

## The Ocean Decade in the perspective of the Global South

Alexander Turra<sup>1,\*</sup> 

<sup>1</sup> Universidade de São Paulo - Instituto Oceanográfico - Departamento de Oceanografia Biológica (Praça do Oceanográfico, 191 - Cidade Universitária - Butantã - São Paulo - 05508-120 - SP - Brazil)

\* Corresponding author: [turra@usp.br](mailto:turra@usp.br)

The ocean is in the spotlight, and for good reason. Since the 1960's, there has been a growing understanding of the importance of the ocean and for the need to implement actions to promote sustainable development (on the ocean and based on the ocean). More recently, important milestones were set.

Aside from the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, 1972), the International Convention for the Prevention of Pollution from Ships (MARPOL, 1973), and the United Nations Conference on the Law of the Sea (1982), the first worldwide and integrated movement that raised specific attention to the ocean sustainability was the Agenda 21, launched at the United Nations Conference on Environment and Development, held in 1992 in Rio de Janeiro (UNGA, 1992). From its 42 chapters, Chapter 17 [Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use, and development of their living resources] raised concerns relating to the various emerging threats that ocean health and sustainable use are facing.

After ten years, at the United Nations Conference on Sustainable Development carried out in Johannesburg, South Africa, a highly structured global mechanism was proposed to regularly review the environmental, economic, and social aspects of the world's ocean and to strengthen the regular scientific assessment of the state of the marine environment, to enhance the scientific basis for policymaking (UNGA, 2002).

The "Regular process for global reporting and assessment of the state of the marine environment, including socio-economic aspects" was operationalized under the structure of the United Nations Convention on the Law of the Sea (UNGA, 2003). Two cycles of the Regular Process have already been concluded, creating World Ocean Assessments I and II (UN, 2017; UN, 2021).

The World Ocean Assessments are based on the framework of the Millennium Ecosystem Assessment (MEA, 2005). They seek to deepen the information on the ocean that is being compiled and to critically analyze the outcomes of other processes such as the Intergovernmental Panel on Climate Change (IPCC), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and Global Environmental Outlook of the United Nations Environmental Program (UNEP/GEO). Given the ecosystem approach and considering the reliance of people on nature, ocean issues also emerged in the climate (IPCC, 2019) and biodiversity (CBD, 2011) Conference of Parties.

In parallel to the World Ocean Assessment cycles, the United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, in 2012, created momentum for important actions relating to the ocean. Also called Rio +20, it evidenced the central role of the ocean in sustainable development in its final document, "The future we want" (UNGA, 2012). A concerted effort of the Intergovernmental Oceanographic Commission at UNESCO led to the preparation of the background document to Rio +20, "A blueprint for ocean and coastal sustainability" (IOC/UNESCO, 2011), which leveraged ocean issues on discussion at the conference and beyond.

The relevance of the ocean to humankind was emphasized in the United Nations Sustainable Development Summit in 2015, which announced 17 Sustainable Development Goals (SDG) (UNGA, 2015).

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SDG 14, named “Life below water,” aims to “Conserve and sustainably use the oceans, seas and marine resources for sustainable development.” The structuring and transversal role of the ocean concerning the other SDGs was later evidenced (Le Blanc, 2015; Le Blanc et al., 2017; Claudet et al., 2020). In parallel, the United Nations Environmental Assembly, created in 2012 at Rio +20, strengthened both its significance and the discussions on environmental issues, with special emphasis on the ocean.

SDG 14 and UNEA pushed international attention toward the ocean, and in 2017 the United Nations Ocean Conference took place in New York. The importance of the ocean was reinforced through the publication of the document “One Planet, One Ocean” (IOC/UNESCO, 2017a). Aside from convening a diverse set of stakeholders and delegates from member states to discuss emerging issues and to share commitments related to the ocean, this conference was the stage from which the United Nations Decade of Ocean Science for Sustainable Development was launched (IOC/UNESCO, 2020a).

The Ocean Decade is underway since 2021 and will take place until 2030 (<https://oceandecade.org/>). The Ocean Decade offers a framework to strengthen connections and to weave partnerships between communities seeking to study, conserve, and sustainably use the ocean and its resources. The Decade will foster scientific research and innovative technologies to ensure science responds to the needs of society. In other words, the Ocean Decade intends to produce “the science we need for the ocean we want.” The significance of a decade on ocean science was made clear during the development of the first Global Ocean Science Report (IOC/UNESCO, 2017b), the panorama that was reinforced in the updated report launched in 2020 (IOC/UNESCO, 2020b), outlining significant gaps and challenges to be overcome. In addition, Visbeck (2018) underlined the central role of ocean science for sustainable development, calling attention to the need for a more integrated and sustainable ocean observing system, a solution-oriented integrated ocean science agenda, a global capacity-building effort, and effective ocean governance.

