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2025 United Nations Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
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Item 9 of the provisional agenda*
Ocean Action panels

Ocean Action panel 2: Increasing ocean-related scientific cooperation, knowledge, capacity-building, marine technology and education to strengthen the science-policy interface for ocean health

Concept paper prepared by the Secretariat

Summary

The present concept paper was prepared pursuant to paragraph 24 of General Assembly resolution 78/128, in which the Assembly requested the Secretary-General of the 2025 United Nations Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development to prepare concept papers on each of the themes of the Ocean Action panels, taking into account the relevant ocean-related processes of the Assembly and other possible contributions. The present paper relates to panel 2, on the theme "Increasing ocean-related scientific cooperation, knowledge, capacity-building, marine technology and education to strengthen the science-policy interface for ocean health". In the paper, the status, trends, challenges and opportunities for the achievement of relevant targets of Sustainable Development Goal 14 are set out, under the overarching theme of the Conference: "Accelerating action and mobilizing all actors to conserve and sustainably use the ocean".

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I. Introduction

1. A healthy ocean underpins food security and livelihoods, supports sustainable and resilient economic growth, regulates the climate, hosts vital biodiversity and ecosystems and is a unique source of cultural values for many communities around the world. However, increasing threats to the ocean, such as climate change, land- and sea-based marine pollution, and the unsustainable loss of biodiversity and ecosystems, are making the capacity of the ocean to continue to perform these functions uncertain. Recent assessments of progress towards Sustainable Development Goal 14 indicate that, despite some advancements, the overall scale and speed of progress remain insufficient. Negative trends are being reported across numerous issues, including increasing pollution from nutrients and other sources, continued upward trends in ocean warming and acidification, decreasing oxygen levels, rising sea levels and intensifying impacts from harmful algal blooms. Climate change is amplifying these stressors, which interact in complex, poorly understood ways, jeopardizing marine and coastal ecosystems and the people and economies that depend on them.

2. The global population is projected to grow by 2 billion over the next 25 years, further intensifying the pressures on coastal and marine resources and increasing the number of people vulnerable to coastal and ocean hazards. Concurrently, the ocean economy is expanding faster than most other sectors, driving demand for – and conflicts over – maritime space. This rapid growth is exacerbating pollution, habitat destruction and other negative impacts from coastal and ocean-based infrastructure development. Despite many advances in the 2030 Agenda for Sustainable Development and its Sustainable Development Goals and targets, most States still lack the technological and human capacity to prepare for and deal with such situations in a timely manner.

3. Identifying and operationalizing actionable solutions to mitigate threats and ensure sustainable ocean use require a strong governance framework, the implementation of which should be rooted in relevant and timely ocean science and knowledge. A rigorous and inclusive science-policy-society interface that supports the co-design and co-delivery of science and knowledge and that works along diverse impact pathways to inform decision-making at all levels, from local to global, is essential. Ocean-related scientific cooperation must foster collaboration across all societal actors, from industry to civil society and beyond. This includes achieving consensus on scientific priorities and addressing significant and systemic discrepancies in access to skills, data and technology that persist for small island developing States, the least developed countries and other marginalized and historically underrepresented groups, including Indigenous Peoples and local communities, women and girls and young people.

4. In its resolution 79/144, the General Assembly reaffirmed the cross-cutting role of ocean science in Sustainable Development Goal 14 and recalled the importance of marine science in understanding, preventing and reducing impacts on the ocean and preserving the integrity of marine ecosystems and in the development and implementation of management and decision-making tools. It highlighted the role of marine science in eradicating poverty, enhancing food security, conserving and sustainably managing marine environments and resources, understanding, predicting and responding to natural events, and promoting the sustainable development of oceans and seas.

5. A set of legal and policy tools is needed to achieve many common goals. In that regard, a comprehensive legal regime for marine scientific research is set out in part XIII of the United Nations Convention on the Law of the Sea. In addition, the third

cycle of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects, for the period 2021–2025, along with its third World Ocean Assessment, will enhance the scientific basis for policymaking and governance. The United Nations Decade of Ocean Science for Sustainable Development (the Ocean Decade) provides a global framework for collaboration, in order to advance ocean science from knowledge to actionable guidelines for decision-making, addressing ongoing challenges and driving solutions. Other related initiatives, such as the United Nations Decade on Ecosystem Restoration, also contribute to enhancing collaboration, capacity enhancement and the exchange and delivery of science outputs of benefit to marine ecosystems.

II. Status and notable trends since 2022

Governance and policy frameworks

6. Since 2022, there have been significant advances in the global legal and policy framework, all of which are dependent on science and knowledge, either through unlocking and increasing the accessibility of existing data or through the generation of new knowledge. The adoption in 2023 of the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction constitutes a landmark achievement. The Agreement is grounded in science, with the use of the best available scientific information being recognized as a guiding principle for its implementation and playing a central role in supporting the work of the institutional arrangements of the Agreement. As a result of the adoption in 2022 of the Kunming-Montreal Global Biodiversity Framework, the place of marine and coastal issues has become significantly more prominent on the global biodiversity agenda, and the importance of science and knowledge for effective implementation of the Framework's targets, including through national biodiversity strategies and action plans, has been recognized. The ocean and climate change dialogue under the United Nations Framework Convention on Climate Change provides a formal entry point for ocean issues, including ocean science and knowledge, into the global climate agenda. Negotiations to develop an internationally legally binding instrument on plastic pollution, including in the marine environment, are ongoing.

Sources of scientific knowledge

7. Established by the General Assembly, the Regular Process, through its World Ocean Assessments, provides a synthesis of the latest science available on the state of the world's ocean and the social, economic and cultural activities related to the ocean. It also provides essential information for decision makers to support sustainable ocean management and various international processes. The third World Ocean Assessment, which is nearing finalization and is scheduled to be approved by the Assembly in December 2025, includes enhanced socioeconomic components, expanded coverage of tools and frameworks for sustainable development and broader regional perspectives.

