, and decision-making of the ocean;

d. Advocate for policies that require bottom-up international collaboration and data/knowledge sharing as current top-down approaches could exacerbate the power dynamic between researchers from high income nations and those in under-represented groups, and could result in meaningless "check boxes" for inclusion;

e. Endorse and support ODA that improve global access to technology, physical infrastructure, data, information, and exchange of diverse ocean knowledge;

f. Endorse and support ODA that encourage development of innovative fit-for-purpose technology solutions;

g. Endorse and support ODA that seek to remove language barriers between different users of the ocean;

h. Promote participation in projects that ensure equitable distribution of funding within across nations to invest in a truly global enterprise of ocean science and management;

i. Provide advice on bringing together policy and management specialists with scientists;

j. Relatedly, encourage constructive, multi-directional partnerships as well as regional and sub-regional coordination mechanisms, enabling equitable sharing of expertise, funding and other resources, and decision-making.

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Annex 1. Links to other Ocean Decade Working Groups

WORKING GROUP	LINKS OF OTHER WORKING GROUPS TO WORKING GROUP 9–TAKEN EITHER FROM TEXT OF THE OTHER WHITE PAPERS OR FROM CONVERSATIONS WITH THE OTHER WORKING GROUP CO-CHAIRS
1	There is a need for people to create and use datasets, and a need to translate the datasets into something that the wider community of stakeholders can understand. [There is a need for] capacity-building initiatives to assist countries in developing sound management solutions for plastic waste. Capacity building and the development of easily accessible databases and summary reports are imperative for efficient sharing of information and informed decision-making in our pursuit of combating marine pollution. Our third priority should be capacity building to help bridge the data gap between the Global North and the Global South, fostering the development and sharing of knowledge and technological solutions to mitigate marine pollution. Particular attention should be paid to improving countries' ability to comply with [data] protocols, which will not be effective without appropriate capacity and trained researchers. The key principles for the capacity development component of marine pollution are engagement, justice, and co-design. Two important aspects should be highlighted within capacity development: the disparities in capacities between the Global South and the Global North, and the widespread lack of participation by local communities in data generation and sharing. Consequently, there is a need to foster engagement with coastal, Indigenous, and marine resource-dependent communities, with a specific focus on involving scientists and community members from Global South countries, Least Developed Countries and SIDS in research activities and decision-making processes. A just capacity development component acknowledges and respects the unique needs of each community, comprehends their perspectives, and seeks to address the knowledge gaps identified not only by scientists, but also by the communities themselves.
2	There is a need for people to create and use datasets, and a need to translate the datasets into something that the wider community of stakeholders can understand. Communities in Small Island Developing States (SIDS) are particularly vulnerable to biodiversity loss and need capacity to monitor and use such information. The Ocean Decade should advance capacity building to develop and implement biodiversity strategies. A primary goal in addressing Challenge 2 is to develop the capacity to collect and share data and for people to easily understand, use, and apply information about marine life and ecosystems. This is closely linked to Challenge 9 (capacity development). The recommendation is that the Ocean Decade help Programs and Projects share core strategies for ecosystem-based management, monitoring tools, and sustainable development. This includes defining and understanding baselines for biodiversity and ecosystem status and change metrics and recognizing the value of biodiversity to an individual and to society. Meeting Challenge 2 depends on advances in Challenge 9. Ocean Decade Actions need to have well-defined co-design and capacity development goals and activities. Of particular importance is the development of a coordinating framework for formal education in ocean observing that focuses on the interoperability of data and information management.
3	There is a need for people to create and use datasets, and a need to translate the datasets into something that the wider community of stakeholders can understand.

