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of Ocean Science  
for Sustainable Development

# **Accelerating Ocean Science for a Better World: The UN Decade of Ocean Science for Sustainable Development 2021-2030**

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An Information paper developed by the Executive Planning Group  
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The Executive Planning Group (EPG) is an expert group composed of 19 members who serve as an advisory body to the IOC governing bodies to support the development of the Implementation Plan as well as the preparatory activities of the UN Decade of Ocean Science. The EPG is composed of:

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## The UN Decade of Ocean Science for Sustainable Development

The ocean is our planet's largest life-support system. It stabilizes climate, stores carbon, produces oxygen, nurtures unimaginable biodiversity, and directly supports human well-being through food, mineral, and energy resources and provides cultural and recreational services. The “blue economy” generates an estimated \$3 trillion USD in value for the world economy from sectors dependent on the ocean such as transportation, fishing, tourism, and energy.

The ocean is rapidly changing in ways that are not yet fully understood or predictable. Critical marine ecosystem services that benefit humanity are under threat. Unsustainable resource extraction, pollution and habitat destruction are on the rise in many parts of the world. While improved management and conservation have helped to reduce threats and restore key ecosystems, estuaries, and even populations of large marine animals, water quality and biodiversity overall is in decline in many places due to human activities. As the world population reaches an estimated 9 billion people by 2050, impacts on the ocean associated with these activities will increase if we don't act, but action can only be effective if it is based on sound knowledge informed by science. A better understanding of the whole ocean system—including oceanic processes, ecosystems, and people—is urgently needed to ensure responsible global stewardship of the ocean while meeting the developmental aspirations of society.

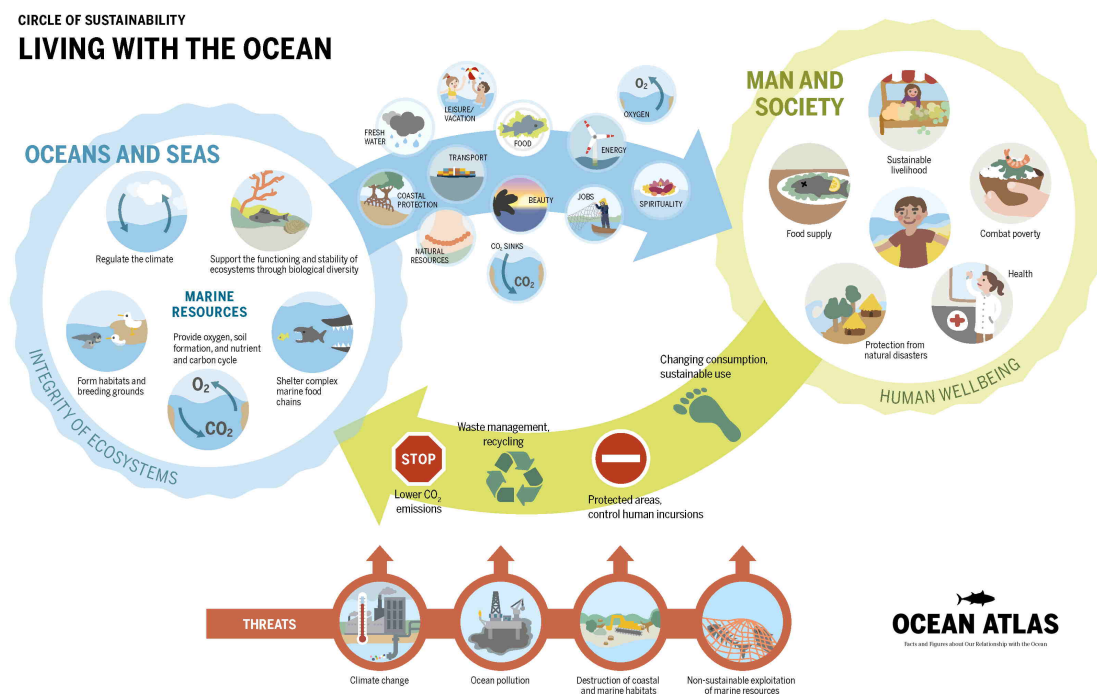


Figure 1: Human–ocean interactions highlighting ocean ecosystem services and their anthropogenic threats taken from the Ocean Atlas ([www.ocean-atlas.org](http://www.ocean-atlas.org), 2017)

At the same time, we are experiencing a revolution in science and technology. In the coming decade, we have a tremendous opportunity to harness advances in ocean science to achieve a better understanding of the

ocean system. This will enable the delivery of timely information about the state of the ocean and to articulate development-dependent scenarios and pathways into the future. This comprehensive information can guide a responsible global pathway for development in which the growing demands of society and a healthy ocean can co-exist in harmony.

