

Brief on the second *World Ocean Assessment* and relevant United Nations Decades

Purpose and preparation of the brief

The programme of work set out for the third cycle of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects,¹ developed by the Bureau of the Ad Hoc Working Group of the Whole on the Regular Process and to be conducted during the period 2021–2025, consists of three main outputs. Output II is focused on supporting and interacting with ocean-related intergovernmental processes. The activities associated with this output include the preparation of policy briefs specifically tailored to meet the requests and needs of a number of intergovernmental processes relevant to the Regular Process. The processes identified in the programme of work include two decadal initiatives designated by the United Nations: the United Nations Decade on Ecosystem Restoration² and the United Nations Decade of Ocean Science for Sustainable Development,³ both of which span the period 2021–2030.

These calls to action by the United Nations are framed within the 2030 Agenda for Sustainable Development,⁴ and both identify the need for:

- Reversing ocean ecosystem degradation
- Transitioning ocean use to sustainable practices
- Improving technical capacity
- Building environmental, economic and social resilience.

The purpose of the present brief is to summarize content from the second *World Ocean Assessment*⁵ while also drawing on baselines presented in the first *World Ocean Assessment*,⁶ where relevant, to provide scientific background to the issues being discussed specifically as part of the two Decades. In addition, the brief describes suggested mechanisms by which the Regular Process might provide input into the activities of the two Decades and, in turn, information and understanding generated as a result of the Decades might be integrated into the third cycle of the Regular Process and beyond into its future cycles. Finally, the brief provides some guidance on specific initiatives that have been launched since the publication of the second *World Ocean Assessment*, associated documents and global assessments that are relevant to the third cycle of the Regular Process and its outputs.

Central to the outputs produced by the Regular Process, including the present brief, are two components.⁷ The first is the utilization of ocean observation and

¹ See [A/75/362](#), annex.

² See General Assembly resolution [73/284](#).

³ See General Assembly resolution [72/73](#).

⁴ See General Assembly resolution [70/1](#) and the Regular Process brief on the second World Assessment and the Sustainable Development Goals.

⁵ United Nations, *The Second World Ocean Assessment: World Ocean Assessment II, vols. I and II* (2021). Available at www.un.org/regularprocess/woa2launch.

⁶ United Nations, *The First Global Integrated Marine Assessment: World Ocean Assessment I* (Cambridge, United Kingdom of Great Britain and Northern Ireland, Cambridge University Press, 2016).

⁷ Karen Evans and others (2019), “The Global Integrated World Ocean Assessment: linking observations to science and policy across multiple scales”, *Frontiers in Marine Science*, vol. 6, art. 298 (2019); and Karen Evans and others, “Transferring complex scientific knowledge to useable products for society: the role of the global integrated ocean assessment and challenges in the effective delivery of ocean knowledge”, *Frontiers in Environmental Science*, vol. 9, art. 626532 (2021).

monitoring outputs and research to temporally assess physical, chemical, biological, social, economic and cultural components of coastal and marine environments to establish their current state, impacts currently affecting such environments, responses to those impacts and associated ongoing trends. The second component is the knowledge-brokering role the outputs of the Regular Process provide in increasing awareness of the ocean, the changes occurring in it, the human activities causing those changes and the progress being made in reducing and mitigating the impacts of human activities on the marine environment. Through identifying both knowledge gaps and capacity needs, the Regular Process also provides direction to policymakers for the future development and deployment of sustained observation systems and delivery mechanisms that are required for enhancing knowledge and supporting national aspirations associated with the sustainable development of coastal and marine ecosystems.

The present brief was prepared by the Group of Experts of the Regular Process for the third cycle, with input from the United Nations Environment Programme and the Food and Agriculture Organization of the United Nations, which are the lead agencies for the United Nations Decade on Ecosystem Restoration, as well as the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization, host of the Decade Coordination Unit for the United Nations Decade of Ocean Science for Sustainable Development. The brief was reviewed by the Bureau of the Ad Hoc Working Group of the Whole on the Regular Process and considered by the Working Group at its sixteenth meeting. The secretariat of the Regular Process assisted with the finalization of the brief.

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I. Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects

1. The Regular Process is a global mechanism established by States Members of the United Nations after the World Summit on Sustainable Development, held in Johannesburg, South Africa, in 2002.¹ Its aims are to regularly review the environmental, economic and social aspects of the state of the world's oceans, both current and foreseeable, and identify current knowledge and capability gaps. Its purpose is to contribute to the strengthening of the regular scientific assessment of the state of the marine environment in order to enhance the scientific basis for policymaking.

