ICES Journal of Marine Science, 2025, Vol. 82, Issue 1, fsae187
https://doi.org/10.1093/icesjms/fsae187
Received: 14 September 2024; **revised:** 7 December 2024; **accepted:** 9 December 2024
Quo Vadimus

Capacity sharing to protect and restore ecosystems and biodiversity

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Abstract

Challenge 2 of the UN Ocean Decade focuses on protecting and restoring marine ecosystems and biodiversity as a fundamental requirement to achieve sustainable development. Addressing this challenge requires reliable and timely information on biodiversity and ecosystems. To achieve this, academic, government, and private groups should engage in a process of co-design that aims to facilitate decision-making at the local and national level, and agree on common and interoperable practices for the collection and curation of biology and ecosystem information. Implementing the flow of data to enable the management of human activities and sustainable

development will require the sharing of capacity. An all-hands-on-deck effort will help us ensure a better future for ourselves. A positive step would be to identify the minimum essential ocean variables that can serve multiple relevant regional and international frameworks and to link and harmonize the required data and information flow (i.e., for frameworks including the Convention on Biological Diversity Kunming-Montreal Global Biodiversity Framework, the United Nations Framework Convention on Climate Change Paris Agreement, the Biodiversity Beyond National Jurisdiction Agreement, the International Seabed Authority, the Convention on the Conservation of Antarctic Marine Living Resources, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, and deep and national ocean fisheries policies). A key strategy is to support and build on existing local and national networks for biodiversity observation. With this information, local communities and nations can better understand and manage how they use marine life and also report on progress toward Sustainable Development Goals.

Keywords: Ocean Decade; marine life; sustainable development; conservation; ecosystem restoration; ecosystem services; capacity development; marine biodiversity; Vision 2030

Introduction

The UN Decade of Ocean Science for Sustainable Development (the Ocean Decade; 2021–2030) lists ten Challenges that need to be addressed concurrently to make progress in sustainable development, including conservation. Challenge 2 seeks to "Protect and restore ecosystems and biodiversity: Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to monitor, protect, manage, and restore ecosystems and their biodiversity under changing environmental, social, and climate conditions." The Ocean Decade Vision 2030 process engaged participants from the academic, private, and government sectors to draft recommendations and milestones to address this goal (Muller-Karger et al. 2024). Here, we highlight some of those recommendations because we need an all-hands-on-deck effort to generate the information that enables us to better manage uses of the ocean.

The reason we are advancing these recommendations in this short manuscript is that marine ecosystems are changing, driven by human activities and climate change. There is much optimism that sustainable development can support human communities everywhere by using strategies that conserve and protect biodiversity and key habitats. Such strategies can possibly help minimize negative impacts from multiple pressures coming from increased fishing, shipping, pollution, human development, rising seas, more frequent weather extremes, changes in water temperature, salinity, pH, and oxygenation, and other ecosystem alterations (IOC-UNESCO 2022). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) provides a summary of changes in biodiversity (the composition, abundance, productivity, species interactions, and distribution of marine living communities and ecosystems) and various stressors that will further affect the economy and well-being of people if there is no broad corrective action and involvement by all of us to improve conditions for ourselves (IPBES 2019; see also IPCC 2023).

The Ocean Decade established a Vision 2030 process to define actions and measures of success for each of its challenges (UNESCO-IOC 2024). The process seeks to catalyze a leap forward in our abilities to assess and forecast ecosystem change in the ocean. This includes developing scientifically accurate information: to better manage watersheds and coastal areas where people and ecosystem health are closely interlinked; about the water column where we still don't have baselines for marine life diversity, abundance, and productivity; regarding the deep ocean where deep benthic habitats are vulnerable; for ecosystems that are frozen permanently or part of the year; and for all remote places where we find human dependencies on marine life today and possible biodiversity benefits tomorrow. The goal is to ensure pathways to sustainable development including conservation and protection well beyond the year 2030.