To meet this challenge, the United Nations General Assembly called for an acceleration of ocean science and data exchange to reverse declines in the health and functioning of the ocean system and to catalyze new opportunities for sustainable ocean uses. The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) will bring together scientists and stakeholders from all relevant sectors to generate the scientific knowledge and to develop the partnerships needed for informing policies to support a well-functioning, productive, resilient, and sustainable ocean.

***The UN Decade of Ocean Science for Sustainable Development will catalyze, coordinate, and communicate the ocean science we need for the future we want.***

Within the context of the 2030 Agenda, in order to achieve the Sustainable Development Goals, we need an ocean that achieves key social objectives. We need an ocean that is **clean**, where pollution is dramatically reduced. We need a **healthy ocean**, in which marine ecosystems are mapped and protected, where multiple impacts, including climate change, are measured and reduced, and the provision of ocean ecosystem services is maintained. We need a better **predicted ocean**, where society has the capacity to understand current and future ocean conditions and forecast their change and impact on human well-being and livelihoods, thereby ensuring a sustainable future. We need a **safe ocean**, where human communities are protected from ocean hazards and where the safety of operations at sea and on the coast is ensured. We need a **sustainably harvested and productive ocean**, that ensures the continuing provision of food and alternative livelihoods needed to meet the needs of humans into the future. Finally, we need a **transparent and accessible ocean**, where all nations, stakeholders, and citizens have access to ocean data and information, technologies and have the capacities to inform their decisions, thereby guaranteeing just and equitable access to the ocean's resources.

## **The Need for Enhanced Ocean Science**

Ocean science has made great progress over the last century in exploring, describing, understanding, and enhancing our ability to predict changes in the ocean system. While these efforts have provided us with a solid foundation, they are still not sufficient to provide time-critical information that decision-makers need to sustainably manage the vast and rapidly changing global ocean.

***Many areas of the world's ocean still represent significant technical, scientific, political, and economic challenges for ocean science.***

Satellites and globally-operating platforms including ships, buoys, and robots have dramatically increased our ability to measure and monitor physical, chemical and some biological ocean conditions. Nevertheless, our ability to observe the subsurface ocean, especially marine ecosystems and ocean floor habitats, is far from complete, both geographically and temporally. We still lack important data needed to understand the deep ocean, marine biodiversity or to warn of ocean dangers. We don't fully understand the ways in which many species contribute to the ecological functioning of the ocean or the benefits humans receive from a well-functioning ocean. As a result, we lack the ability to understand the significance of biodiversity and habitat loss and whether we are approaching key tipping points.

Significant geographic gaps remain in our *in situ* measurement of ocean conditions. Technical constraints, government policies, global scientific capacity, geopolitical disputes, and ongoing military conflict challenge our ability to collect *in situ* data in some parts of the world. For instance, measurements are notably scarce in the Coral Triangle region of the western Pacific Ocean, the South China Sea, and coastal East Africa. These are areas of high significance for potential coral reef refugia and all places where meeting Sustainable Development Goals will be critically important for growing populations. The polar regions, and many high seas and deep-seas areas, are still poorly measured and understood. These resource-rich areas are the subject of rapidly-developing international policy that needs to be informed by good ocean data. The seabed remains one of the least studied and most poorly-understood biomes on the planet. Until these vast areas are better known, exploitation and management processes will not be properly informed nor will they be effective in reducing impacts and risks associated with potentially threatening uses.

Roughly 40% of the world's population lives within 100 km of the coast. More than 600 million people currently live in low-elevation coastal zones, a number that is expected to grow to more than a billion by 2050. Thus, coastal seas are the hotspots of human-ocean interactions and in need of improved understanding. Coastal seas and estuaries are complex, and scientists in many of these regions around the world frequently lack the capacity and scientific understanding needed to both measure and model key processes and impacts associated with global environmental threats as well as local environmental stresses and demands on resources driven by economic and population change. Coastal ecosystems account for approximately half of the sequestered total carbon in ocean sediments, the great majority in sea grasses, mangroves, and salt marshes. The ability to measure and monitor ocean health and function in coastal areas, and to model the potential impacts of policy intervention, are particularly important for sustainable development. New science could create new opportunities for sustainable ocean uses.