	There are huge data gaps in the global south. Much of the capacity sharing needs to be done in the social science and policy realms. There is a need for promoting small-scale fisheries and aquaculture, promoting south-south as well as north-south knowledge sharing, separating knowledge into pre- and post-harvest components, understanding the circularity of connections between land and sea, and developing capacity for governance and monitoring of practices. There is a need for capacity to make sure that different groups (users, private sector, small-scale actors) are getting information. Capacity building is needed to overcome overfishing and other ocean management failures.
4	Capacity development and the exchange of knowledge will play pivotal roles in achieving the vision outlined in Challenge 4. To prioritise [investments in capacity development], a capacity and knowledge landscape map and gap analysis of the sustainable ocean economy should be undertaken. This is a necessary step to ensure that initiatives to increase capacity and knowledge are doing so in a measurable way and that they underscore equity, innovative solutions, and sustainability. A key facet of capacity development is the empowerment of local communities, particularly Indigenous groups who possess invaluable traditional knowledge and historic stewardship of the ocean as well as other vulnerable or marginalised groups. There is a need for trained (skilled) people to run ships, fish in a sustainable way, and employ new energy sources as society shifts towards greener energy. There needs to be more awareness of challenges facing local communities. Users need access to technology. There needs to be more capacity for information sharing, and training for management skills. Current institutional structures, at national, regional, and global levels, are laden by inefficiencies as well as a lack of inter-institutional coordination, compromising their ability to navigate complex ocean issues. This includes insufficient capacity, resulting in limited effectiveness, as well as systemic inequities leading to the uneven distribution of resources and benefits. Building the capacity of institutions, fostering inter-institutional collaboration, and establishing mechanisms for capturing, analysing, and sharing critical data are crucial to effectively manage and govern the ocean. [There is a need to develop] the provision of venture builder and incubator services to strengthen the capacity of communities and enable them to develop pipelines of viable enterprises and projects. [Funding should be developed to] support research, technology development, capacity development and innovative solutions aimed at addressing the challenges posed by climate change and other environmental stressors through a human-rights based approach.
5	International/intergovernmental science organisations have a role to play in developing best practices (including data management and sharing, and capacity development) for measurement of variables that show the status and impacts of mitigation and regulation. Partnerships between the various actors in each region will be required, for example, Morgera et al. (2023) make ambitious recommendations on implementing Strategic Ecosystem Assessments at the regional level through fair research partnerships, mutual capacity-building and technology co-development between least and well-developed states (termed the Global North and South), to fill key knowledge gaps and ensure ecologically meaningful management of BBNJ, including for the purposes of climate change mitigation.
6	[Effective coastal resilience] entails a comprehensive set of data covering environmental conditions, human activities, and socio-economic assets. On one side, there is a need for fair access to this information, while on the other, there is a necessity for capacity building, awareness raising, and investment in disaster recovery, as well as planning for risk mitigation and adaptation.