2. The Regular Process is mandated by the General Assembly to provide scientific information that supports the 2030 Agenda for Sustainable Development,² the development of an international legally binding instrument 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,³ the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea⁴ and the United Nations Framework Convention on Climate Change process.⁵

3. The main output of the first and second cycles of the Regular Process was a global integrated marine assessment (also known as the *World Ocean Assessment*), with the first *World Ocean Assessment* focused on establishing a baseline and the second on building on that baseline, evaluating trends and identifying gaps.⁶

4. The first *World Ocean Assessment*, published in 2016, indicated that growing population, economies and agricultural and industrial requirements for feeding, clothing and housing the world's population were seriously degrading parts of the marine environment, especially near the coast. The assessment concluded that, without an integrated, coordinated, proactive, cross-sectoral and science-based approach to coastal and marine management, the resilience of coastal and marine ecosystems and their ability to provide vital services would continue to be reduced.

5. The second *World Ocean Assessment*, released in 2021, highlighted that although some improvements in some sectors and some regions had been made, ongoing decline in many aspects of the ocean as a result of the many unabated pressures humans were placing on the ocean had occurred. These findings are the focus of the present brief and three others focused around the topics of marine biodiversity, climate change in the ocean and the Sustainable Development Goals.

II. Decades declared by the United Nations of relevance to the Regular Process

A. United Nations Decade on Ecosystem Restoration

6. The United Nations Decade on Ecosystem Restoration has as its main aim massively scaling up the restoration of degraded and destroyed ecosystems as a proven measure to fight the climate crisis and enhance food security, water supply

¹ See www.un.org/regularprocess/content/about.

² See <https://sustainabledevelopment.un.org>.

³ See www.un.org/bbnj.

⁴ See www.un.org/Depts/los/consultative_process/consultative_process.htm.

⁵ See <https://unfccc.int>.

⁶ See A/64/347, annex, para. 19; and General Assembly resolution 71/257.

and biodiversity. Its strategy⁷ identifies six primary barriers that must be addressed to achieve this vision and restore the relationship between humans and nature:

- (a) Limited awareness of the negative effects of ecosystem degradation on human well-being and livelihoods;
- (b) Lack of political motivation to invest in restoration initiatives despite economic benefits;
- (c) Lack of legislative and policy incentives for investing in restoration and environmentally sustainable production;
- (d) Limited technical knowledge and capacity for restoration efforts;
- (e) Perceived and/or real risks in investing in restoration efforts;
- (f) Lack of support for long-term research that focuses on innovation to improve restoration efforts.

7. The Decade is aimed at addressing these barriers via three pathways that build momentum for restoration efforts, including:

- (a) Generation of a global movement focused on raising awareness and changing how societies perceive the value of ecosystem restoration;
- (b) Assisting Heads of State, government ministers, directors of government departments, parliamentarians, business leaders and landowners to champion restoration and foster political will for ecosystem restoration;
- (c) Building the technical capacity to increase the upscaling of ecosystem restoration globally by strengthening the role of science, indigenous knowledge and traditional practices and applying best technical knowledge and practice.

8. The implementation of this vision will be supported through (a) activities undertaken by the Decade's core team (United Nations Environment Programme and Food and Agriculture Organization of the United Nations (FAO)) and partner organizations to catalyse and support initiating and scaling up restoration initiatives globally; and (ii) self-orchestrated activities proposed and conducted by the Decade's diverse array of stakeholders⁸ that will build a global restoration economy and establish a new trajectory for the relationship between humans and nature.

B. United Nations Decade of Ocean Science for Sustainable Development

9. The United Nations Decade of Ocean Science for Sustainable Development is aimed at harnessing, stimulating and empowering interdisciplinary ocean research at all levels to support the timely delivery of the data, information and knowledge needed to achieve a well-functioning ocean in support of the 2030 Agenda. To achieve this, the aim of the Decade is to mobilize resources and technological innovation to build capacity, develop scientific knowledge, build and share infrastructure and foster partnerships for a sustainable and healthy ocean. Implemented through a framework⁹ that calls for actions focused around 10 challenges of the highest priority at the beginning of the Decade and aimed at achieving three core objectives related to ocean knowledge, the Decade is envisaged as taking society from “the ocean we currently have” to “the ocean we want”, resulting in seven key outcomes for society:

⁷ See www.decadeonrestoration.org/strategy.

⁸ For a full list of activities occurring as part of the decade, see www.decadeonrestoration.org.

⁹ Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), *The United Nations Decade of Ocean Science for Sustainable Development (2021–2030): Implementation Plan* (Paris, 2021).

- (a) A clean ocean in which sources of pollution are identified and reduced or removed;
- (b) A healthy and resilient ocean in which marine ecosystems are understood, protected, restored and managed;
- (c) A productive ocean supporting sustainable food supply and a sustainable ocean economy;
- (d) A predicted ocean in which society understands and can respond to changing ocean conditions;
- (e) A safe ocean in which lives and livelihoods are protected from ocean-related hazards;
- (f) An accessible ocean with open and equitable access to data, information and technology and innovation;
- (g) An inspiring and engaging ocean that society understands and values in relation to human well-being and sustainable development.

10. The actions carried out during the Decade will be facilitated by a wide range of stakeholders,¹⁰ supported by a data, information and digital knowledge framework; capacity development initiatives, including on ocean literacy; various engagement structures and mechanisms, including a global stakeholder forum; and a governance and coordination framework that spans global, regional and national scales.