8. The 2025 edition of the *Global Ocean Science Report*, produced by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization to support reporting against target 14.a of the Sustainable Development Goals, will provide updated information on investments in ocean science capacity and infrastructure. It will also provide information on the disciplinary, gender and demographic aspects of ocean science and on where and how science outputs are being applied.

9. The 59 global programmes and 535 national and regional projects endorsed under the framework of the Ocean Decade are generating science and knowledge across 10 Ocean Decade challenges, ranging from marine pollution to the ocean-climate nexus, sustainable blue foods and coastal resilience. The focus of the Ocean Decade in the second half of its implementation will be on consolidating and increasing the accessibility of the vast amounts of science and knowledge being generated through those programmes and projects.

10. Sectoral assessments also exist. For example, since 1971, the Food and Agriculture Organization of the United Nations (FAO) has been publishing regular analyses of the state of fishery stocks, including the summary updates presented in its flagship publication *The State of World Fisheries and Aquaculture* since 1994. At the 2025 United Nations Conference to Support the Implementation of Sustainable Development Goal 14, the new edition of the FAO publication *Review of the State of World Marine Fishery Resources*, including an updated methodology for assessing global marine fishery resources, will be launched. Developed through collaboration among over 650 experts from 92 countries and 200 organizations, the new approach evaluates approximately 2,600 fish stocks, making it the most comprehensive and participatory assessment ever conducted.

11. The *Special Report on the Ocean and Cryosphere in a Changing Climate* of the Intergovernmental Panel on Climate Change has been critical in assessing the role of the ocean and cryosphere in the Earth's climate system and in understanding the impact of climate change on the ocean and assessing the options for taking science-based action.

Inclusive scientific cooperation

12. Since 2022, there has been significantly growing recognition of the importance of co-design and co-delivery of ocean science involving knowledge holders, generators and users. There have been substantial investments in building skills and sharing approaches for co-design, including in small island developing States and the least developed countries. There has also been greater analysis and understanding of the diverse impact pathways that allow science and knowledge to inform decision-making at various scales and in diverse ways, as well as a growing body of research on the tools, skills and resources needed for a rigorous and sustainable science-policy-society interface.

13. Increased recognition of the importance of inclusivity in scientific cooperation is reflected in the increased attention to Indigenous and local knowledge as an equally valuable source of information and insight. Most attention has been focused on the increased engagement of Indigenous Peoples and local communities in scientific initiatives; however, further support is required for Indigenous-led research. In addition, systemic barriers must continue to be identified and addressed in order to enable the full participation of marginalized and historically underrepresented groups, including women and young people, in the generation and application of ocean science for decision-making.

Capacity development and ocean literacy

14. Capacity development is required for the full and active participation of groups across society in ocean science. Through targeted initiatives, a large number of United Nations agencies and partners have contributed to capacity development in ocean science at the global, regional and national levels since 2022. Such contributions include the development of human resources at the individual and institutional levels; the establishment or improvement of access to technology, physical infrastructure, data and information; the promotion of ocean research policies in support of

sustainable development; and increased visibility, awareness and understanding of the values of the ocean and ocean research in relation to human well-being and sustainable development. However, despite significant investments and advancements, capacities and skills associated with ocean science remain uneven across locations, generations and genders. A lack of coordination across different initiatives undermines the effectiveness and sustainability of impacts.

15. Recognition of the importance of increased ocean literacy across all sectors of society as a means of triggering behaviour change has increased since 2022. Numerous initiatives are being implemented, with increasing international coordination and collaboration, including through the framework of the Ocean Decade. There have been significant achievements in the integration of ocean issues into educational curricula and the expansion of ocean literacy programmes targeting policymakers and the private sector. Work is ongoing to develop national baselines of perceptions of the value of the ocean and to define methods to measure the translation of ocean literacy efforts into individual and institutional behaviour change.

Marine technology

16. Marine technology provides opportunities for enhancing cooperation, capacity development and education. Innovation in technologies, in particular in the development of low-cost, widely deployable equipment, the expansion and sharing of satellite-derived observations, and analysis-ready tools and modelling platforms, contributes to empowering underserved Member States to build and maintain their own infrastructure. Since 2022, the Global Ocean Observing System has continued to expand, with the Array for Real-time Geostrophic Oceanography (Argo) platform now collecting information on ocean warming at depths below 2,000m (DeepArgo) and on ocean carbon storage (BGC-Argo). The roll-out of new or enhanced automated technologies (e.g. uncrewed surface and subsurface vehicles, drones, and satellites) and the involvement of industry (e.g. through the Fishing Vessel Ocean Observing Network) is also expanding observation in coastal and ocean systems. Marine life in remote, hard-to-access regions is now being regularly monitored using satellite and automated technologies, thereby supporting conservation and management efforts.

17. Artificial intelligence and machine learning are assisting in processing and translating observations into information for a wide range of users, including managers and regulators. Modelling efforts that integrate multiple data streams are advancing the development of digital twins in a number of regions, enabling an improved understanding of the impact of human activities, interactions between users and impacts, and testing of management strategies to mitigate impacts and provide for equitable sharing of resources and their benefits. Developments in data processing and the expansion of observation are enabling new capacities in early warning systems, including forecasting marine heatwaves and harmful algal blooms, to be built, thereby strengthening resilience in fisheries and aquaculture. The S-100 Universal Hydrographic Data Model will contribute to safer and more efficient navigation, to marine spatial management and to the protection of the marine environment.

