Partnership for
Observation of the Global Ocean

The Value of the Global Ocean Observing System and the Regular Assessment of the State of the Ocean in Support of Wise Decision-Making

A Statement by the Partnership for Observation of the Global Ocean (POGO)

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Introduction

The ocean is the dominant feature of planet Earth, covering over 70 per cent of its surface and over 99% of the Earth's biosphere, and making Earth the only known habitable planet in our solar system. The ocean is responsible for half of our oxygen, is the source of 80 percent of the water vapour in the Earth's atmosphere, and produces an enormous portion of the world's food. The ocean regulates the Earth's climate and weather patterns, is critical in the cycles of heat, freshwater, and carbon, and is the home of a large portion of the world's biodiversity. The ocean is a highway for ships that carry the goods that we produce and consume. The seabed and the strata beneath it hold minerals and oil and gas deposits that we increasingly need to use. Submarine cables across the ocean floor carry 90 per cent of intercontinental communications, financial transactions and information exchange. Our energy supply will increasingly rely on sea-based wind turbines and wave and tidal power from the ocean. Large numbers of us take our holidays by the sea. The seabed is a rich repository for archaeology.

In recent years, the world has increasingly recognised the critical role the ocean plays in the Earth's life-support system, as well as its importance for our societies and economies. The importance of the world's oceans has been emphasised at the highest political levels through:

- The decision by the Intergovernmental Panel on Climate Change (IPCC) to produce a Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) to be finalized in September 2019[1];
- Reference to the ocean made in the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement (United Nations, 2015)[2] and an Ocean Pathway negotiation introduced by the Fiji presidency at the 23rd Conference of the Parties (2017);
- The inclusion of a Sustainable Development Goal (SDG) to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" as part of the United Nations (UN) 2030 Agenda for Sustainable Development, launched in 2016[3];
- The first UN conference dedicated entirely to the ocean, held at the UN headquarters in New York in June 2017, and set to be the first of a triennial series that will run until 2030[4];
- The publication of the first UN global integrated marine assessment (World Ocean Assessment I (WOAI) (United Nations, 2016)[5];
- The highlighting of ocean issues, such as plastic pollution, seabed mining and ocean observations, in the Communiqués of the Group of Seven (G7) Science Ministers in 2015[6], 2016[7], 2017[8] and 2018[9];

[1] See https://www.ipcc.ch/report/srocc/ (accessed 25 September 2018).
[2] See http://unfccc.int/paris_agreement/items/9485.php (accessed 25 September 2018).
[3] See https://sustainabledevelopment.un.org/sdg14 (accessed 25 September 2018).
[4] See https://oceanconference.un.org/ (accessed 25 September 2018).
[5] The First Global Integrated Marine Assessment, World Ocean Assessment I, by the Group of Experts of the Regular Process. http://www.un.org/Depts/los/global_reporting/WOA_RegProcess.htm (accessed 25 September 2018), and Cambridge University Press, 2017 (ISBN-13: 978-1316510018).
[6] See https://www.bmbf.de/files/English_version.pdf (accessed 25 September 2018)
[7] See http://www8.cao.go.jp/cstp/english/others/communique_en.html (accessed 25 September 2018)

- A report by the Organisation for Economic Cooperation and Development (OECD) on the "Ocean Economy in 2030" (OECD, 2016)[10];
- The UN Decade of Ocean Science for Sustainable Development (2021-2030), adopted by the UN General Assembly in 2017.

While the increasing attention given to the ocean by the UN and other political and intergovernmental entities is encouraging, the Partnership for Observation of the Global Ocean (POGO) is concerned that not enough is being done by countries to sustainably support oceanographic research and observations at a high level and in a globally coordinated manner. Full planned deployment of a Global Ocean Observing System (GOOS), for measuring the physical properties of the ocean, particularly in support of climate research, has slowed in the last decade, hampered by fragile long-term funding arrangements. Although there has been increased focus on biological, chemical and ecosystem observations for monitoring the health of our ocean in the last decade and promising pilots have been successfully implemented, these systems generally have yet to be operationalised.

The Challenge

As human population is predicted to reach 9 billion by 2050, people are turning with growing urgency to the ocean for answers to the greatest challenges of our age, such as:

- feeding the world's growing population;
- providing clean energy to power vibrant economies;
- sourcing the metals on which industry depends;
- increasing resilience to dangers from the sea, especially flooding;
- mitigating and adapting to climate change and variability;
- mitigating human impacts on marine ecosystems.