Building a global body of knowledge

A better future for all depends on transparent processes to use marine resources along with reliable and timely information to manage these uses. The vision for Ocean Decade Challenge 2 is that, by 2030, the scientific information needed to quantify, understand, and forecast marine biodiversity and ecosystem changes (positive and negative) will be available to advance sustained uses and management in coastal and marine environments. This includes information sufficient to understand and forecast the drivers of change. It also includes developing and using the human and technological capacity to generate and use this information. Achieving this leads to benefits for everyone because all humans depend on ecosystem services in one way or another (e.g. OECD 2019).

From a practical point of view, achieving this vision requires that academic, government, private stakeholders, and rightsholders come together, in a collaborative process, to agree on sets of essential ocean variables that facilitate decision-making. An achievable vision requires agreement on common and interoperable practices for the collection and curation of biology and ecosystem information and linking relevant social, economic, and cultural information in the process of developing an understanding and for forecasting conditions of marine ecosystems (Miloslavich et al. 2018). The technology to collect biology and ecosystem data will continue to advance and is becoming more accessible (Estes et al. 2021, Sequeira et al. 2021, Rogers et al. 2022). Today, we understand how to move these data so they can be used by managers. These methods should be implemented by all sectors in an interoperable way (Benson et al. 2021). We can work with natural history museums, aquaria, other non-academic research groups, and informal and formal education and professional development organizations to help develop and harness the human and technological capacity to generate and use information sufficient to understand change and what drives this change (Arengo et al. 2018). Private companies are innovating in scalable data collection and AI-based analytics, funding research, and implementing sustainable practices. The private sector can, and is, carrying out large-scale habitat mapping, biodiversity monitoring, and ecosystem restoration in many places around the world. The Ocean Decade provides multiple additional programs with opportunities to engage (Bograd et al. 2024). A major step forward could be an initiative led by the private sector to fully collaborate with all sectors in evolving and adopting guidelines such as those developed by the Science Based Targets Network (SBTN) and the Taskforce on Nature-related Financial Disclosures (TNFD). The TNFD in turn considers the recommendations from the Task Force on Climate-related Financial Disclosures and the International Sustainability Standards Board. In general, communities everywhere would benefit by implementing ocean

Table 1. Uniform resource locator (URL) links to organizations mentioned in the text

Organization/Program acronym and name	URL
BOLD: Barcode of Life Data System	https://v4.boldsystems.org/
CCAMLR, Convention on the Conservation of Antarctic Marine Living Resources	https://www.ccamlr.org/
Challenger 150 (UN Ocean Decade Programme)	https://challenger150.world/
G3W: The Global Greenhouse Gas Watch Initiative	https://g3w.wmo.int/site/global-greenhouse-gas-watch-g3w
GBIF: Global Biodiversity Information Facility	https://www.gbif.org/
GOOS: The Global Ocean Observing System of the Intergovernmental Oceanographic Commission (UNESCO)	https://goosocean.org/
IPBES: The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services	https://www.ipbes.net/
IPCC: Intergovernmental Panel on Climate Change	https://www.ipcc.ch/
ICES: International Council for the Exploration of the Sea	https://www.ices.dk
IUCN: International Union for Conservation of Nature	https://iucn.org/
Marine Life 2030 (UN Ocean Decade Programme)	https://marinelife2030.org/
MBON: Marine Biodiversity Observation Network	https://marinebon.org/
OBIS: Ocean Biodiversity Information System	https://obis.org/
OBON: The Ocean Biomolecular Observing Network (UN Ocean Decade Programme)	https://obon-ocean.org/
Ocean Census	https://oceancensus.org/
OECD: Organisation for Economic Co-operation and Development	https://www.oecd.org/
TNFD: Taskforce on Nature-related Financial Disclosures	https://tnfd.global/
SBTN: Science Based Targets Network	https://sciencebasedtargetsnetwork.org/
UNFCCC: United Nations Framework Convention on Climate Change	https://unfccc.int/
WoRMS: World Register of Marine Species	https://www.marinespecies.org/

best practices to improve operational ecological forecasting in management—like the way that engineers, weather forecasters, and other operational groups apply standards to safeguard life and property (Pearlman et al. 2019).