III. Challenges and opportunities

18. The present section sets out the challenges and opportunities that have emerged or become more urgent since the 2022 United Nations Conference to Support the Implementation of Sustainable Development Goal 14. Where relevant, the section includes interlinkages and synergies between Goal 14 targets and other Goals.

Ocean observations and data underpinning scientific knowledge

19. The central role of ocean observation systems as the fundamental and first step in the value chain of ocean-related scientific knowledge cannot be overemphasized. Ocean observation systems must be recognized as critical infrastructure and resourced accordingly. However, they continue to suffer from a lack of investment and coordination. Significant gaps remain in the coverage of existing networks, spatially and in terms of the variables observed, as well as in the form of barriers to accessing, sharing and using the acquired data. There is a need for substantive expansion of coastal observations within and beyond national jurisdiction, as well as of marine biodiversity, carbon and deep-ocean observations. To that end, where multiple agencies may be involved in ocean observations and research, national-level coordination challenges must be overcome. International coordination is also essential, in particular in addressing data and information gaps in areas beyond national jurisdiction. The Global Ocean Observing System 2030 Strategy provides an overview of the existing challenges and a framework to expand and strengthen the ocean observing system to meet the growing demands of policymakers, private sector users and the general public. However, in order to attain an interconnected system that meets the demands of society, substantive resource commitments will need to be made at the national, regional and international levels, and investment in the coordination of the Global Ocean Observing System will be required.

20. Access to data, information and knowledge is critical for an integrated, science-based approach to the management of human activities in coastal and open ocean areas. A lack of quality control in data sets, a lack of interoperability of different data platforms, “hidden” or unexploitable data sets, a lack of data sets tailored to regional or national scales and a lack of skills in accessing and analysing data are among the challenges in understanding ocean processes. Such challenges hinder the capacity of stakeholders from across society to use relevant data to make informed decisions. Prediction, forecasting and modelling applications and services are essential to delivering societal outcomes and benefits of ocean knowledge, including early warning systems for ocean hazards. Stakeholders in the least developed countries and small island developing States are particularly affected by the lack of accessible data. In order to achieve a holistic digital ecosystem and the integration of science-based approaches at scale, countries will need to increase cooperative efforts and investments in infrastructure, scale up the adoption of innovative technologies, and address current inequities in access to and the use of quality-assured observations and data sets.

21. Such efforts are particularly important in cases in which the use of internationally accepted technical standards and the associated regulatory frameworks enables scientific data to be made available to ocean users who would otherwise not have access to relevant science. For example, the e-navigation strategy of the International Maritime Organization (IMO) sets out the future regulatory environment for shipping, including the use of new technology, such as the S-100 Universal Hydrographic Data Model, which allows for interoperable thematic layers, such as marine protected areas, and real-time oceanographic data to be presented in navigations systems, reducing the impact on ecosystems and reducing pollution through more efficient route planning.

22. Public-private collaboration to unlock privately held data sets, to advance the development and deployment of technologies and modelling systems and to advance data management will be important, in particular to unlock industry-held data sets in line with commercial and legal requirements for data-sharing. There is also a need for significant efforts in capacity development and technology transfer to developing countries in order to enable access to new technologies and data, for which the

Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction, with its part V dedicated to capacity-building and the transfer of marine technology, will provide significant opportunities when it enters into force.

Persistent and emerging gaps in scientific knowledge

23. There are persistent gaps in the knowledge and understanding of the ocean, as well as emerging gaps in knowledge stemming from the rapid acceleration of threats to the ocean, including climate change, new technologies and emerging economic activities. The Ocean Decade Vision 2030, a year-long process coordinated in the framework of the Ocean Decade in the lead-up to the 2024 Ocean Decade Conference, engaged more than 150 experts from across all sectors of society with a view to identifying gaps and needs in ocean science in order to inform policy and decision-making. The results of the process were discussed at the 2024 Ocean Decade Conference, and the resulting Barcelona Statement contained a series of priorities for the generation and use of co-designed and co-delivered science. Those priorities have since continued to be refined, including through reference to the recommendations of the scientific commission of the 2025 One Ocean Science Congress. They will inform the implementation of activities in the second half of the Ocean Decade and provide a foundation for discussions at the 2025 United Nations Conference to Support the Implementation of Sustainable Development Goal 14 on the most pressing needs for collaborative action in science and knowledge generation, namely:

(a) Understanding the global distribution and human health and ecosystem impacts of marine pollution across the land-sea continuum, including the identification of priority pollutants and consideration of emerging and unregulated pollutants;

(b) Enhancing and scaling up marine and coastal ecosystem-based management approaches, including a focus on a better understanding of, and solutions for, multiple stressors, including human impacts and climate change;

(c) Better understanding deep-sea biodiversity, ecosystems and ecosystem services and improving knowledge of vulnerability to climate change and the impacts of new or emerging economic activities;

(d) Increasing knowledge to underpin sustainable, resilient and equitable small-scale fisheries and aquaculture and to facilitate the sustainable management of industrial fisheries;

(e) Better understanding the role of the ocean as a food source in order to strengthen sustainable aquatic food production and innovation, with a focus on developing countries and strengthened public-private partnerships. Aquatic foods have great potential to contribute to healthy diets and to improve food security and nutrition. They are an excellent source of macronutrients and micronutrients, but there are some challenges in fully understanding their potential contribution to feeding a growing population;

(f) Advancing climate-informed fisheries management by systematically integrating climate change considerations into the fisheries management planning and implementation cycle, which may include incorporating finer-scale climate projections into fisheries policies and decision support tools, strengthening scientific evidence for climate-proofed fisheries infrastructure, and enhancing monitoring and early warning systems (e.g. for harmful algal blooms) to support the adaptive management of fisheries resources;