Advancing scientific understanding of the ocean is rooted in making systematic, high quality, long term measurements of the ocean and the human activities that impact on it. We believe that this understanding and its wise use are critical to, and will make a real positive difference in, enabling humanity to develop a sustainable relationship with a healthy, productive and biologically diverse ocean. Systematic observations are critical for scientific research, for example on ocean circulation, biogeochemical cycles and ecological processes.

Despite its growing importance and pervasive impact, too little is known about the ocean. While satellite observations of the ocean tell us much about its surface, the subsurface ocean is invisible from space and the only way to observe it is through *in situ* instruments on ships and autonomous platforms. There are far more detailed maps of the surface of Mars and the dark side of the Moon than there are of the seafloor. In fact, between 66 and 85% of the ocean (depending on the depth

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[8] See http://www.g7italy.it/sites/default/files/documents/G7%20Science%20Communiqu%C3%A9.pdf (accessed 25 September 2018).
[9] See https://g7.gc.ca/en/official-documents/charlevoix-g7-summit-communique/ (accessed 25 September 2018)
[10] See http://www.oecd.org/environment/the-ocean-economy-in-2030-9789264251724-en.htm (accessed 25 September 2018)

interval) is still uncharted[11]. When it comes to ocean waters and marine life we know even less. The decade-long "Census of Marine Life" programme (2000-2010) estimated that, although 99% of Earth's biosphere is in or under marine waters, only 5% of the ocean has been systematically explored for life (Census of Marine Life, 2010)[12]. The deep sea represents 98.5% of the Earth's habitable volume, and less than 0.0001% of it has been investigated in any detail[13]. The Census of Marine Life also estimated that at least three species remain to be discovered for each already known. If our knowledge of "what exists" in the ocean is limited, our understanding of, and ability to predict, climate processes, ecosystem functioning, and the ocean's resilience to anthropogenic stressors are even further from being adequate. Finally, without a good knowledge of the "baseline", or current state of our ocean, and regular measurements sustained over the long term, detecting (and therefore managing) change will be impossible.

The main issues hampering the completion of GOOS are:

(1) the capacity for conducting ocean observations is lacking in many parts of the world, particularly developing countries,
(2) where sustained ocean observation programmes do exist, they are largely supported by short-term, research project funding,
(3) although technological developments are taking place for biological and biogeochemical observations, the cost of these currently prohibits routine and large-scale deployment, and makes these technologies inaccessible to developing countries, and
(4) the resources available for international coordination are currently insufficient for the scale of the work that is required.

An adequately funded, sustained, and truly global GOOS is essential to support informed decision-making, in the context of policy frameworks such as the Paris Climate Agreement, the Sustainable Development Goals, the Convention on Biological Diversity, and the Sendai Framework for Disaster Risk Reduction.

Furthermore, the UN Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (or "Regular Process") is the only concerted effort that has been made to assess the current state of the world's oceans from all aspects of sustainable development (environmental, social and economic) in order to be able to monitor changes in the ocean's physical, chemical and biological properties and in its ability to provide ecosystem services and other benefits to humankind. The success of such an assessment relies heavily on the existence of a sustained and coordinated GOOS, which provides open access to quality-controlled data in a standardised format. Although several elements of such a system are in place, an overall system is currently far from being operational. More than ever, it is critical that the world's governments prioritise funding of ocean observations and their coordination at the global level, to complete a comprehensive Global Ocean Observation System, covering all aspects. It is also vital that the scientific

[11] The Nippon Foundation-GEBCO Seabed 2030 Road Map for Future Ocean Floor Mapping, 2017. https://seabed2030.gebco.net/data_centers/documents/seabed_2030_roadmap_v10_low.pdf (accessed 12th July 2018).
[12] Census of Marine Life Highlights Report, 2010. http://www.coml.org/highlights-2010 (accessed 12th July 2018).
[13] The First Global Integrated Marine Assessment, World Ocean Assessment I, by the Group of Experts of the Regular Process, Chapter 36F, and Cambridge University Press, 2017 (ISBN-13: 978-1316510018). http://www.un.org/Depts/los/global_reporting/WOA_RegProcess.htm (accessed 25 September 2018).

community, and the many intergovernmental and non-governmental organisations and national institutions that already focus on ocean observing, work together with IOC-UNESCO, WMO and UNEP (the co-sponsors of GOOS) towards this common goal.