***New paradigms for ocean data collection and sharing are needed to manage the increased volume, complexity, and interdisciplinarity of data.***

While it is widely recognized that meeting many of the Sustainable Development Goals by 2030 will require an enhanced and holistic understanding of marine social-ecological systems, our collection and management of ocean data often remain siloed. Physical, biological, and human data often are managed in ways that can make it difficult to conduct large-scale interdisciplinary and transdisciplinary science, analysis, and modeling. The joint Academies of Sciences of the G20 countries are unanimous in pointing out the need to better coordinate and integrate the collection, management, analysis, and sharing of these interdisciplinary data streams. Only a concerted global effort can align the many existing data networks in a way that will allow scientists and planners to create the strategies and scenarios needed to achieve development goals.

Despite the development of many important global ocean data platforms, a great deal of ocean data are never shared, or are incompletely shared, on such platforms. Many relevant data streams, across all disciplines, even if made public, may not be easily found, accessed, or interpreted. Even within single disciplines, data are not organized and managed in ways that allow these data to be combined with data from other disciplines and across scales (from local to national to regional to global). Businesses and industry also collect and make use of a large variety of data to help better route ships, avoid risks, and exploit marine resources, yet much of these data are never shared publicly. Improving the sharing of this information would increase the global coverage of our understanding of the ocean social-ecological system and improve our ability to conduct interdisciplinary science at regional and global scales. There is a clear need not only for ocean data to be made available but also to develop the infrastructure and architecture systems that allow data currently residing in the many isolated on-line platforms to be shared at a global

scale. The Decade will spur a revolution in how information and communication science can be used to gather, harmonize, and analyze ocean data from sources as different as satellites and smartphones. Advances in managing the large quantity and diverse types of ocean data can be made by drawing on experiences from the private sector and other disciplines that combine scientific and social-economic data.

## **Accelerating Ocean Science**

The Decade will stand on the shoulders of a vast and growing body of ecological, physical, economic and social ocean knowledge to guarantee that science informs and guides the global push towards sustainable development. The UN Decade of Ocean Science for Sustainable Development will create a global process to generate the body of ocean science and knowledge the world needs to achieve a healthy and sustainable planet. It will build on existing partnerships and technologies and create new ones to enhance and expand the global scientific capacity required to quickly collect issue-specific information to meet the constantly-evolving needs of ocean and coastal zone managers and a rapidly developing blue economy.

### ***A comprehensive and sustained ocean observing system open to all.***

The Decade will advance our fundamental understanding of the ocean and its role in the earth system by finding new ways of developing, expanding and sustaining ocean observing systems, with particular emphasis on under-sampled and understudied areas such as the deep ocean, the seafloor, biodiversity, and impacts and feedbacks from human activities. This will require:

- new technologies to measure and monitor the ocean including, but not limited to, the use of remote sensing, micro- and nano-satellites, acoustic and electromagnetic sensors, environmental “e-DNA” techniques, autonomous platforms and shared infrastructure,
- the identification and routine measurement of essential variables related to the ocean, climate, and ecosystems that can serve as sentinels of ocean function and health, and will facilitate global scientific coordination and communication by reaching consensus on common classification systems for ocean attributes,
- the development of a comprehensive digital atlas of ocean bottom topography and conditions, focusing on the huge deficiency of current maps of the global ocean seafloor,
- new public-private partnerships in ocean observing, data distribution, and information product delivery (e.g., Ocean Data Platform) and leveraging the power of distributed technologies to create a new global community of professional scientists and informed citizen scientists, and
- new ways of monitoring ocean conditions in real-time and predicting future ocean conditions and human exposure in order to support integrated multi-hazard early warning systems, including improved community preparedness and awareness.

### ***Enhancing interdisciplinary research cooperation, coordination, and communication to create a quantitative and holistic understanding of ocean systems and to deliver fit-for-purpose knowledge to meet sustainable development goals and support the blue economy.***

In order to meet many of the aspirations for sustainable development, advanced tools must be developed to explore potential pathways for sustainable uses of the ocean. This can only be achieved with a holistic approach to ocean science. The Decade will drive the collection of interdisciplinary science, data, and information needed by multiple stakeholders to meet sustainable development goals by:

- bringing multidisciplinary teams of natural, social, behavioral, and engineering scientists together to break down barriers and find new ways of better integrating data, analysis, models, and predictions into decision-making for sustainable development. The Decade will advance our

fundamental understanding of ocean systems, with new emphasis given to research on social-ecological aspects of sustainable uses of the ocean, as well as understanding and managing the effects of cumulative stressors, and

- accelerating the development of more integrated, comprehensive, and accurate models to assess and predict the impact of societal feedback loops on ocean systems. This “whole earth” approach to ocean modeling will allow communities to better account and plan for the complex and often non-linear processes that drive ocean systems and impact society. It will be these new modeling approaches that provide the science-based, future ocean use scenarios that planners need to understand how to manage a changing ocean on local, regional, and international scales, including providing key data to support area-based management of important ecosystems.