(g) Accelerating efforts and investments to achieve a fully mapped seabed by creating a favourable policy environment that results in increased funding, the

advancement of suitable technology and increased data-sharing based on fair principles. While progress has been made towards a fully mapped seabed (from 6.0 per cent mapped in 2016 to 26.1 per cent in 2024), upward of 70 per cent still remains unmapped. Given that the shape and nature of the ocean floor informs the understanding of fundamental ocean processes, targeted efforts will be required to achieve a fully mapped seabed;

(h) Generating data, information and skills to support the development of sustainable ocean-based economies, including through evidence-based sustainable ocean plans at the national level and in relevant transboundary areas. This includes the use of national ocean accounting systems with the aim of encouraging sustainable and climate-resilient ocean economy projects, prioritizing those that integrate environmental conservation with socioeconomic benefits for local communities and that are founded on partnerships with the private sector;

(i) Rapidly generating knowledge to scale up climate mitigation, including through marine renewable energy and the management of coastal ecosystems, and to enable timely understanding of the technical, ecological and social feasibility and potential impacts of proposed marine carbon dioxide removal initiatives and contribute to future policy and regulation development;

(j) Generating science and knowledge to underpin adaptive governance and management systems and decision support tools for the assessment of vulnerability and risk to coastal communities and marine industries from ocean and coastal hazards, including climate change, and to support the development of multi-hazard early warning systems;

(k) Developing the evidence base to support economic models, policies and innovative financial instruments to diversify and accelerate investment in ocean science, including for the enhanced digital representation of the ocean, and sustained and sustainable ocean observation and infrastructure;

(l) Unlocking and generating new knowledge drawn from transdisciplinary social science and ocean literacy research on the human-ocean relationship, behaviour change and cultural engagement that can be integrated into Ocean Decade digital infrastructure and used to map and measure the impact of ocean literacy initiatives;

(m) Increasing engagement with the health sector as a means of better understanding connections and knowledge gaps in relation to the links between ocean health and human health;

(n) Strengthening the empowerment of Indigenous leadership in the co-design and co-delivery of ocean science and knowledge, and supporting Indigenous-led research.

Capacity development and transfer of marine technology

24. Part XIV of the United Nations Convention on the Law of the Sea relates to the development and transfer of marine technology and requires States to cooperate in accordance with their capabilities to actively promote the development and transfer of marine science and marine technology on fair and reasonable terms and conditions. However, ad hoc, poorly coordinated and unsustainable capacity-development and marine technology transfer activities exacerbate the geographical, gender and generational disparities in the effective generation and use of ocean science and knowledge. The need for capacity development has never been greater. The role of and specific needs for capacity development, at multiple scales, are identified under the global legal and policy framework for ocean issues. States lack the capacity to promptly act and solve emerging issues affecting the health of the ocean. Major gaps

relate to insufficiently trained human resources, deficient technological infrastructure, and non-existent or embargoed data and information that relate to the use and management of the ocean.

25. Effective capacity development is an essential tenet for achieving more evenly distributed capacity across the globe, across generations and across genders and, thus, reversing asymmetry in knowledge, skills and access to technology. Aligned with the Criteria and Guidelines on the Transfer of Marine Technology of the Intergovernmental Oceanographic Commission, the strategic framework of the capacity-development strategy of the Commission serves to emphasize innovations in marine science and technology with a view to stimulating sustainable socioeconomic benefits derived from ocean-related activities. The Guidelines have been instrumental in advancing the objectives of the 2030 Agenda, in particular Sustainable Development Goal 14, which prioritizes enhancing scientific knowledge, research capacity and technology transfer to safeguard ocean health and support developing States, including small island developing States and the least developed countries. The Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction, which includes the objective of promoting international cooperation in marine scientific research and in the development and transfer of marine technology is also expected to contribute significantly in that regard once it enters into force, including with a dedicated capacity-building and transfer of marine technology committee.

26. Ocean observation provides a clear example of the multiple, interrelated challenges that exist in research capacity and the transfer of marine technology. Developing research capacity and transfer of marine technology for sustained ocean observations requires investing in people and their institutions so that they can build infrastructure and long-term support networks with better access to data, tools and technologies. While this can be facilitated by international initiatives, it needs support nationally and internationally if it is to be sustained. Capacity development needs to occur at all stages of the ocean observation process, from identifying needs and designing systems to the transformation of data into products and information. This includes the use of best practices at all levels of the process, from instrument deployment to data collection, data analysis, data modelling and management, and in the final reporting.

27. Extended training of ocean practitioners can be a successful mechanism to accelerate equitable capacity development. When individuals enhance their capabilities, there is a higher chance that the knowledge gained is multiplied to the institutional levels, with long-lasting impacts. The recent development of marine and maritime academies and training programmes has enabled knowledge-sharing beyond excellence centres and significantly increased upskilling opportunities. Such initiatives, which are often outside formal education systems, tackle specific knowledge gaps and are designed to address societal demands. For example, to improve the effective implementation of marine protected areas, the online Marine Protected Area Tool Hub,[1] a learning platform, has been launched by the United Nations Environment Programme, the Nature Conservancy, the World Wide Fund for Nature and partners to support the effective and equitable development and implementation of marine protected areas. At its core, the Tool Hub provides an innovative, easily accessible problem-solving and “learning journey” platform that applies machine learning algorithms to identify insightful guidance, decision support tools and practical knowledge to support marine protected area planners and practitioners at the different design and implementation stages.

[1] Available at https://mpath.unep.org/.