III. Relevance of the Regular Process and the United Nations Decades to each other

A. Regular Process

11. The Regular Process produces the only integrated review of the environmental, economic and social aspects of the state of the ocean, including current knowledge and capacity gaps in understanding and managing human use of the ocean. Importantly, it takes an interdisciplinary approach to the outputs produced by each cycle, thereby providing primary information on the ocean that is underrepresented in the outputs of other processes.

12. As such, the Regular Process and the outputs it produces have the potential to provide a means through which the actions, innovations and changes expected to occur across the period spanned by the two Decades, in reversing declines in the state of the ocean and its ecosystems and transforming human use to sustainable practices, can be documented. Indeed, the first *World Ocean Assessment* and its evaluation of the state of the ocean was a major contribution to catalysing efforts towards the development of the proposal for a decade focused on ocean science for sustainable development submitted to the United Nations by the Intergovernmental Oceanographic Commission.¹¹ The second *World Ocean Assessment* provides an overview of the state of the global ocean at the start of the two Decades, thereby providing a useful baseline on scientific understanding that could serve as a basis of comparison, allowing progress to be measured throughout the period covered by the two Decades.

13. The delivery of outputs of the third cycle of the Regular Process over the course of the 2021–2025 period can contribute to the evaluation of progress made during the

¹⁰ For a full list of endorsed actions being conducted as part of the Decade, see www.oceandecade.org.

¹¹ See https://en.unesco.org/sites/default/files/ioc_inf_1341_13nov2017.pdf.

first half of the two Decades. The programme of work for the third cycle allows for more than one assessment to be produced and that the assessment(s) “may focus on specific topics in evaluating trends”. A scoping exercise, to be conducted throughout 2022, provides an opportunity for identifying how the outputs of the third cycle might contribute to both documenting and evaluating the progress made on ocean science and ecosystem restoration during the first half of the two Decades.

14. Further activities of the Regular Process beyond the third cycle will coincide with the second half of the two Decades. Depending on the outcomes of discussions of the General Assembly, the Ad Hoc Working Group of the Whole on the Regular Process and its Bureau in setting the programme of work for the period beyond the third cycle, collaborative and mutually beneficial activities involving both the Regular Process and the two Decades could be further developed. These could include contributing to evaluations of the progress made towards achieving the visions of the two Decades, from the perspective of changes both since the mid-Decade point and across the entire 10-year period covered by the two Decades.

15. Importantly, by providing a global view of current knowledge and capacity gaps in understanding and managing human use of the ocean, the second *World Ocean Assessment* and assessments undertaken during the both the third cycle of the Regular Process and beyond provide the two Decades with strategic information on where regionally and operationally to direct efforts in order to achieve their common goals.

B. United Nations Decade on Ecosystem Restoration and United Nations Decade of Ocean Science for Sustainable Development

16. The activities of both of the United Nations Decades are likely to:

- (a) Progress understanding of the state of the ocean and its future state;
- (b) Monitor improvements to ocean ecosystems as a result of regeneration and restoration efforts and improved management and mitigation of pressures, including cumulative effects;
- (c) Track changes to capacity, including through the transfer and implementation of new technologies and the sharing of knowledge;
- (d) Monitor changes to societal interactions and relationships with the ocean.

17. The activities of the two Decades during the 2021–2030 period will therefore provide highly relevant and important information that could be incorporated into assessments developed by the Regular Process during the third cycle and future cycles during this period. Reporting mechanisms and the transfer of information developed as part of both Decades could be directly linked to the Regular Process to provide direct inputs into the assessment(s) delivered by the Regular Process and serve as a foundational basis of assessments during the third cycle and beyond. This could be facilitated through the direct sharing of programme, project and activity reports related to the Decades with the secretariat of the Regular Process, as well as regular updates on activities and outputs from the contributions to the Decades by the lead agencies for each Decade. The connectivity between the Decades and the Regular Process could be further enhanced during the third cycle through the direct involvement of experts from the programmes, projects and activities related to each Decade in the pool of experts and writing teams for any assessment(s) developed as outputs from this cycle. Beyond the third cycle, this connectivity could be further enhanced beyond the membership of the pool of experts and writing teams through the nomination of relevant experts involved in the two Decades to the Group of Experts of the Regular Process via the United Nations regional groups. These

linkages, both during the third cycle and beyond, would facilitate involvement in the development and delivery of the outputs of the Regular Process and would also support identifying opportunities for the input of traditional owner and indigenous perspectives and knowledge into assessments. These are key perspectives that have been lacking from the outputs that have been produced under the Regular Process to date.

18. The frameworks for the two Decades could also be directly linked to the Regular Process to provide guidance on the focus of the assessment(s) produced (e.g. particular topics of overall assessment(s) or topics to be included as chapters in the assessment(s) conducted across relevant cycles of the Regular Process, similar to the current collaborative development of a technical paper on the interlinkages between biodiversity and climate change by the Intergovernmental Panel on Climate Change and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). This would further facilitate the transfer of information and understanding resulting from the two Decades into the Regular Process and would ensure that outputs from the Regular Process are based on timely and up-to-date information generated during the two Decades.