***Increasing scientific and technical capacity so that all nations can participate in, and benefit from, developments in ocean science and technology, in particular the most vulnerable: small island developing states and least developed countries.***

While many countries benefit from sophisticated, cutting-edge scientific infrastructure, technology, and human capacity for science and innovation, the First World Ocean Assessment concluded that major disparities exist in the capacity around the world to undertake the marine scientific research or the collection of ocean data required for proper management of human activities that can affect the marine environment. The Decade will:

- actively promote the equitable sharing of science and knowledge, work to fill gaps in the global distribution of scientific capacity, and accelerate the transfer of marine technology. It will do so by facilitating new partnerships to improve access to data, equipment and expertise, thereby providing pathways for new knowledge production needed to fill current gaps. With this new knowledge and capacity, communities will be better able to harness new science-based services in order to enhance resource management, food security, hazard mitigation, and resilience, and
- create new processes and dialogues to help build the capacity of decision-makers to understand and use ocean knowledge and to push for institutional change in order to allow for more evidence-based policy making. These partnerships will be developed through early engagement in those regions where gaps exist, ensuring that scientific capacity needs are identified during the planning process for the Decade.

***Promoting innovative ways to communicate the value of a healthy ocean and the impact our activities have on it.***

The vast majority of humanity is unaware of the many benefits they derive from the ocean and its ecosystems, or how their actions affect ocean health and how changes in ocean health in turn affect their well-being and survival. As a result, ocean science is rarely funded at the level needed to adequately inform sustainable development decision-making. The Decade will:

- promote a programme of Ocean Literacy that will raise awareness of the services provided by a healthy ocean ecosystem, the ways in which those services are currently under threat, the science needed to redress those declines, and the ways in which stakeholders and citizens can act to improve the health of the ocean and the planet, and
- transform how we communicate ocean science by (1) simplifying the language used to communicate ocean science and sustainable development issues, (2) ensuring free, open, comprehensible and wide access to sound knowledge, (3) targeting future generations and taking into consideration their technological means of communication and their creative minds, (4) reaching out to new communities through innovative channels of communication such as major news media outlets,



high-profile foundations and NGOs, or partnering with personalities from the business or entertainment world, and (5) communicating complex issues across cultures and languages.

## **Stakeholders Working Together in a Global Approach to Meet Sustainable Development Goals**

***Because all people have a stake in ocean health, all must be invited to participate actively to identify needs for ocean science and its products and services.*** The Decade will rely on a stakeholder process that will be inclusive, participatory and global in approach to plan and implement the activities of the Decade. This participatory approach will also ensure that the way we share science, how we communicate science, and how the value of science is perceived is transformed.

Scientists, focused on research issues and driven by varying stakeholder priorities, are often unaware of the public's perceptions, concerns, and priorities for ocean science and associated knowledge. The Decade will bring together scientists, engineers, and scholars from all disciplines to work with stakeholders from sectors that directly or indirectly use ocean science data, including policy and decision-makers at local, regional, national and global levels, Non-Governmental Organizations, civil society, the philanthropic sector, blue economy leaders, and education and communications professionals. This will guarantee that the science conducted under the Decade directly meets the needs of the public and decision-makers in setting future sustainable pathways.

For more than 60 years, the United Nations has been the global body that facilitates worldwide efforts to manage our common heritage. Through the Decade, the UN will continue this work by focusing on the public value of enhanced and transformational ocean science in the service of the globally agreed-upon Sustainable Development Goals. Like all UN approaches, the process will be people-based, making the most of the world's combined scientific capacity, societal knowledge (including indigenous knowledge), and technological innovation.

Stakeholders will be engaged at the earliest stages in the design of the science of the Decade and throughout its implementation. As part of planning activities for the Decade, consultation and planning meetings inviting stakeholders from all sectors will be held in 2019 and 2020 to identify priority areas for the Decade and to define the ocean science needed to achieve sustainable development goals. This series of meetings will also include an official Stakeholder Forum that will continue to collect relevant inputs into the design of the Decade.