The Ocean Decade has seven outcomes that cover various gaps in ocean science (IOC/UNESCO, 2020c):

- A clean ocean, where sources of pollution are identified and removed;
  - A healthy and resilient ocean, where marine ecosystems are mapped and protected;
  - A predictable ocean, where society has the capacity to understand current and future ocean conditions;
  - A safe ocean, where people are protected from ocean hazards;
  - A sustainably harvested ocean, ensuring the provision of food supply;
  - A transparent ocean, with open access to data, information, and technologies; and
  - An inspiring and engaging ocean, where society understands and values the ocean.
- More specifically, the Ocean Decade identified ten challenges to overcome by 2030 (IOC/UNESCO, 2020c):
1. Understand and map land and sea-based sources of pollutants and contaminants and their potential impacts on human health and ocean ecosystems, and develop solutions to mitigate or remove them;
  2. Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to protect, monitor, manage and restore ecosystems and their biodiversity under changing environmental conditions, including climate;
  3. Generate knowledge, support innovation, and develop solutions to optimize the role of the ocean to contribute to sustainably feeding the world’s population under changing environmental and social conditions;
  4. Generate knowledge, support innovation, and develop solutions to contribute to the equitable and sustainable development of the ocean economy under changing environmental and social conditions;
  5. Enhance understanding of the ocean-climate nexus and use this understanding to generate solutions to mitigate, adapt and build resilience to the effects of climate change, and to improve services including improved predictions and forecasts for weather, climate, and the ocean;
  6. Expand multi-hazard warning systems for all biological, geophysical, and weather and climate-related ocean hazards, and mainstream community preparedness and resilience;
  7. Ensure a sustainable ocean observing system that delivers timely data and information accessible to all users on the state of the ocean across all ocean basins;

8. Develop a comprehensive digital representation of the ocean, including a dynamic ocean map, through multi-stakeholder collaboration that provides free and open access to explore, discover, and visualize past, current, and future ocean conditions;
9. Ensure comprehensive capacity development and equitable access to data, information, knowledge, and technology across all aspects of ocean science and for all stakeholders regardless of geography, gender, culture, or age; and
10. Ensure that the multiple values of the ocean for human wellbeing, culture, and sustainable development are recognized and widely understood, and identify and overcome barriers to the behavior change that is required for a step-change in humanity's relationship with the ocean.

The implementation of the Ocean Decade assumes a broad and participatory process to anchor the initiative worldwide, while capturing the diversity of conditions to which different countries are subject. This diversity may encompass socioeconomic, environmental, and scientific factors that influence how countries will face the challenges and achieve the goals of the Ocean Decade. This strategy was based on the findings of the Global Ocean Science Reports (IOC/UNESCO, 2017b, 2020b), that revealed a biased distribution of the scientific capital (e.g., number of institutions and researchers; funding opportunities) and knowledge (science, technology, and innovation) in favor of developed countries. To be more inclusive, the Ocean Decade is promoting global dialogue, including through regional consultation workshops, eleven of which occurred between 2019 and 2020 and offered opportunities to co-design solution-oriented research strategies for the Ocean Decade in line with the 2030 Agenda and regional strategies and commitments (IOC/UNESCO, 2020c).

The strategy and roadmap of the Ocean Decade value the participation of the least developed countries, which are collectively denominated the Global South (*sensu* Brandt, 1980). The "Global South" refers to developing countries (transition economies) south of industrially developed countries (other than Australia and New Zealand). The Global South includes emerging economies, such as some of the BRICS (Brazil, India, and South Africa). The differences among countries in generating and distributing prosperity may influence their capacity to play a central role in the Ocean Decade, as can be assessed from the Global Ocean Science Reports (IOC/UNESCO, 2017b, 2020b).

This Special Issue on the Ocean Decade in the Global South was envisioned by the UNESCO Chair on Ocean Sustainability (<http://catedraoceanio.iea.usp.br/>) to take advantage of the Ocean Decade process to unveil the perspectives of vulnerable countries and regions regarding emerging and critical ocean-related issues.

The Chair is in direct alignment with the UNESCO mission and operates in synergy with the overarching objectives of UNESCO's and IOC's Medium-Term Strategy. The Sustainable Development Goals (SDGs) are also at the core of the Chair objectives. The Ocean Decade is one of the main inspirations of the Chair, which intends to promote integrated and interdisciplinary science for ocean sustainability through knowledge co-production and public dissemination, thus contributing to ocean literacy and social control. It also aims to actively reach out to policymakers, thus contributing to better-informed decision-making. The Chair acts by channeling institutions and ongoing activities and catalyzing partnerships and actions for ocean sustainability. The Chair is also building a multi-stakeholder Ocean Partnership that would contribute to the transition to a sustainable ocean, taking into consideration social, economic, and cultural development. In this way, the Chair contributes to the Ocean Decade through promotion in various manners and at several levels. This Special Issue is one such strategy to connect science, ocean, and society, with a dedicated focus on the countries that lag the ocean science leadership.