Working across the science-policy-society interface

28. Strengthening the science-policy-society interface to ensure that decision makers understand the value of ocean science and knowledge in informing decision-making and to ensure that knowledge is available in readily accessible forms and ultimately incorporated into policy and decisions is critical for numerous facets of sustainable development. Despite increased recognition of the need for science to inform policy and management, gaps remain between the science community and policymakers and decision makers. While there are numerous national and regional examples of bridges being successfully constructed between the two communities, there is a need to further increase efforts to systematically engage policymakers and decision makers in co-design approaches that allow the generation of relevant and timely knowledge, as well as the uptake of that knowledge in accessible forms. This approach is required at the global, regional and national levels, for example to ensure that Member States can fulfil national commitments to global policy frameworks.

29. At the global level, the World Ocean Assessments represent a comprehensive scientific basis containing up-to-date knowledge on various ocean-related issues for consultation by Governments, stakeholders involved in intergovernmental processes and all policymakers who are involved in ocean affairs to enable them to position their decisions more effectively in the context of ocean science. Tailored assessments and syntheses are required to meet regional and national needs and inform decision-making at all scales.

30. Sustainable ocean planning, as committed to by the members of the High-level Panel for a Sustainable Ocean Economy, is an emerging framework aimed at strengthening the science-policy interface. It is a broad concept that incorporates diverse tools and approaches but fundamentally relies on participatory, multisectoral approaches to use natural, economic and social science for spatial and temporal decision-making in coastal and marine areas. Marine spatial planning is one example of a tool that represents an important opportunity for improved integrated management through the adoption of a multi-stakeholder participatory process for decision-making.

31. Area-based management tools offer an opportunity for improved integrated management through the adoption of a multi-stakeholder participatory process for decision-making (e.g. other effective area-based conservation measures for fisheries and measures such as area-based management tools, including marine protected areas, under the Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction). Many other examples of science-based planning tools exist across the United Nations system. Areas in which further research is needed to improve the science-policy interface include existing and new technologies for compliance and ecological monitoring in remote areas (such as satellites or vessels for combating illegal, unreported and unregulated fishing).

32. In the context of marine fisheries, regional fisheries management organizations are an example of means to enhance the effectiveness of the science-policy interface by ensuring that existing organizational structures channel science into decision-making. For example, the General Fisheries Commission for the Mediterranean of FAO has adopted several binding recommendations that require climate drivers to be taken into account in fisheries management and has two capacity development programmes aimed at supporting the formulation of science-based decisions.

Ocean literacy and strategic communication of ocean science

33. To catalyse action, it is necessary to communicate ocean science to users across all sectors of society and to ensure that individuals and institutions have the skills to

undertake, interpret and apply ocean science. There is a need to achieve a collaborative effort between scientists, professional educators, communicators, ocean literacy experts and marine social scientists, which is an important consideration reflected in the work and activities undertaken under the Regular Process, the Ocean Decade and beyond.

34. Ocean literacy is an area that has evolved rapidly since the 2022 Conference, from its beginnings as a school-based initiative to teach ocean science, to a global community that recognizes the ocean's vital importance to the future. Priority actions to increase the impact of ocean literacy include increased participation in coastal and urban planning processes, support for transdisciplinary research to understand behaviour change in relation to the ocean, and continued investment in the development and implementation of a solid and adaptable ocean literacy framework for formal and non-formal education systems for all stakeholders.

35. Effective ocean literacy activities and competencies must be grounded in evidence and, to that end, additional efforts in marine social sciences are needed, for example in relation to public perceptions of ocean research; marine citizenship and identity research; behavioural science research linked to ocean-climate education and communications; research on how ocean literacy can be measured and monitored over time, and the impacts of an ocean-literate society on ocean health; and research on multidisciplinary and critical ocean literacy as a policy tool.

36. The success of ocean literacy initiatives will also depend on the generation, sharing and use of priority data sets, including human-ocean relationship and human-ocean values data sets; pro-ocean behaviour change methodologies, case studies and effective practices; impact mapping of regional and key global ocean literacy initiatives; and ocean culture mapping that includes a global body of evidence (contextual and local knowledge) that demonstrates and supports cultural engagement as an enabler of ocean and human health.

Advancing diversity, equity and inclusivity in ocean science

37. Despite the growing recognition of the need for systematic processes to identify and dismantle barriers to ensure diversity, equity and inclusivity in cooperation and capacity development in ocean science, gaps persist, including for women and young people. The latest available data from the *Global Ocean Science Report* indicate that, in 2020, women represented 38 per cent of scientists in the marine domain and that women remain underrepresented in scientific fields and professions.

38. Supporting the next generation of ocean professionals is also vital. The Ocean Decade programme for early career ocean professionals is at the heart of the Decade. It is aimed at supporting young ocean professionals in their capacity development and work by providing meaningful networking, training and funding opportunities and creating capacity for cooperation and knowledge exchange. A dedicated programme for young ocean professionals guarantees a forum for them to elevate and strengthen diverse perspectives through a collective voice, and ensures that knowledge is exchanged between experienced professionals and early career ocean professionals, with a view to incorporating innovative ways of thinking into global ocean sustainability and into addressing stewardship challenges.

39. Geographical barriers persist, in particular for individuals and institutions in small island developing States and the least developed countries, and significant, coordinated and long-term investments are needed across all facets of the ocean-science value chain, ranging from support for fundamental ocean observations and data infrastructure, to the empowerment of local scientific institutions and individuals to lead the co-design and co-delivery of research initiatives, support for Indigenous-

led research, and the enhancement of spatially and temporally appropriate science-policy-society pathways to ensure that knowledge informs local and national decision-making.

Investment and financing for ocean science

40. Addressing the challenges and seizing the opportunities identified above will require significant resources. Sustainable Development Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) is the least funded of all the Goals, receiving a 0.01 per cent share of all Goal funding from official development assistance up to 2019. Estimates from 2020 indicate that only 15 per cent of funding needs have been met for the achievement of Goal 14. Due to the Goal's interdependence with many other Goals, including its central role in meeting Goals related to climate action and food security, deficits in investment in Goal 14 hamper the implementation of the 2030 Agenda as a whole.