	People-centred warning systems include a focus on stakeholder engagement and responsibility sharing, multi-sensor observational networks, probabilistic impact forecasts, accessible communication at multiple levels through multiple communication channels and supported by technological innovations, and institutional capacity building, including strong inter-agency collaboration, as well as community level capacity building. At the community level, there is a critical need for capacity-building initiatives that empower local populations with the knowledge and skills required to understand, prepare for, and respond to ocean hazards. ...partnerships with international organisations, such as the Food and Agriculture Organization (FAO), the United Nations Environment Program (UNEP), the United Nations Development Program (UNDP), and others, facilitate collaborative capacity-building efforts. Developing capacity in coastal resilience is essential at both institutional and community levels, particularly for nations in the global south. Building capacity within institutions and local communities across various aspects of resilience, including Early Warning Systems (EWS), is crucial.
7	There is a need for the capacity for collecting, creating and using observations, and explaining to the public why they matter. We need to listen to local and indigenous groups describe what they want to get out of the process and co-design capacity development initiatives to meet those goals. We need to consider a values-based approach in which processes other than "traditional science" processes are valued. We need a funding mechanism, for example an Ocean SOFF (Systematic Observations Financing Facility - as managed by WMO) to support capacity in less developed regions, especially those with large EEZ to GDP ratios. White Paper 7 specific recommendations for capacity development: Strengthen and expand existing training programs for ocean observing, data collection, analysis and modelling, promoting innovation for data processing and synthesis, and embracing cutting-edge technologies to improve data collection for both in situ and automated data acquisition. Local technical and scientific expertise that is intergenerational and equitable needs to be supported and developed to handle the different observing data streams and models that can be applied to their national fisheries, tourism, ocean health and other blue economy resources. Quality data can only be acquired and analysed by properly trained people using reliable technology and infrastructure. For all stakeholders to be able to effectively use ocean data, we need to strengthen and expand existing training programs for data collection and analysis, promoting innovation for data processing and synthesis, and embracing cutting-edge technologies to improve data collection for both in situ and automated data acquisition. Local technical and scientific expertise needs to be developed to handle the different observing data streams and models that can be applied to their national fisheries, tourism, ocean health and other blue economy resources. Co-design of observing needs and ensuring community buy-in, training, and meaningful participation are an important part of supporting and sustaining observing into the future. Encouraging the sharing of software and data/analytical tools and capabilities (including training on their use) will significantly reduce the need to replicate or duplicate software, tools, and other digital resources. Disseminating the results in multiple languages will also be essential for the different stakeholders across geographic regions, particularly in developing countries, as well as to leverage Indigenous, traditional, and Western knowledge to bring innovative and solving capacities to ocean related problems affecting society. There also needs to be capacity building and training for policy makers to better equip them to feel more confident about using ocean data and knowledge to inform policy. As a community, the observing system facilitates knowledge exchange across all stakeholders and developing data-sharing standards, platforms and systems accessible to all, and jointly supports sustainable Blue Economy development addressing societal needs.
8	There is a need to train people to create and use data. A culture change is needed to convince people of the importance of data sharing. Priority is given to case studies located in SIDS and in coastal Least Developed Countries, as LDCs are expected to have less institutional capacity to identify, collect, digitise and share ocean data.

	To maximise engagement with the digital representation (both contribution to, and use of), we identify the need for facilities and resources for Capacity Development and training. These facilities and opportunities should: ● Take account of language barriers. ● Provide a space to learn how to use the digital representation resources but also how to contribute to it, as well as to new uses of it. ● Be a two-way mechanism, to also collate user feedback on the digital representation(s) products and services, for owners/custodians to incorporate and improve future iterations of base-layers, data-products, services. Consider both contributors and users of the digital representation at varying levels of ability and capacity access, to maximise sharing and use of Decade data resources.
10	[The Decade should] co-develop and share current best practice resources to increase capacity and confidence in impactful ocean communications. A key progress indicator is the increased confidence and capacity of storytellers to take an evidence-based approach to communications, including monitoring and evaluation of impact. [The Decade should] co-develop and share resources to increase teacher capacity and confidence in teaching about the ocean-climate with diverse learners in locally relevant, culturally appropriate ways.

Annex 2. Details on Working Group 9 members

Working Group 9 Co-chairs:

Brian K. Arbic (University of Michigan, USA) is a physical oceanographer and a professor at the University of Michigan. He co-founded the Coastal Ocean Environment Summer School In Nigeria and Ghana (COESSING; https://coessing.org), a UN Decade-endorsed project that has been running for one week every year since 2015, and the Global Ocean Corps and Conveyor (https://globaloceancorps.org), a Decade-endorsed programme aiming to build more capacity sharing projects around the globe.

Edem Mahu (University of Ghana) is a marine biogeochemist and a senior lecturer at the University of Ghana. She co-leads the Building Capacity in Ocean Acidification in the Gulf of Guinea (BIOTTA) project. She is involved in other capacity building activities including COESSING, the Global Ocean Corps and Conveyor, EQUISEA: The Ocean Fund for All, and the Citizen Observation of litter in Coastal Ecosystems (COLLECT) projects. She chaired the maiden West Africa Marine Science Symposium (WAMSS; https://oceandecade.org/events/west-africa-marine-science-symposium-wamss/) in Ghana which convened several scientists and non-scientists from the West African Sub-region and beyond.