The Special Issue on the Ocean Decade on the Global South intended to summarize the key issues requiring focus (status and trends), key science and capacity development needs (gaps, challenges, and opportunities), and/or recommendations (pathways for solutions and cross-cutting priorities) for the science-policy agenda to achieve the Ocean Decade outcomes and face its challenges. It is assumed that recommendations of the published papers will be used by governments, agencies, companies, scientists, and society to set priorities for future action and research towards the sustainable use of the ocean.

The Special Issue is comprised of eleven papers, either collective positioning, reviews, or case reports, covering emerging topics of ocean science, from blue economy, ocean literacy, and gender balance to a safe ocean, and regions, such as Western Africa, the Mediterranean, the Western Tropical Atlantic, and the Caribbean.

The article entitled “Ocean Literacy, formal education, and governance: A diagnosis of Brazilian school curricula as a strategy to guide actions during the Ocean Decade and beyond”, authored by Carmen Pazoto and collaborators, covered a core issue of the Ocean Decade. Ocean literacy has been supported by the IOC/UNESCO (2018) and is strongly related to the decade outcome “An inspiring and engaging ocean.” This is a transversal outcome related to other results expected from the Ocean Decade. The work analyzed the match between ocean literacy and curricular documents associated with formal education at federal and regional levels in Brazil, and concluded that contents related to the importance and functioning of the ocean should be expanded, such that they may be more effective in helping citizens discuss and promote ocean sustainability. The authors also provided strategies to increase the prevalence of ocean literacy in formal education, which may also apply to other countries.

The blue economy was addressed by two papers in the Special Issue. The first, entitled “Dotting the I’s and crossing the T’s on the fifty shades of blue economy: an urgent step to address the UN Ocean Decade,” was authored by Thauan Santos. The article applied a broad bibliometric approach to survey the different terms (e.g., blue economy, marine economy, maritime economics, ocean economy, the economy of the sea, blue growth, coastal economy, and maritime cluster) associated with the concept. The study assessed the distribution of publications and citations across time and space, the most relevant sources of information, and trending topics, intending to better understand the concept of blue economy and to create common ground for academics and practitioners which may support its development in the Global South.

Karen Silverwood-Cope and Marcelo Ling authored the paper “Discussing the blue economy: considerations from a public expenditure review on tax exemption and subsidies,” which is a case study based on the Brazilian federal government budget system. The study revealed that tax exemptions and subsidies represented a significant portion of resources (R\$ 316.4 billion; US\$ 80.2 billion between 2011–2018), either directly and indirectly spent by the federal government on ocean-related economic activities, such as fisheries. Since tax exemption and subsidies are a strategy to foster a blue economy, the authors argue that it is necessary to develop and establish standardized ocean-related markers

in the economy and in public expenditure reviews to assess and compare the effectiveness of cross-country investments in the ocean economy.

The ecosystem approach is an important strategy behind Ocean Decade outcomes and challenges and was the theme of two papers in the Special Issue. Assuming that the understanding of ocean structure and functioning and of ecosystem processes and services is not necessarily present to support decision-making, Milton Asmus and collaborators authored the study “Systems approach: a shortcut to the ocean we want, which addressed the context of data gaps that are common in the Global South, given institutional and resources limitations. The authors reported on lessons learned from an interdisciplinary case study (Ecosystem-Based Marine and Coastal Management - Eco-MCM) and proposed a strategy to develop a systemic view of the ocean considering its dominant components and processes, which would be capable of supporting policies without the need of time- and resource-consuming detailed studies.

Hélio Hermínio Checon and collaborators, in turn, focused their study on sandy beach ecosystem services. The paper “Beach market: what have we been computing in Brazil?” addressed the economic valuation of ecosystem services of sandy beaches in the country, which has been an important tool to recognize and translate nature’s contribution to people’s well-being and to support better decision-making. A review of the literature revealed incipient information on the value of beach-associated ecosystem services, mostly related to tourism and leisure. The recent increase in the number of published papers still does not match the growing need for information to manage sandy beaches under the ecosystem approach, and the authors presented recommendations to overcome this gap.