19. Directed joint activities between the Group of Experts and the lead agencies for each Decade, supported by the Regular Process secretariat, could also assist in identifying linkages. This would be particularly useful in directing capacity-building efforts, one of the three key outputs in the programme of work for the third cycle. The development and identification of joint activities could be beneficial across all three processes, assisting each process in achieving its goals and amplifying messaging across all three processes to further bridge the science-policy gap throughout the period of the two of the Decades.

IV. Main findings of the second *World Ocean Assessment* of relevance to the United Nations Decades: a baseline of the state of understanding

A. Ocean health

20. Improved understanding of the ocean and ongoing implementation of responses for mitigating or reducing pressures and their associated impacts are improving sustainable ocean practices in some areas, with resulting benefits for ocean health. However, both the coastal and offshore areas of the ocean continue to be affected by climate change, marine pollution and unsustainable resource use, largely as a result of drivers associated with a growing human population, economic activity, technological advances, governance structures and geopolitical instability and climate change.

21. Although better control of releases is reducing the input of nutrients into the ocean in some areas, increases in anthropogenic nutrient inputs have caused a global increase in cultural eutrophication¹² of the coastal ocean, with such inputs now exceeding those owing to natural processes. This is disturbing the balance of organisms in coastal waters, resulting in declining coastal water quality and declining capacity of these regions to provide ecosystem services. Other forms of pollution, including anthropogenic sources of noise, continue to have an impact on water

¹² The enrichment of water by nutrients, causing an accelerated growth of algae and higher forms of plant life.

quality, habitats and species, with marine litter documented in all marine habitats, including remote regions such as the deep ocean.

22. Afforestation and the replanting of mangroves on all continents have partially decreased the speed of mangrove area loss, highlighting the positive impacts of restoration efforts. There have also been recent efforts to restore the productivity of coastal waters, notably by developing nutrient and pollutant management plans, restoring ecosystems and keystone species and protecting estuaries and deltas in parks and marine protected areas. Protective measures have also improved the status of some species (e.g. some large whale and marine reptile species); however, numerous plant and animal species in many parts of the ocean are declining because of continuing or increasing pressures associated with human activities, including the cumulative effects of those pressures.

23. Over the past two decades, marine heatwaves have had a negative impact on marine organisms and ecosystems in all ocean basins. These events, along with other climate change effects on coastal and offshore ocean environments, are projected to increase in frequency, duration, spatial extent and intensity under future global warming, thus pushing some marine organisms, fisheries and ecosystems beyond the limits of their resilience, with cascading impacts on economies and societies.

24. Given the crucial ecosystem services the ocean provides, the state of the ocean is intricately linked to human health and well-being. The marine environment provides many opportunities for sustaining livelihoods and economies and brings both benefits and risks to human health, especially for people who live near it. Many communities have close connections to marine environments via spiritual and religious heritage, cultural identity and traditions and water-related habits and activities. These linkages are discussed in the following sections in relation to the benefits and opportunities provided by the blue economy,¹³ the need for equitable access to those benefits and opportunities, and the requirements for sustainability.

B. Ocean wealth in the context of the blue economy

25. The ocean supports a wide range of economic activities, and many countries are developing or have developed strategies for recognizing the opportunities provided through the blue economy.

26. Marine and freshwater food production is a key protein provider for many vulnerable communities and is estimated to have provided a source of income for approximately 59.6 million people globally in 2016. Although marine capture fisheries remain stable, mariculture is steadily increasing. In addition to providing a source of food and income, such production supports carbon sequestration and oxygen production and reduces eutrophication. The application of information technology to help to expand the opportunities of small-scale fisheries in areas such as safety, the sharing of local knowledge, capacity-building and governance have been outlined by FAO in its Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication,¹⁴ and the growing use of human rights approaches is providing opportunities for the empowerment of such fisheries.

27. Utilization of the ocean for energy by both the oil and gas and the renewable energy sectors has continued to expand. Global crude oil production has grown steadily, while natural gas production has increased more rapidly. Production of

¹³ The blue economy, as defined in *The Second World Ocean Assessment*, refers to ocean-based economies.

¹⁴ Available at www.fao.org/voluntary-guidelines-small-scale-fisheries.

renewable energy, including that derived from the ocean, has grown as many countries shift to energy strategies aimed at reducing greenhouse gas emissions, with offshore wind technology growing most rapidly. Mining activities remain largely restricted to marine aggregate mining in near-shore areas, which is predominantly driven by increasing demand for sand associated with rapid urban expansion. Broader seabed mining has been identified as a focus of a number of countries, several of which have developed national legislation relevant to deep sea mining activities. The International Seabed Authority was administering 30 exploration contracts in 2020. It had adopted a “mining code” regulating exploration and was developing regulations for the exploitation of minerals in areas beyond national jurisdiction and criteria that would support the establishment of new regional environment management plans.