Stakeholders will also be called on throughout the Decade to examine the results of the ocean science they helped to design, with particular emphasis on new prediction systems and models that will help elaborate scenarios and pathways for sustainable development.

The Decade will foster critical partnerships with industry and business that will explore new potential investments in science-driven ocean businesses, research and development resulting in:

- the demonstration of the economic importance of reliable data and information,
- improvements in the ability of ocean businesses to track their progress towards corporate environmental responsibility and ocean sustainability targets,
- the development of new public-private partnerships based on research and data-product development needs, and



- the provision of expertise in the use of emerging technology breakthroughs of the 4th industrial revolution for data collection, sharing and management.

Non-academic scientists, from NGOs, the private sector, and government, will also be invited to participate in the Decade. Similarly, citizen scientists will be encouraged to participate in the Decade, particularly through the uptake of new technologies developed under the Decade to collect and share data.

Governments and multilateral agencies alone cannot fund the level of ocean science required to meet global sustainable development goals, especially given the accelerating development of the blue economy. The Decade will seek to catalyze major new investments in ocean science as well as stimulate research agendas at the national level by aligning science priorities with national commitments towards the sustainable development agenda. During the Decade, natural and social scientists will continue to improve estimates and understanding of the economic value that ocean science and data have for commercial activities related to the ocean (e.g., shipping, tourism, fisheries, aquaculture, oil and gas, mining, and renewable energy). The Decade will see new engagement with those sectors that depend on healthy oceans in order to encourage financial support for the ocean science that will be needed to guarantee these activities are ecologically and economically sustainable. It will also work with leaders from the financial world, the philanthropic sectors, venture capital firms, and even crowd sourcing mechanisms to create a portfolio of funding for ocean science, data, and services.

## **A New Era of Ocean Science for a Better World**

A globally-coordinated effort to better observe, understand and predict the ocean is urgently needed to reverse the decline in ocean ecosystem health and function and to meet the development and security needs of a growing world. Achieving the Sustainable Development Goals will require a clear and unbiased understanding of how human activities impact ocean health, how ocean ecosystems and biodiversity benefit people, how ocean and coastal hazards threaten lives and livelihoods, and how healthy ocean ecosystems contribute to the present and future well-being of the world's growing population. The current pace of scientific advances and oceanic data collection has generated a solid foundation for better management of the ocean, but it is only a beginning.

We need to dramatically scale up the way we collect and share ocean data, expand our global coverage of remote-sensing platforms and observation systems, invest in exploration of the sea floor, and grow the scientific capacity of all nations to collect, manage, analyze, and use ocean data for better stewardship of ocean resources.

***The UN Decade of Ocean Science for Sustainable Development will encourage the science community, the public, and decision-makers to think beyond business-as-usual and aspire to real change in the level of knowledge of the ocean that is currently produced and in the way we manage cooperation and partnerships in support of sustainable development and healthy ocean. The Decade will stimulate action over the next ten years in areas of critical importance for the UN 2030 Agenda: Planet. People. Prosperity. Peace and Partnership.***

## **Further reading**

***The UN Decade of Ocean Science for Sustainable Development***

(<https://en.unesco.org/ocean-decade>)

***The UN Decade of Ocean Science for Sustainable Development Roadmap*** (Revised, June 2018)

(<https://en.unesco.org/ocean-decade/resources>) (available in English, French, Russian, and Spanish)

***UN Resolution: Decade of Ocean Science*** (Extract from UN General Assembly Resolution A/RES/72/73)

([https://en.unesco.org/sites/default/files/oceandecade\\_unomnibusresolution\\_extract\\_en\\_final.pdf](https://en.unesco.org/sites/default/files/oceandecade_unomnibusresolution_extract_en_final.pdf))

***Towards the Ocean We Need for the Future We Want***. UNESCO Information document:

([https://en.unesco.org/sites/default/files/ioc\\_inf\\_1341\\_13nov2017.pdf](https://en.unesco.org/sites/default/files/ioc_inf_1341_13nov2017.pdf))

***The UN Oceans Conference Fact Sheet***

(<https://www.un.org/sustainabledevelopment/wp-content/uploads/2017/05/Ocean-fact-sheet-package.pdf>)

***The First Global Integrated Marine Assessment: World Ocean Assessment I***. UN, 2016.

([http://www.un.org/depts/los/global\\_reporting/global\\_reporting.htm](http://www.un.org/depts/los/global_reporting/global_reporting.htm))

***The Global Ocean Science Report. IOC/UNESCO, 2017.***

(<https://en.unesco.org/gosr>)