POGO underlines the importance of the engagement of the scientific community, as well as governments from around the world, in the critical endeavour that is the WOA. The success of WOA is essentially in the hands of the world's governments, both through their engagement with the UN process and through their support of the scientific, economic and social observations and studies on which WOA depends. We urge the UN, its Member States, and other intergovernmental groupings such as the G7, G20 and G77 to provide adequate support and resources for WOA II to overcome the limitations that were faced in the first cycle, and make the second assessment an even more valuable product for the benefit of decision-makers, our ocean, and ultimately humankind.

The First World Ocean Assessment (2016) points to the many gaps in our scientific understanding of the ocean, including sea-level rise, ocean acidification, nutrient distribution and cycling, primary production, biodiversity, population health and reproductive success, fish stocks, threatened and declining species and habitats, and the list goes on. The report also points out that we do not yet know enough about human activities that affect or interact with the ocean to enable us to manage those activities sustainably.

The WOA also highlights large geographical gaps in our knowledge, due to insufficient coverage of ocean observations. The Ocean Biogeography Information Service (OBIS) shows vast areas where very little data have been gathered, and little is known of the species that exist in them[14]. One of the few sustained marine biological sampling programmes (the Continuous Plankton Recorder survey) has major gaps, particularly in the South Atlantic, South Pacific and Indian Oceans.

In short, there is far too little *in situ* measurement coverage across the ocean's near-surface area, even less going deeper below the surface, and far too few measurements that allow us to track changes over time. We need a commensurate improvement in ocean observation technology to fulfil monitoring goals and complement satellite remote sensing. Examples include floats; Argo and Bio-Argo; new options in drones, AUV and under-sea-ice floats. We need to be more continuously aware of how and why the ocean is changing – and better predict the impacts of the ocean on people and of people on the ocean. To this end, making continuous ocean measurements with global coverage is now a pressing priority. We need to do this to manage a safer, more sustainable relationship between people and the ocean – and we cannot manage what we cannot measure.

Under the remit of the Global Ocean Observing System's framework for ocean observing, a diverse set of "essential ocean variables" has been established which range from physical quantities such as temperature, salinity and sea-level through to chemical, biogeochemical and ecosystem variables. Building the global ocean observing system began nearly two decades ago and important advances have been made, particularly in the realm of physical (climate-related) ocean observations. Disappointingly, however, progress has been slow, partly because of the costs entailed especially during a period of economic down-turn for many countries. Biological and chemical observations are still lagging behind their physical counterparts. The observing system falls short of what is needed.

[14] See http://www.iobis.org/indicators/ (accessed 12th July 2018).

Call to Action

We call on governments from around the world, and groupings such as the G7, G20 and G77, as well as the United Nations, to provide the financial support that is urgently needed to ensure the completion of the Global Ocean Observing System, its sustainability, and its international coordination.

We call on international and regional organisations, intergovernmental and non-governmental, from within and outside the United Nations, to present a united front and work together to ensure that their efforts are complementary rather than duplicative.

We also call on these governments to provide the financial as well as expert support from the active marine science pool to the UN Regular Process towards achievement of a more complete and scientifically sound WOA II that identifies trends in the health of the ocean and coasts, and in their capacity to provide ecosystem services for the benefit of humankind.

We call on the scientific community to get involved and provide the much-needed scientific input to WOA II to ensure that it is a useful product.

About POGO

Since 1999, the Partnership for Observation of the Global Ocean, POGO, has served as a forum for leaders of major oceanographic institutions around the world to promote global oceanography, particularly the implementation of international and integrated ocean observing systems. POGO is an international network of collaborators who foster partnerships that advance efficiency and effectiveness in studying and monitoring the world's oceans on a global scale. Through its efforts, POGO has promoted observations underpinning ocean and climate science, interpreted scientific results for decision makers, provided training and technology transfer to emerging economies, and built awareness of the many challenges still ahead.

The POGO membership comprises of 38 major oceanographic institutions from around the world, represented by their Directors (see http://ocean-partners.org/members).

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POGO Secretariat

Plymouth Marine Laboratory
Prospect Place
The Hoe
Plymouth
PL1 3DH
United Kingdom

Tel: +44 (0)1752 633424
Fax: +44 (0)1752 633101
Email: pogoadmin@pml.ac.uk
Website: http://ocean-partners.org

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