41. Under target 14.a of the Sustainable Development Goals, investment in ocean science is tracked and reported through the *Global Ocean Science Report*. The 2020 data indicate that, while national Governments remain the primary source of funding for ocean science, the availability and allocation of funding continue to vary widely between countries and regions, with much lower budgets in developing countries. Overall, the share of gross domestic expenditure on research and development dedicated to ocean science is low, with, on average, around 1.7 per cent of the total attributed to ocean science in 2017. The lack of standard, replicable and transparent definitions, data and methods for calculating the benefits of investment in ocean science leads to a lack of credibility and transparency. A future focus of work under the Ocean Decade will be on generating a robust and reliable evidence base to support decision-making in relation to investment in ocean science and knowledge.

42. There is an ongoing need to enhance cross-sectoral collaboration, as well as partnerships at all scales, to support the uptake of science, management and policy. In addition, emphasis should be placed on closely linking business and industry with other ocean science actors and on recognizing private-public partnerships as critical to generating ocean science. In particular, partnerships led by and involving low- and middle-income countries should be promoted, given the persistent bias towards ocean science knowledge, capacity and infrastructure investment in developed countries. Such partnerships would help to ensure equitable ownership over science and advance effective governance.

IV. Action-oriented, pragmatic solutions

43. Building on the section above, the present section provides action-oriented, pragmatic solutions to challenges, as well as opportunities, and includes an overview of impactful initiatives that can be scaled up and serve as best practices. Only five years away from 2030, initiatives that have been completed or are well on their way to completion should be highlighted alongside a discussion on their impact.

44. Although pragmatic solutions to the range of challenges identified in the previous section exist, they require greater coordination, replication and scaling up over the next five years if the Sustainable Development Goal 14 targets are to be met.

45. Coordinated by the Intergovernmental Oceanographic Commission since 2021, the Ocean Decade is arguably the largest coordinated global ocean science initiative ever undertaken. The Ocean Decade has galvanized more than 20,000 individuals working in multidisciplinary, international teams to implement 59 endorsed global programmes and more than 500 regional and national projects under the Ocean

Decade. These programmes and projects are led by research institutes, non-governmental organizations and private sector and government partners in 76 countries. Thirteen regional and thematic decentralized coordination structures are hosted by partners, including a newly launched Decade Collaborative Centre for sustainable ocean economy hosted by the Barcelona City Council. Forty countries have established national Decade committees. The 2024 Ocean Decade Conference, hosted by Spain in Barcelona in April 2024, convened more than 2,600 in-person participants to discuss the science and knowledge needs that will guide the future priorities of the Ocean Decade, as well as opportunities related to partnerships and resources and the means of ensuring the full engagement of underrepresented groups. The Ocean Decade remains the central United Nations-wide action framework to facilitate the generation and use of ocean science for sustainable development.

46. The third cycle of the Regular Process will result in the publication of the third World Ocean Assessment, which is scheduled to be approved by the General Assembly in December 2025 and will provide an invaluable synthesis and review of scientific knowledge regarding the state of the marine environment, including socioeconomic aspects, and serve as a resource for policymakers that can be used at the regional and national levels. There is potential to update the publication *Marine Scientific Research: A Revised Guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea*, developed by the Division for Ocean Affairs and the Law of the Sea in 2010 to incorporate new practices in marine science and technology development and to act as an important capacity-development tool.

47. Voluntary commitments to implement sustainable ocean plans as a means of developing evidence-based intersectoral policy and spatial solutions in support of a sustainable ocean economy are increasing. In advance of the 2025 Conference, the 100% Alliance for Sustainable Ocean Management seeks to increase formal commitments from Member States to implement sustainable ocean plans by 2030, and the Ocean Decade programme on sustainable ocean planning and the Ocean Action 2030 coalition are collaborating to provide technical and financial resources to assist States in meeting their commitments.

48. New initiatives to strengthen the science-policy-society interface are emerging, including a proposal to establish an international platform for ocean sustainability as a demand-driven mechanism with the aim of providing evidence and scientific knowledge to support States in fulfilling their commitments under global, regional and national policy frameworks. Enhanced ocean modelling capabilities are also critical to informing decision makers on the state of the marine environment, marine life and the impact of human activities. The transition of Mercator Ocean International – recognized as a Decade Collaborative Centre for Ocean Prediction by the Intergovernmental Oceanographic Commission at the 2022 Conference – into an international intergovernmental organization will support ocean modelling by facilitating the pooling of knowledge, technical expertise and resources, including those of national oceanographic organizations. The organization will conduct targeted joint research and develop free and open digital ocean information services and digital twins of the ocean.

49. The 2025 Conference will also see an emerging focus on the science-policy interface at the subnational level through the launch of the Ocean Rise and Resilience coalition, which includes a focus on connecting municipal-level decision makers with scientific knowledge and which builds on work on coastal cities carried out as part of the Ocean Decade.

50. FAO is spearheading numerous initiatives to enhance the generation and uptake of science and knowledge in order to inform fisheries management and sustainable

aquatic food production. Notably, the EAF-Nansen Programme serves to enhance knowledge on marine resources, ecosystems and biodiversity through extensive data collection on fish stocks, habitats, environment and ecosystems through surveys using the research vessel *Dr. Fridtjof Nansen*, which operates year round in the waters of 32 partner countries in Africa and the Bay of Bengal. In addition, FAO is collaborating with the Fisheries and Marine Ecosystem Model Intercomparison Project team, which is a global network of marine ecosystem modellers and scientists that provides projections of future climate change impacts on marine systems at global and regional scales. The Common Oceans Tuna Project has modelled climate change and its impacts on tuna stocks in the Pacific, and its work is currently being applied to the Atlantic and Indian Ocean basins.