28. Both shipping (international trade and passenger traffic) and tourism have grown. The quantity of cargo loaded in developing countries now exceeds that unloaded in those countries (net export), although ownership and control of shipping has increasingly been consolidated in the hands of a small number of firms (see also sect. IV.C). Coastal tourism represents a substantial proportion of overall economic activity for many countries, especially small island developing States and archipelagic States.

29. The coronavirus disease (COVID-19) pandemic has disrupted global trade and tourism extensively, in particular during 2020. Demand for the transport of raw materials and finished goods dropped significantly, resulting in declines in cargo shipping activity. Passenger traffic on ferries dropped significantly early in the year but, by August 2020, was beginning to recover, while cruise ship activity plummeted and had yet to recover at the time the second *World Ocean Assessment* was released. At the same time, travel and border restrictions imposed in 2020 to control the spread of COVID-19 created a major crisis for seafarers as a result of difficulties in changing crews, with an estimated 600,000 individuals either having to remain on vessels or wait on shore to join their ships.

30. Recent technological innovations have resulted in advances in the exploration for and exploitation of marine genetic resources for pharmaceutical, cosmetic and food and feed applications. The rate of discovery of new marine molecules, and their sources, has been increasing rapidly. In addition, the rate of discovery of enzymes from marine organisms has also been accelerating, and exploration of their application in industrial processes and the blue economy is advancing in tandem.

C. Ocean equity

31. The distribution around the world of the benefits drawn from the ocean is still very uneven. Not all countries have the capacity to participate fully in and benefit from the ocean and its resources. That may be because they either do not have access to the ocean, such as countries that are landlocked, or do not have the financial means to develop maritime industries, which is the case for many developing countries.

32. Global inequities, including those associated with wealth, gender, geography, rights and access to resources, can have implications on the effectiveness of policies designed to manage the marine environment. Large corporations have increased their potential to negotiate directly with Governments, which could hamper progress towards equitable access to resources and sustainable outcomes for the marine environment. Despite contributing to the employment of more than 90 per cent of the people involved in capture fisheries (about 50 per cent of whom are women), small-scale fisheries continue to be marginalized, with increasing pressure from both industrialized (and often subsidized) fleets and other ocean uses. The expansion of opportunities for small-scale fisheries has been outlined in the FAO Voluntary

Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, and 2022 has been proclaimed by the United Nations as the International Year of Artisanal Fisheries and Aquaculture.¹⁵

33. The concentration of the human population in the coastal zone is increasing as a proportion of the total global population. Of coastal settlements, small coastal communities are both physically and socially vulnerable to climate change impacts, in particular in rural areas. Such communities not only are affected by severe weather events and flooding as a result of their geographical location, but also often have limited access to health care, goods, transportation and other services, and are frequently reliant on local resources that can be similarly affected, increasing their vulnerability. Sensitivity to market fluctuations as a result of dependence on natural resources, poverty, limited economic opportunities and population loss creates challenges for small communities when they try to adapt. Such factors strain material assets, as well as the social and moral foundations that facilitate collective problem-solving. Both gender differences and gender inequalities can give rise to inequities in the benefits derived from the ocean, including well-being. Particular attention needs to be paid to small and rural communities when designing adaptation measures if the global goals of reducing poverty, ensuring food security and reducing inequalities are to be met.

34. A number of international guidelines and agreements have been developed to assist in addressing, in particular, inequalities related to capacity and access, including the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity. Participants in the negotiations on the draft text of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of resources in areas beyond jurisdiction are also considering the sharing of benefits, capacity-building and the transfer of marine technology.

35. Innovations in technology and engineering have expanded ocean data collection and are making information more readily available, reducing inequalities in accessing and using ocean knowledge. Cost-effective and user-friendly sensors, along with smartphone applications, the enhanced participation of citizens and the deployment of sensors on non-scientific ships, are also facilitating the expanded collection of ocean observations and providing greater opportunities for ocean observation and research. Platforms that share best practices in ocean observing, data sharing and community dialogues have also been established with the aim of improving both accessibility and the effective use of ocean data for the benefit of society.

D. Ocean sustainability

36. Central to sustainability is the effective implementation of ecosystem-based and integrated management frameworks supported by inclusive marine spatial planning approaches. This requires an appreciation of how, and to what extent, human activities and natural events occur and interact and how they affect different ecosystem components and their functioning. It also requires the identification of solutions to prevent and mitigate the pressures being caused by human activities and their interactions and resolve conflicts between differing uses of the ocean.

37. Application of cumulative effects assessments is a first step towards identifying solutions, as these assessments require (a) collation of information on the intensity

¹⁵ See www.fao.org/artisanal-fisheries-aquaculture-2022.

and footprint of activities that may be affecting marine ecosystems; (b) identification of the responses of ecosystem components; and (c) identification of management measures that could be applied in response. Such assessments link directly with marine spatial planning, as the development of an effective plan requires an understanding of the ecological, environmental and oceanographic conditions of the area that is the focus of planning efforts and the identification of specific management measures that achieve the social, economic and ecological objectives of the plan. Implementing an ecosystem approach to management then ensures an integrated approach across the environmental social and economic management of human interactions with the marine environment, incorporating both top-down and bottom-up perspectives, thereby achieving the objectives of the planning activity.