Working Group 9 Members:

Kristina Alexander (Texas A&M University-Corpus Christi, USA) is the Endowed Chair for Marine Policy & Law at the Harte Research Institute for Gulf of Mexico Studies. Her work includes collaborating with small communities along the Gulf Coast without access to environmental attorneys to address issues such as limiting stormwater runoff, reducing coastal erosion, and addressing marine pollution. Additionally, her free publications put into plain language the legal issues facing the users of the Gulf including desalination, fishery competition, and protected species.

Pamela M. Buchan (University of Exeter, UK) is an interdisciplinary marine scientist with research experience in both natural and social marine sciences. As a consultant and Research Fellow, she researches marine governance and the relationship people have with the sea, with a focus on marine citizenship and participatory rights in marine decision-making. She worked for a decade in science communication in the UK, managing volunteers and building capacity in the science communication field and community. She is involved directly in marine decision-making at local scale in the UK, in ports

and inshore fishing, and served a term as a municipal city councillor, representing a coastal ward with high deprivation.

Juliet Hermes (South African Environmental Observation Network) leads a team focusing on observations, modelling, and research of the marine environment around southern Africa. In addition, Juliet manages the South African Polar Research Infrastructure and is a Professor at the University of Cape Town and the Nelson Mandela University. She has significant experience with developing and managing national, regional, and international multidisciplinary, ocean observations. Her passion is in fostering regional and international collaborations as well as capacity development. Juliet focuses attention on development through ensuring knowledge generation and sharing, as well as growing a diverse cohort of marine scientists.

Samina Kidwai (National Institute of Oceanography, Pakistan) is Director General and Senior Research Scientist with affiliation with the National Institute of Oceanography Pakistan. Over 29 years of experience in marine science in Pakistan. National representative of UNESCO IOC, IOCINDIO, Executive Council Group IV, SCOR, IIOE WG III. Member of the IMBeR Capacity Building Task Team 2010 onwards. Member of the UNESCO GE CD. Understanding in importance of international collaborations, Coordinator in several international collaborations of Pakistan. She has an MBA in Human Resource Management with special interest in Strategic HRM, Organisational Change, R&S, T&D.

Evgeniia Kostianaia (IOC-UNESCO, P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences, Russia) is the Global Coordinator of the UN Ocean Decade-endorsed Programme for Early Career Ocean Professionals ("ECOP Programme") and Consultant at IOC-UNESCO. The goal of the Programme is to support Early Career Ocean Professionals in their capacity development and work by providing meaningful networking, training, professional development, and funding opportunities and creating capacity for cooperation and knowledge exchange. Evgeniia is a marine environmental manager with research interests in marine pollution, ocean clusters, and impacts of climate change on coastal tourism, railway infrastructure, and food security.

Li Li (First Institute of Oceanography, China) is the director of the International Cooperation Department of the FIO and a senior scientist in marine geochemistry. She is currently the representative of the China National Decade Committee. FIO currently hosts the UNESCO/IOC regional training and research centre on Ocean Dynamics and Climate, as well as the UN Decade Collaborative Center on Ocean Climate Nexus. FIO also has a Decade Programme on Ocean to Climate Seamless Forecasting Systems. Li works to facilitate international training activities, international scientific cooperation projects on marine science and management, as well as conferences and workshops, etc.

Xin Lin (State Key Laboratory of Marine Environmental Science, College of Ocean and Earth Sciences, Xiamen University, China) is a biological oceanographer, and an associate professor at Xiamen University. She has experience in scientific research, public science education and policy consultation. She is a scientist member of the UN Decade endorsed project, Coastal-SOS, which aims to develop a novel partnership across academic institutions, industrial enterprises, non-profit foundations and NGO/IGOs for the co-delivery of science.