51. The International Seabed Authority is strengthening its regulatory framework through, inter alia, consolidating scientific foundations. For example, with the assistance of an intersessional expert group, the Authority's Legal and Technical Commission is developing binding environmental threshold values with the aim of setting measurable requirements with regard to levels of harm from activities in the international seabed area (the Area). To better understand and manage the possible effects of anthropogenic activities on deep-sea ecosystems, the Authority launched the Sustainable Seabed Knowledge Initiative with the goal of describing by 2030 over 1,000 new species from the regions of the Area that are currently being explored for mineral resources.

52. The International Atomic Energy Agency, through its Marine Environment Laboratories in Monaco, deploys multiple global initiatives aimed at enhancing ocean health. These initiatives support capacity-building training and activities, including the transfer of advanced technologies to its member States and the generation of scientific knowledge in key areas, such as ocean acidification, harmful algal blooms, biotoxins, blue carbon, radioactive and non-radioactive marine pollution and plastic pollution. Notably, the Agency's Nuclear Technology for Controlling Plastic Pollution initiative is driving efforts to better understand microplastic abundance and its impact on marine and coastal ecosystems. Through the initiative, the Agency is collaborating with more than 100 of its member States to establish a global network of analytical laboratories across all continents, capable of producing scientific data and information on microplastic abundance.

53. Actionable solutions are also being developed through collaborations across United Nations agencies. UN-Oceans is an inter-agency mechanism that seeks to enhance, strengthen and promote the coordination, coherence and effectiveness of the activities of the United Nations system and the International Seabed Authority on ocean and coastal issues, including marine science. UN-Oceans can support efforts to identify priorities, enhance coordination and foster the scaling up of successful initiatives to meet persisting ocean science challenges.

54. Since 2020, IMO and FAO have been working together through a series of projects to assist countries, in particular the least developed countries and small island developing States, in preventing and reducing marine plastic litter from the maritime transport and fisheries sectors. The projects are intended to achieve their objectives by focusing on a number of areas identified in the Action Plan to Address Marine Plastic Litter from Ships of IMO, and on complementary actions identified by FAO, including supporting the provisions of its Voluntary Guidelines on the Marking of Fishing Gear.

55. Financing and investment mechanisms that convene multiple partners around common goals are effective means of leveraging resources to address challenges beyond the capacity of any individual stakeholder or partner. The Common Oceans programme, financed by the Global Environment Facility, contributes to the

mobilization of co-financing and brings together United Nations agencies, international environmental non-governmental organizations, foundations, academia and, importantly, the private sector, with representatives from key sectors operating in areas beyond national jurisdiction. Other examples include the Belmont Forum, which is developing a new oceans-focused call that will convene resources from public and private financing sources; the Ocean Matcher philanthropic investment tools, under the framework of the Ocean Decade, aimed at providing direct links between funders and research projects; and the Pink Flamingo Society, which brings together a group of international philanthropic foundations that make available their research vessels for coordinated and collaborative initiatives.

56. Initiatives to enhance gender inclusivity in marine science exist. For example, the International Seabed Authority has a vision of women from developing States playing a pivotal role in marine scientific research and mainstreams that vision in all its programmatic documents, including its strategic plan and high-level action plan for the period 2019–2023, and its marine science research action plan in support of the Ocean Decade and its capacity-development strategy, adopted by the Authority's Assembly in December 2020 and July 2022, respectively. Another example is the Empowering Women in Hydrography project of the International Hydrographic Organization, which has been endorsed as an Ocean Decade project. The Intergovernmental Oceanographic Commission is developing a gender-responsive strategy aimed at enhancing the role of women in ocean science.

57. Various initiatives involving the International Hydrographic Organization, the Organisation for Economic Co-operation and Development, the Intergovernmental Oceanographic Commission and other partners are intended to enhance the evidence base for describing the economic, social and financial benefits of investment in ocean science and ocean science infrastructure as a means of enhancing investment from across society.

58. To achieve global seabed mapping goals, a new strategy has been developed under the General Bathymetric Chart of the Oceans programme, which is jointly managed by the Intergovernmental Oceanographic Commission and the International Hydrographic Organization. The five pillars of the strategy (data, technologies and standards, capacity, community and governance) reflect the breadth of activity that will be required to achieve a fully mapped seabed. The Nippon Foundation-General Bathymetric Chart of the Oceans Seabed 2030 project serves as an accelerator for gaining access to data sets that have previously not been in the public domain, as well as providing means of advocating for the need for new data collection and prioritizing areas to be mapped. Recognizing that greater efforts are required, the Ocean Decade Alliance has developed a seabed mapping initiative designed to leverage the convening power of the patrons of the Alliance to seize the opportunity presented by the 2025 Conference to secure commitment to a fully mapped seabed through the delivery of the General Bathymetric Chart of the Oceans strategy. AREA2030 is a collective initiative being implemented to foster partnerships and collaboration to enable the high-resolution mapping of the Area by 2030. Over the years, International Seabed Authority contractors have collected vast amounts of geological and environmental data during their exploration of the Area. The initiative is aimed at compiling and analysing all the bathymetric data shared voluntarily by the contractors, in line with the vision of Authority members to help to achieve agreed global objectives.

