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Editorial: An OMBAR perspective on the United Nations' Decade of Ocean Science for Sustainable Development

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The year 2021 saw the start of the UN Decade of Ocean Science for Sustainable Development. Ocean and coastal ecosystems play crucial roles in supporting our planet and our lives, from regulating climate and protecting shorelines, to providing food and employment. The UN estimates that billions of people rely on the ocean for their livelihoods. The First Global Integrated Marine Assessment (World Ocean Assessment I), published by the United Nations in 2016 (UN 2016), flagged that much of the ocean was severely degraded. The second (WOAII), released last year, suggests that the situation has not improved (UN 2021). The UN Climate Change Conference (COP26) in Glasgow demonstrated that the world's oceans and its species and ecosystems are under immense pressure from climate change. The UN Decade of Ocean Science is a call to arms for scientists and others to deliver research to enable societal outcomes which include a clean ocean, a healthy and resilient ocean, a predicted ocean, a safe ocean, a sustainably harvested and productive ocean and a transparent and accessible ocean. These are lofty ambitions, but can they be realised in a ten-year programme that has no funding attached to it? This question is particularly relevant when one considers the starting point and how little progress has been made in addressing other major global environmental issues such as the climate crisis.

The Research and Development (R&D) priority outcomes for the Decade of Ocean Science are likely to be achievable, especially when considering the enormous scientific progress made during the 10-year Census of Marine Life programme (www.coml.org) that showed what can be achieved when scientists are brought together with a common purpose. Global science programmes during the Census of Marine Life demonstrated the real impact that could be made through international coordination and cooperation. The UN Decade of Ocean Science aspires to produce a georeferenced digital atlas of the oceans and a comprehensive ocean observing system – data systems that can be used in research and prediction. Achieving this will require progress in data standards, particularly for biological data which lag behind their physical and chemical counterparts, such that data from

individual studies are interchangeable enabling science to move away from local studies to a more global understanding. To make such an atlas truly global will also require capacity building among less developed countries and accelerated technology transfer. National funding needs to be aimed at all aspects of marine science, and to ensure that the R&D outcomes are translated to societal outcomes will require increased participation and better integration of social science within national frameworks. Pan-national funding schemes such as those driven by the European Union and European Science Foundation have a key role to play in facilitating integrated approaches and effective sharing of platforms such as satellites and research vessels. Major international charities or foundations can also contribute to this effort, as the Sloane Foundation did with the Census of Marine Life.

Foundations have an important role to play in global science. For example, the global Ocean Health Index is supported by a diversity of philanthropic organisations (oceanhealthindex.org), including the Pacific Life Foundation; the Tara Ocean Foundation¹ is currently supporting public-private-citizen partnerships focussed on ocean exploration.

Some fields of marine science are better prepared to embrace the global challenges presented by the UN Decade of Ocean Science. For example, the International Ocean Discovery Programme (known as the Integrated Ocean Drilling Programme 2003-2013, and the Ocean Drilling Programme prior to that) that has been operating internationally in some form since 1983. Expensive, large-scale research requiring expensive infrastructure such as research vessels tends to drive international co-operation through shared platforms. Thus, the open and deep-water oceanographic science community may be in a better position to deliver a fast response to the UN Decade than the more fragmented coastal marine science community. This is particularly the case for coastal marine science given the regional uniqueness of coastal fauna and flora, and the context dependency of many important processes influenced by sharp local environmental gradients as well as mesoscale oceanographic and coastal features. There are, of course, many international networks linking scientists, managers and policy-makers working on particular systems, including the International Coral Reef Society, the World Seagrass Association and the Global Mangrove Alliance, who could play critical roles in coordination and stimulating collaboration. Many of the most pressing issues are global - especially the rapid alteration of the coastal zone by development leading to much habitat loss or modification and the proliferation of artificial habitat (Firth et al. 2016; Bugnot et al., 2021), on top of rising and stormier seas. Clearly the interaction of global change with regional and local scale impacts will influence biodiversity, ecosystem structure and functioning and continued delivery of critical ecosystem services to society. Some of the impacts will be the direct result of societal mitigation of, and adaptation to, climate change, such as offshore renewable structures and defences of vulnerable coastal property and infrastructure and peoples' lives.

Nonetheless, scientists appear to be rising to the challenges that the UN Decade of Ocean Science presents. The first tranche of endorsed Decade Actions² includes projects that aim to observe and predict the coastal ocean globally, and to monitor estuaries globally. Other projects are focussing on the deep sea and open ocean and some are specifically addressing

¹ <https://fondationtaraocean.org/en/foundation/>

² <https://www.oceandecade.org/resource/166/Announcement-of-the-results-of-the-first-endorsed-Decade-Actions-following-Call-for-Decade-Actions-No-012020>

capacity building – especially early career researchers and women. But none of these programmes come with guaranteed funding. Project leads, and all marine scientists globally, now have the challenge of pressing at national and regional (e.g., EU) levels to ensure that policy makers open sufficient funding calls to make the UN Decade of Ocean Science for Sustainable Development a success. To ensure that research funding translates to actionable improvements in protecting and restoring oceanic and coastal ecosystems, it will be important to include end-users when designing such research opportunities. Failure to do so may yield a proliferation of cutting-edge science that continues to overlook key barriers to operationalisation. For example, while automated, AI-based monitoring approaches require sufficient technological innovation to appeal to many donors, the resulting data have limited impact without a parallel investment in ecological interpretation and the identification of thresholds that might trigger remedial management action.

Going forward from its 60th year, *Oceanography and Marine Biology: An Annual Review (OMBAR)* will play its role in the UN's decade of ocean science for sustainable development by providing an integrated view of marine science embracing physical, chemical, geological, biological, and social science for a wide readership.

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