38. Through engaging all relevant sectors of society, the ecosystem approach to management has motivated increasing levels of support for bottom-up, community-led approaches to ocean management that take into consideration traditional rights and social justice and apply participatory processes. Adaptive management frameworks that sequentially implement management measures or actions over time take into account future conditions and uncertainties associated with the responses of the resource being managed. This allows for the identification of adaptation pathways that may be undertaken to advance climate resilience, thereby allowing ecosystems to have a greater ability to cope with perturbations and recover from adverse circumstances, and, in parallel, to support maintaining ecosystem functions and the provision of services necessary for human well-being.

39. Along with management tools, such as marine protected area networks, there is a diversity of adaptation measures that can be carried out at the community and institutional levels in addition to more traditional area-based and non-area-based management approaches. These include tools such as cross-sectoral coordination, flexible fishing licences, seasonal rights and transboundary management. In addition, enhanced institutional cooperation can be applied in conjunction with market and livelihood diversification and resilience-building tools such as emergency preparedness, early warning systems, remittances and post-disaster recovery plans.

V. Key knowledge and capacity gaps as they relate to the United Nations Decades

A. Knowledge and capacity gaps relevant to both Decades

Ocean observations

40. Since 2015, on average, one new species of fish has been described per week, and since 2012 over 10,000 new benthic invertebrate species have been described, highlighting how much of the ocean remains to be discovered. Observations of physical and biogeochemical observations are lacking from a number of regions, including coastal regions, marginal seas and deep ocean regions below 2,000 metres. Plankton diversity, despite its importance to primary productivity, oxygen supply and nitrogen fixation, is not specifically monitored by current global ocean observations, and there is a lack of coordination in the collection of biological observations at higher trophic levels beyond those associated with capture fisheries and some habitats. Further, most global observation networks do not incorporate economic, social and cultural aspects of the ocean and, as a consequence, focused, sustained and publicly accessible observations of those aspects of marine systems in standardized formats at the regional and global levels are lacking.

41. This highlights the need for the uptake and widespread implementation of the Global Climate Observing System essential climate variables and the Global Ocean

Observing System essential ocean variables, the expansion of coordinated approaches to observations beyond the current essential ocean variables, including pressures placed on marine ecosystems by human activities, and the recognition and respectful integration of local, traditional and indigenous knowledge. There is also a corresponding need to ensure the timely dissemination of collected measurements for their effective usage in ocean prediction and monitoring systems and tools for decision-making. This requires widespread application of findable, accessible, interoperable and reusable data principles in a harmonized manner.

Understanding of ecosystem processes and pressures on ecosystems

42. Knowledge of the biology and ecology of coastal species, interactions between species and the contribution of species to ecosystem functioning, in particular in the territorial waters of developing countries, is lacking. This is also the case for the understanding of deep-sea ecosystems, despite these regions comprising 43 per cent of the Earth's surface.

43. There is universally a need for better understanding of the impacts of pressures on species, habitats and ecosystems and the interactions and feedback processes associated with those pressures, in particular cumulative effects. These include:

(a) Physical and biogeochemical changes to the ocean associated with climate change and impacts on biological and ecological processes, including the impacts of range shifts of species;

(b) The scale, progress, distribution and transport and impacts of pollution of all forms;

(c) The impacts of fisheries, seabed mining, coastal development (including development associated with tourism activities and coastal reinforcement), shipping (including the transport of invasive species) and activities associated with energy extraction and production on species and habitats.

Capacity to manage human activities, mitigate threats and restore and maintain the resilience of habitats and species

44. Many of the capacity gaps limiting countries from fully participating in and benefiting from the conservation and sustainable use of the ocean and its resources remain. Human, institutional and systemic capacities, as well as financing, continue to be the primary limiting factors, in particular for developing countries. Improving the management of human uses of the ocean, thereby ensuring full participation in the conservation and sustainable use of the ocean and its resources, will require improved coordination and cooperation to provide capacity-building in regions where it is lacking, innovations in marine technology, the integration of multidisciplinary observation systems, the implementation of integrated management and planning, and improved access to, and exchange of, ocean knowledge and technologies.

45. Geographical bias in capacity highlights the need for the development of tools and approaches that can be easily implemented in regions where data are sparse and that produce outputs that can be readily understood and are translatable to decision-making processes, in particular in developing countries. This includes the development of low-cost and deployable tools for collecting observations that facilitate understanding of the changing state of the environment and the key social and economic drivers that affect the marine environment.