59. Ocean literacy is rapidly emerging as a critical tool for fostering global awareness of and inclusive action on ocean sustainability in order to advocate for ocean conservation through transdisciplinary approaches that integrate education, research and policy. For example, the capacity-building strategy of the International

Hydrographic Organization promotes a holistic approach to supporting coastal States, including through academic capability development, while fostering the inclusion of "blue" economic and environmental concerns within their national priorities. Young people are also playing a vital role in ocean literacy efforts. The Ocean Literacy Task Team of the Early Career Ocean Professionals programme, under the Ocean Decade, supports ocean literacy initiatives by co-creating global projects, offering opportunities to showcase efforts and collaborating with international partners on capacity-building and mentoring. Such examples underscore the importance of participatory processes, along with transdisciplinary research and inclusive education, in building a more ocean-literate society. Citizen science initiatives are growing in number, and a new platform under the Ocean Decade serves to provide a single entry point for such initiatives to allow individuals to take concrete science-based action.

V. Conclusions and recommendations

60. Many of the underlying challenges identified during the 2022 Conference with respect to ocean science and knowledge unfortunately remain relevant, with urgent actions associated with advancing ocean knowledge and capacity development yet to be adequately deployed. Although the capacity to generate new knowledge and unlock existing information and data continues to increase, such generation is not occurring at a speed that meets global, regional or national needs. Without significant acceleration in the generation and uptake of science and knowledge, there is a risk that Sustainable Development Goal 14 and the many related Goals will not be met by 2030.

61. Global governance mechanisms aimed at improving outcomes for the ocean cannot be implemented effectively without a paradigm shift in efforts to unlock existing data and information or to generate new data, information and scientific knowledge. In parallel, despite the growing recognition of the importance of a strong and inclusive science-policy-society interface, efforts are still needed to ensure that effective mechanisms are in place to make knowledge accessible, and to develop capacity and raise awareness for the uptake of knowledge to inform decision-making.

62. Investment lies at the heart of the issue. Sustainable Development Goal 14 is the least funded of all the Goals. With less than 1.7 per cent of national research budgets dedicated to ocean science, funding for ocean science is woefully insufficient to fill existing knowledge gaps and deliver the information needed for the decisions, tools and solutions for a sustainable ocean. Increased investment and cooperation, including with private partners through public-private partnerships, will be essential to fill these gaps. Given the fundamental role of the ocean in supporting life and the livelihoods of humans on Earth, a lack of investment in achieving the targets of Goal 14 has implications for almost all other Goals.

63. Persistent spatial and thematic gaps in ocean observations, data and knowledge remain, due primarily to a lack of sustained investment in ocean science infrastructure and research. For example, around 70 per cent of the global seabed has yet to be mapped despite growing, irrefutable quantitative and qualitative evidence of the benefits of seabed mapping for sustainable development. The situation is further compounded by a rapidly changing climate and the complex interplay of multiple stressors, which generate new and emerging knowledge gaps.

64. The weak uptake of scientific knowledge in decision-making stems from various factors, including the inaccessibility of knowledge in decision-ready formats and a lack of recognition of ocean science as a fundamental contribution to nearly all facets of sustainable development. Those gaps and challenges are particularly pronounced

in small island developing States and the least developed countries, where capacity, access to data, information and technology, and funding availability are more limited. Reflecting these challenges, new advancements in the law of the sea emphasize the need for accessible scientific information and data, including the requirement in the newly adopted Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction in relation to non-monetary benefit-sharing, for open access to scientific data that is findable, accessible, interoperable and reusable.

65. The 2025 United Nations Conference to Support the Implementation of Sustainable Development Goal 14 provides an opportunity for a comprehensive stocktaking of progress towards the Goal and the creation of new partnerships and initiatives to address gaps in the remaining five years of the 2030 Agenda. The Conference also falls at the midpoint of the Ocean Decade and has the potential to consolidate and strengthen the momentum of the Ocean Decade up to 2030. The Ocean Decade, which is coordinated by the Intergovernmental Oceanographic Commission on behalf of the United Nations system, provides a global action framework for the generation and application of ocean science and knowledge and has already mobilized tens of thousands of stakeholders around the world in the largest structured global ocean science initiative ever launched. Through the Barcelona Statement, a number of science and knowledge priorities aimed at contributing to the achievement of the 2030 Agenda and complementary policy frameworks have been identified, and these priorities should form a solid basis for discussion to identify action at the 2025 Conference. Equally important, the Conference should catalyse dialogue and encourage partners to support the critical elements of a reinforced enabling environment for effective ocean science, including support for the co-design of inclusive and interdisciplinary science and knowledge that spans across sectors to support decision-making and action and that fosters and catalyses innovative partnerships across society.

VI. Guiding questions

66. The following guiding questions may be used to inform the panel:

(a) What have been the main obstacles to overcoming the challenges identified in 2022 in the generation and uptake of ocean science and knowledge, and what can be done to create the paradigm shift needed to achieve Sustainable Development Goal 14 before 2030?

(b) How can the strengthened global ocean governance and policy framework (including through the Agreement on Marine Biological Diversity of Areas beyond National Jurisdiction, the Kunming-Montreal Global Biodiversity Framework and the United Nations Framework Convention on Climate Change) be leveraged to increase support and resources for ocean science and knowledge?

(c) How can successful examples of work across the science-policy-society interface to inform decision-making be shared, replicated and scaled up?

(d) What can be done to ensure that the knowledge of underrepresented groups, including Indigenous Peoples and local communities, women and girls and young people, is taken into account and that these groups benefit from the progress made in ocean science and knowledge?

(e) How well do the science and knowledge gaps identified in the present concept paper reflect the realities of Member States and other actors in small island developing States and the least developed countries, and how can small island developing States and the least developed countries be collectively supported in relation to ocean science and knowledge generation and uptake?

(f) What can be learned from other sectors or disciplines in order to build a stronger value proposition for investing in ocean science, including the recognition of ocean observations and data infrastructure as critical infrastructure that is resourced accordingly?