To scale from short-term small-scale studies to long-term large-scale programs, scientific and management efforts need better coordination. Nations should agree on, or "mandate," an international entity to coordinate these efforts equitably. Highlighting economic benefits, like profits from sustainable fisheries and eco-tourism, can encourage more involvement. Capacity development and shared curricula are essential to guide this process. Policy frameworks will benefit from timely understanding of biodiversity and biological and physical connectivity patterns at sea and with the land. Private companies can, and many do, inform policy and support sustainable practices. Leaders should address climate, pollution, and use habitat monitoring and restoration as tools to ensure development is sustainable. Indeed, corporate initiatives can align with Ocean Decade goals for everyone's gain.

Information enables proactive, imaginative, and innovative management of ocean uses. Yet, sustainable development can only occur if opportunities are available for individuals of different ages, genders, cultures, and geographic backgrounds to have their views expressed and considered in management options. Indigenous and Local Communities are acutely impacted by negative marine biodiversity and ecosystem change. They are recognized leaders in sustainable biodiversity (IPBES 2019) and must be supported, in partnerships, resources, and funding, to allow a paradigm shift in the relationship of people with the ocean and its resources. Uplifting Indigenous Peoples and Local Communities will give us a better chance toward a sustainable future for people and the planet. In general, communities in watersheds, those who are further downstream including coastal areas, and all of us whose livelihoods depend in one way or another on the high seas should have a say in the management of activities that affect our lives. This co-design paradigm will be welcome and will be effective everywhere, as we all depend on and benefit from marine life.

Conclusion

The Ocean Decade seeks to provide the science and data the world needs to achieve a host of goals and targets for biodiversity and human health. The risk of inaction to address changes in biodiversity summarized in the IPBES 2019 Global Assessment Report on Biodiversity and Ecosystem Services (the Global Assessment), or taking the wrong action, risks exacerbating the current threat of extinction of an additional one million species within the next few decades. The Global Assessment further alerts us that there is observational evidence that the effects of changes in biodiversity are already impacting agriculture, aquaculture, fisheries and nature's contributions to people, and that negative effects may become chronic and acute. The Ocean Decade Challenge 2 working group offers recommendations to move in a better direction. Actions should be inspired by imagination and the goal of a positive future. Co-design can properly scope observation networks and management actions. Partnerships between private, academic, the public, and government sectors can define high-priority policy recommendations on ocean biodiversity and management actions that span the watershed to deep ocean habitats. Implementation will require lowering the cost of observing technologies. Much of the foundation to do this already exists in national programs and laws, and internationally in the World Ocean Assessment, the Convention on Biological Diversity Kunming-Montreal Global Biodiversity Framework, the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement, the Biodiversity Beyond National Jurisdiction Agreement, the International Seabed Authority, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), IPBES, and deep and national ocean fisheries policies. There should be joint actions of the Ocean Decade and the Decade on Ecosystem Restoration. A positive step would be to link and harmonize these and other relevant frameworks and to support existing networks for biodiversity observation (e.g. see Table 1: GOOS, OBIS, GBIF, WoRMS, BOLD, MBON,

Marine Life 2030, OBON, Challenger 150, Ocean Census, G3W, ICES, IUCN, and others). We should build on these resources to satisfy national and international assessment programs and conservation strategies. We also urge National Ocean Decade Committees (UNESCO-IOC 2021) to play out their role in driving change in their countries.

Author contributions

All authors contributed in equivalent proportion to the conceptualization, writing of the original draft, and review and editing of the manuscript.

Conflict of interest: None declared.

Data availability

There was no data used to develop this manuscript. The purpose of the manuscript is to facilitate a dialogue on data mobilization for biodiversity monitoring and assessments.

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Handling Editor: Howard Browman