Mariana Martins de Andrade and collaborators authored the paper entitled “Gender and small-scale fisheries in Brazil: insights for a sustainable development agenda,” in which they intended to expand interactions between SDG 14 (Life below water) and SDG 5 (Gender equality) in Brazil. Based on a systematic review of the literature on gender-oriented studies in marine fisheries in Brazil, the authors revealed that women in the fishery (and aquaculture) sector remain essentially invisible, and their work underreported, underpaid, and undervalued. Science and policy recommendations to overcome this scenario were provided, and include bringing this hidden workforce to light, embracing interdisciplinarity, setting research priorities, filling the data gap, and subsidizing public policies.

A safe and predictable ocean was also addressed by two articles. Silvia Chacon-Barrantes and collaborators presented the paper “Advances on tsunami preparedness at the beginning of the Ocean Decade: the Costa Rica case.” Considering the rising awareness associated with earthquakes and tsunamis and the need to advance in tsunami science and preparedness worldwide, the authors presented the National Tsunami Monitoring System (SINAMOT, Sistema Nacional de Monitoreo de Tsunamis) and its recent developments. However, the study revealed important shortfalls for further study, such as the incorporation of atypical tsunami sources in hazard assessments, the improvement of sea level monitoring, capacity building, specialized personnel (e.g. physical oceanographers and geoscientists), and appropriate funding.

Christa von Hillebrandt-Andrade and collaborators authored “Co-designing a safe ocean in the Western Tropical Atlantic within the framework of the UN Decade of Ocean Science for Sustainable Development” to address various hazards in a very large and vulnerable region. This overarching approach considers threats such as hurricanes, storm surges, earthquakes, *Sargassum* outbreaks, and oil spills along with additional climate, weather, and human-induced events, whose synergic and cumulative effects are impacting lives and livelihoods. The study describes a co-design and co-deliver initiative (Western Tropical Atlantic Safe Ocean Working Group), with local, national, and regional partners, to develop transformative strategies that reduce and mitigate the ocean-related threats while creating resilient and safer coastal communities and maritime activities. The Integrated Multi-Hazard Ocean Data and Forecast System was described, seeking to link real-time information to decision making and responses for the protection of society and its assets.

Following the study above, the paper published by Alejandro Acosta and collaborators focused on a different subject within the same region. “Perceptions of the Western Tropical Atlantic and Caribbean stakeholders and decision-makers regarding their role in achieving sustainable fisheries” summarizes the outcomes of the Western Tropical Atlantic (WTA) Regional Workshop for the United Nations Decade of Ocean Science for Sustainable Development, as well as of two prior workshops conducted in the region.

The paper assessed perceptions of major barriers to resource sustainability under current anthropogenic factors, impacts to natural resources, and climate change and revealed that ineffective communication between scientists, stakeholders, and policymakers represents one of the key barriers to the integration of science and decision-making. Among the recommendations, the authors propose that understanding the perceptions of end-users, identifying knowledge gaps, and eliminating the processes that hinder addressing these gaps can overcome this situation, and that improving and developing targeted strategies for communication, engagement, and implementation would be beneficial.

An additional assessment was carried out in West Africa, where ocean productivity and fishery outputs have long been in declining. Isimemen Osemwegie and collaborators published “Diagnostic Analysis of the Canary Current System of West Africa: the need for a paradigm shift to proactive natural resource management,” which provides an integrative assessment of the Canary Current Large Marine Ecosystem biodiversity-rich social-ecological system. A literature review of environmental (e.g., productivity, fish stocks, pollution, and ecosystem health), socioeconomic, and governance factors revealed that fishing pressure, land-based pollution, coastal habitat loss, and climate change are the primary drivers of change. Productivity, land-based pollution, and ecosystem health are identified as priority areas for data collection, with data deficiencies in some countries. The authors also recommend effective implementation, monitoring, and enforcement of existing national and transboundary regulations, as well as of ecosystem-based, human-centered management strategies.

Finally, Margherita Cappelletto and collaborators presented the major gaps and challenges for implementing the UN Decade of Ocean Science for Sustainable Development (2021-2030) in the Mediterranean region (“The Mediterranean Sea we want”). A small-scale representation of the Global North-to-South conundrum, the Mediterranean encompasses complex challenges to be managed in an integrated and ecosystem manner, especially due to threats posed by pollution and rising impacts of climate change. The paper conducted a broad review of scientific knowledge, temporal trends, capacity development needs, specific challenges, and recommendations for each of the Decade’s societal outcomes in the Mediterranean Sea, proposing pathways to narrow the North-South gaps.



The collection of studies in the Special Issue of the Ocean Decade on the Global South reveals the scale of the challenge. The Ocean Decade should be inclusive, built by all, for all, with no country left behind. The objective of promoting the Ocean Decade while providing opportunities to hear from the Global South was accomplished. The movement now needs to be deepened and broadened throughout the Ocean Decade.

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