46. Readily deployable modelling frameworks that integrate available data sources and allow for the exploration of the environmental and economic effects of a changing climate, changing coastal populations, industrial and human use of the marine environment and the effectiveness of various governance and management options

will also be essential. These will facilitate understanding of the trade-offs between sectors and the management approaches required for sustainably managing the ocean under changing conditions, ensuring equity of benefits. At the same time, developing capacity in the understanding of management approaches and their implementation will assist managers and stakeholders in identifying and implementing options for marine management and governance that support sustainability.

47. Increased understanding of the state of coastal communities, the threats to their current and future social, cultural and economic connections and the benefits derived from the ocean is needed, especially for communities of indigenous peoples, given the crucial roles they play in maritime industries and in ocean conservation. This is especially important for identifying opportunities for involvement in the development of mitigating actions that support the rebuilding and maintenance of ecosystem resilience, and also in identifying where capacity-building might be best directed.

B. Knowledge and capacity gaps with regard to the United Nations Decade on Ecosystem Restoration

48. Without filling the knowledge and capacity gaps outlined in section 6.1, it will be difficult to identify priority areas for restoration, focus dispersed efforts, integrate restorative practices into management frameworks and maximize enduring benefits to marine ecosystems and the provision of associated services. There are three areas of knowledge and capacity gaps discussed in the second *World Ocean Assessment* that may be useful for identifying focal areas for efforts during the Decade, which are described below.

Engineering approaches

49. Coastal and near-coastal marine environments are the marine habitats most affected by climate change, physical disturbance, development, traffic and pollution. The construction of urban and maritime infrastructure creates a substratum, a potential reef-like hard bottom that can be occupied by rocky intertidal species. Some materials used, often called “living seawalls”, are designed to support habitat space for intertidal organisms that can provide important local-scale mitigation of habitat loss and improve delivery of additional benefits to humans. However, there is a need for more information on the succession of habitat types and species ranges that accompany alterations in coastlines and how such structures can contribute to restoration efforts. At the same time, blue engineering approaches, such as coral concrete, have been suggested for the development of marine infrastructure and land reclamation. To achieve sustainable development, it is critical to understand the source, the amount of coral material needed and the impact of its extraction from the environment, as coral reefs have biological, chemical and physical importance in the dynamics of coastal areas, in particular in the context of changing ocean conditions with climate change.

Replanting and transplanting restoration approaches

50. Although there have been some significant advances in the success of restoration methods, their use continues to be limited. For example, coral reef rehabilitation remains limited, and capacity for transplanting and farming corals and maintaining them, in particular at scale, needs to be developed. Capacity-building is needed in the restoration of degraded mangroves and abandoned aquaculture ponds within former mangrove areas, and in the rehabilitation of salt marshes. The long-term effectiveness of interventions and, correspondingly, whether they will need to

be continued and how often, in particular in the context of changing shorelines as a result of sea level rise, is unknown.

Protection for natural regeneration

51. Although restoration will be increasingly necessary to mitigate habitat disturbance, it is critical to emphasize that restoration is never 100 per cent successful, and that restored and degraded habitats rarely provide the same level of ecosystem services. As a result, protection of habitats remains a more effective management strategy and a better use of resources. This is the case in particular with deep-water habitats, where active restoration is not currently possible. To support such strategies, increased capacity of local managers, empowerment of local communities in effectively conserving resources and better understanding of the connectivity and interrelationships of habitats (and between habitats and the marine resources on which communities rely) are needed. To better understand the recovery of habitats, there is a need for improved understanding of the major influences on species distribution and connectivity to determine recolonization potential.

C. Knowledge and capacity gaps with regard to the United Nations Decade of Ocean Science for Sustainable Development

52. Achieving the seven societal outcomes of the United Nations Decade of Ocean Science for Sustainable Development will rely fundamentally on filling the knowledge and capacity gaps outlined in section 6.1. In addition, improving knowledge of the connections between ocean health and human health is needed to better connect outcomes from the Decade to the benefits (including well-being) that humans derive from a healthy ocean. These include:

(a) Measurement and monitoring of marine pollutants at required time and spatial scales, including their dynamics of transport and transformation in the environment. Of particular focus are algal toxins and nanoparticles as contributing factors to cardiovascular disease and lung cancer; microparticles, nanoparticles and plastic marine litter as vectors of non-indigenous species; and pathogens as potential health hazards;

(b) Impacts of waste management activities on the marine environment and human health;

(c) Associations between the marine environment and observed human health benefits, described as the “blue gym” effect,¹⁶ including socioeconomic influences.

53. Achieving the societal outcomes of the Decade will also require improving access to both current and future technologies and the capacity to use and deploy these technologies. For example, addressing pollution will require the introduction of cleaner production and quieter technologies and cheaper and readily deployable wastewater-processing technologies, in particular in less developed countries. Access to solutions that address coastal erosion and related changes to coastlines will require capacity-building in the application of coastal defence strategies that incorporate environmentally friendly structures and materials.