Sarah Mahadeo (Sasakawa Global Ocean Institute, World Maritime University, Sweden) has a background in Urban Planning, Marine Spatial Planning and Blue Economy and more than 10 years' experience spread across working in spatial planning practice, research and consulting. She has been involved in sharing capacity through different avenues including online and onsite technical training workshops, tertiary level classroom sessions as well as preparation of technical reports, policy briefs, academic papers, and book chapters. Recent collaborations include the UNESCO IOC ECOP Programme, the SwAM SIDA International Training Programme, the World Maritime University, the UNESCO IOC MSPglobal initiative, and the UN DOALOS Nippon Foundation SIDS fellowship Programme.

Elígio de Raús Maúre (Independent Researcher, Japan) is an oceanographer and researcher specialising in applied ocean colour remote sensing for water quality monitoring. With a wealth of experience in capacity development, he has been actively engaged as a member of ECOPs (Early Career Ocean Professionals), contributing to the co-design and delivery of training in remote sensing data analysis.

Cosmas Munga (Technical University of Mombasa, Kenya) is an Associate Professor of marine and fisheries sciences with experience in resource-use dynamics between small-scale fishery and bottom trawl prawn fishery in Kenya. Prof. Munga is an active member of the editorial board of the Western Indian Ocean Journal of Marine Science (http://www.wiomsa.org/wio-journal-of-marinescience/) and coordinates an Erasmus Mundus master of Science Degree in Tropical Biodiversity and Ecosystems (TROPIMUNDO) in Kenya (www.tropimundo.eu) where students from Europe spend a semester in Kenya for practical exercises and fieldwork.

Aidy M. Muslim (Institute of Oceanography and Environment (INOS), Universiti Malaysia Terengganu (UMT), Malaysia) is a full professor at the Institute of Oceanography and Environment, Universiti Malaysia Terengganu, Malaysia. He is a member of the IOC Group of Experts On Capacity Development (GE-CD) and a Co-Chair of the IODE OceanTeacher Global Academy since 2016.

Gail Sant (Nippon Foundation-University of Edinburgh Ocean Voices Programme, UK) is an ECOP from Malta who is working at the intersection of climate, ocean, and community. Through her work with the Ocean Voices programme, Gail works to facilitate research and policy opportunities and partnerships for ocean thought-leaders in low- or middle- income countries who have the expertise, skills, and ideas to support a global, transformative shift towards an equitable ocean for all.

Sophie Seeyave (Partnership for Observation of the Global Ocean (POGO)) is the CEO of POGO, an international organisation that brings together over 50 oceanographic research institutes to promote and support global ocean observations. One of the three pillars of POGO's mission is capacity development for ocean observing, which POGO has been working on for 25 years, through visiting fellowships, visiting professorships, shipboard training, an alumni network, funding for collaborative research projects, low-cost technology development, and more.

Zhen Sun (WMU-Sasakawa Global Ocean Institute, World Maritime University, Sweden) is an Associate Professor (Research / OSGM) at the World Maritime University (WMU) where she researches and teaches on law of the sea and ocean governance. WMU's mission is to provide postgraduate maritime and oceans education, professional training, and research, and build global capacity and promote sustainable development. Dr. Sun is the Co-Principal Investigator for a research and capacity building programme on Empowering Women for the Ocean Decade, which is an endorsed Decade Action.

United Nations Decade of Ocean Science for Sustainable Development (2021-2030)

Proclaimed in 2017 by the United Nations General Assembly, the UN Decade of Ocean Science for Sustainable Development(2021-2030), provides a convening framework to develop the scientific knowledge and partnerships needed to catalyse transformative ocean science solutions for sustainable development, connecting people and our ocean. The Ocean Decade is coordinated by UNESCO's Intergovernmental Oceanographic Commission (IOC).

Established during the Preparatory Phase and to continue throughout implementation until 2030, the IOC's Ocean Decade Series will provide key documentation about this global initiative and aims to serve as a primary resource for stakeholders seeking to consult,monitor and assess progress towards thevision and mission of the Ocean Decade.

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