54. Capacity-building gaps remain for developing countries in terms of their ability to take part in regional and international negotiations to reach consensus on

¹⁶ The effect of time spent by the sea on health and well-being, particularly in association with stimulating physical activity, reducing stress and building stronger communities (Michael Depledge and William Bird, “The blue gym: health and wellbeing from our coasts”, *Marine Pollution Bulletin*, vol. 58, No. 7 (July 2009)).

management practices for sustaining healthy populations of species and ecosystems. Increased capacity in transboundary cooperation; strengthening of capacity for reducing gaps in the science-policy interface; greater coordination between social and natural sciences, and between science and civil society, including industry; and recognition of traditional and indigenous knowledge, culture and social history, are needed to support holistic management. Human, institutional and systemic capacities, as well as financing, continue to be the primary limiting factors in ensuring the protection and preservation of the marine environment, in particular for developing countries. Underdeveloped marine scientific research capacity and technological constraints are often an impediment to the effective implementation of obligations under regional and international agreements. Specific challenges exist in the enforcement of management measures in areas beyond national jurisdiction, owing to regulatory gaps and a lack of cross-sectoral coordination.

VI. Considerations for the third cycle of the Regular Process

55. In preparing the present brief, a number of key areas of focus for consideration during the third cycle of the Regular Process (and its associated outputs) were highlighted by United Nations agencies and intergovernmental organizations. These include the need for the Group of Experts in developing outputs of the third cycle, to consider more directly:

- (a) Emerging policy areas, including those associated with blue and aquatic foods and blue transformations;
- (b) Opportunities provided through the blue economy;
- (c) Gaps in the enabling environment for the science needed to progress global initiatives, including finance, linkages with industry and support from Governments;
- (d) Progress on achieving the transformations committed to by the High-level Panel for a Sustainable Ocean Economy. These include commitments to a range of transformations associated with ocean health, ocean wealth, ocean equity, ocean finance and ocean knowledge required for achieving a sustainable ocean economy by 2030;¹⁷
- (e) Progress on achieving Sustainable Development Goal 14, on life below water, and the impacts of the COVID-19 pandemic on achieving this Goal;
- (f) The impacts of the COVID-19 pandemic on ocean industries.

56. Further, a number of publications that have been produced since the finalization of the second *World Ocean Assessment* were highlighted by United Nations agencies and intergovernmental organizations as being relevant to the outputs of third cycle of the Regular Process. These include:

- (a) The proceedings of the 2019 FAO International Symposium on Fisheries Sustainability.¹⁸ The focus of this symposium was on identifying the need for a new vision for capture fisheries, including how fisheries need to transform in response to the complex and rapidly changing challenges facing society. The proceedings provide a description of each of the sessions of the symposium, a summary of plenary discussions and key messages and recommendations identified during the symposium;

¹⁷ See www.oceanpanel.org.

¹⁸ FAO, *International Symposium on Fisheries Sustainability: Strengthening the Science-Policy Nexus*, Fisheries and Aquaculture Proceedings, No. 65 (Rome, 2020). Available at www.fao.org/3/ca9165en/ca9165en.pdf.

(b) The Intergovernmental Oceanographic Commission *Global Ocean Science Report 2020*,¹⁹ which provides an assessment of ocean science being conducted globally, by whom and how, on the basis of contributions provided from 45 countries. Key findings are that ocean science is underfunded, females are underrepresented among participants in ocean science, early career scientists are largely not recognized for their contributions, technical capacity is uneven and, as a result, countries are inadequately equipped to manage their ocean data and information. This is despite the number of ocean science publications increasing over the period of the report;

(c) A recent publication from the Intergovernmental Oceanographic Commission Global Harmful Algae Status Reporting initiative,²⁰ which details the analysis of around 9,500 harmful algal bloom events over 33 years. It found that all ocean regions of the world were affected by multiple such blooms, but in varying proportions. The analysis also found that the negative impacts caused by harmful algal blooms had risen in step with the growth of the aquaculture industry and marine exploitation;

(d) The contribution of Working Group I to the *Sixth Assessment Report of the Intergovernmental Panel on Climate Change*,²¹ which provides an update to the physical understanding of the climate system and climate change, including the oceans. Of the peer review publications referenced in that report specifically focused on changes occurring in the ocean, several were also referenced in the second *World Ocean Assessment*, the process for which was conducted independently. The relevant content of the second *World Ocean Assessment* in relation to climate change and ecosystem and socioeconomic impacts is summarized in the Regular Process brief on the second *World Ocean Assessment* and climate change in the ocean.

¹⁹ Intergovernmental Oceanographic Commission, *Global Ocean Science Report 2020: Charting Capacity for Ocean Sustainability* (Paris, UNESCO, 2020). Available at <https://en.unesco.org/gosr>.

²⁰ Gustaaf Hallegraff and others, "Perceived global increase in algal blooms is attributable to intensified monitoring and emerging bloom impacts", *Communications Earth and Environment*, vol. 2, art. 117 (2021).

²¹ Intergovernmental Panel on Climate Change, *Climate Change 2021: The Physical Science Basis, Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Valérie Masson-Delmotte and others, eds. (Cambridge University Press, 2021). Available at www.ipcc.ch/report/ar6/wg1.