

GI-07 Oceans and Society: Blue Planet

2017 – 2019 Implementation Plan

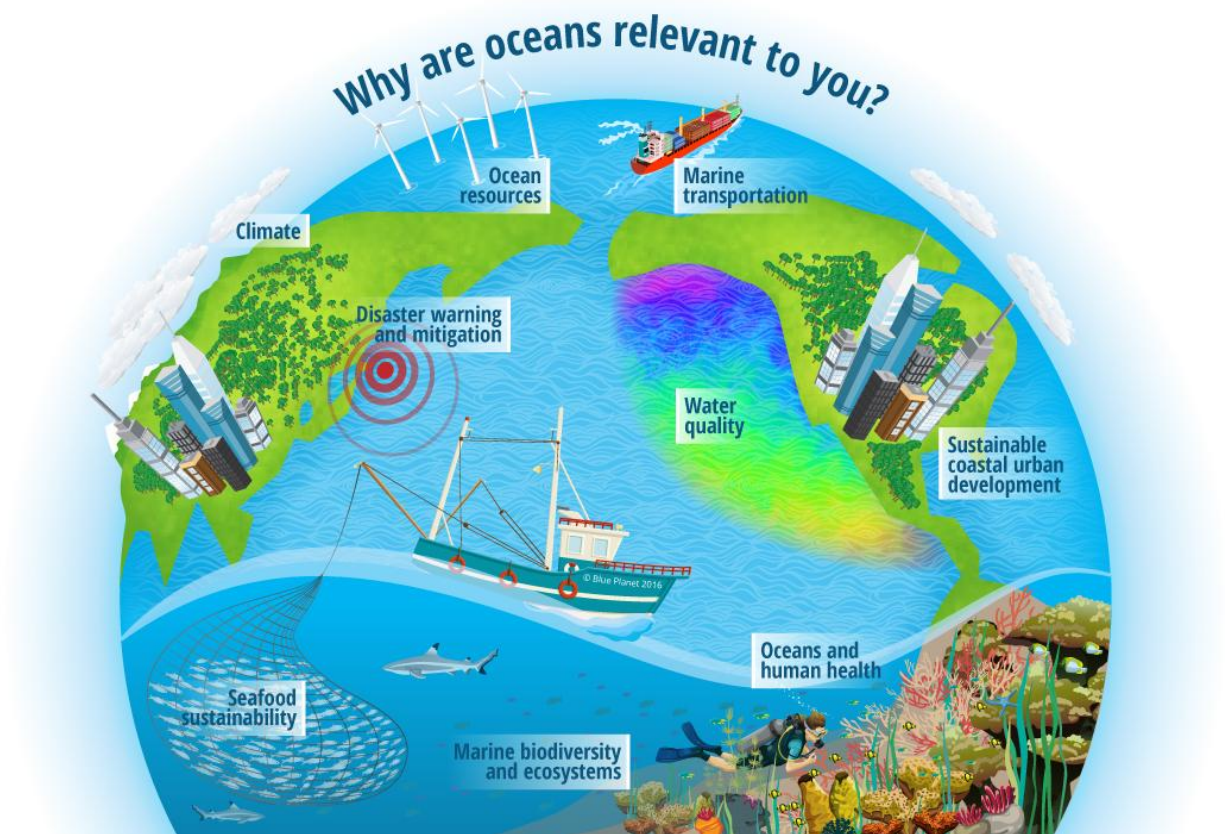


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Executive Summary

We live on a Blue Planet, and Earth's waters benefit many sectors of society. In 2015, through development of a United Nations Sustainable Development Goal explicitly targeted at the oceans (SDG 14), the global community has prioritised the need for concerted action to ensure sustainable growth and management of blue economies across the planet. Sustainable Development Goals 13 and 15 (climate action and life on land) further recognise that the future of our Blue Planet is increasingly reliant on the services delivered by marine, coastal and inland waters and on the advancement of effective, evidence-based decisions on sustainable development.

The overall goal of Blue Planet Initiative is to ensure the sustained development and use of ocean and coastal observations for the benefit of society. The objectives to achieve this goal are:

Objective 1: Increase integration of and access to in situ and remote sensing ocean observation data

Objective 2: Conceptualize, promote and facilitate the development of end-to-end ocean information services

Objective 3: Improve connections between the producers and providers of ocean observation data, products and information and the end users

Objective 4: Increase societal support and build capacity for ocean observations

As a Group on Earth Observations Initiative, Blue Planet will allow for direct linkages between the ocean observing community and users within an agreed, yet flexible framework. Blue Planet will support the Group on Earth Observations' work to promote open and accessible data and will work to facilitate, promote and conceptualize prototype/pilot services that address the Group on Earth Observations' societal benefit areas. Blue Planet will also work to facilitate the development of prototype/pilot services that address specific policy mandates into Group on Earth Observations Flagships. Blue Planet activities are organized into four components: 1) data integration and informatics, 2) information services, 3) user engagement and 4) capacity building and advocacy. Blue Planet activities will address the Group on Earth Observations' three strategic objectives – Advocate, Engage and Deliver – and add value by:

Deliver

- Providing discoverable, integrated and accessible ocean observation data
- Providing a framework to enable comprehensive world ocean assessments
- Building on and adding to GEOSS infrastructure
- Promoting and facilitating the development of ocean information services through technology transfer, upscaling of existing products and conceptualizing new services

Engage

- Creating an improved understanding of the potential beneficiaries of ocean observations
- Improving the mutually beneficial relationship between the ocean observing community and users of observation-derived products, information and knowledge

- Improving the bidirectional feedback mechanisms between the ocean observation community, decision- and policy-makers and society at large
- Reducing the cost and effort to delivering usable information by shortening the science to policy pathway
- Benefiting society by creating conditions that support better environmental decision-making
- Facilitating more effective and frequent use of ocean observation data in monitoring and implementation of critical international frameworks and policy goals

Advocate

- Providing additional exposure and visibility to existing ocean observing programmes
- Promoting communication with decision makers and the general public on the societal benefits of ocean observations
- Working with stakeholders to expand capacity in the field of ocean observation
- Championing for enhanced access to and integration of ocean observation data
- Promoting the use of end-to-end ocean information services

Blue Planet is a network of networks made up of participants from a variety of international organisations, regional organisations, national institutes, universities, government agencies, project groups and other interested parties. Over the coming year, Blue Planet will focus on engagement with the ocean observing community, end-users and industry with the goal of expanding its network. The Initiative will also work to first identify and then undertake prototype/pilot projects aligned with Blue Planet's objectives. As a living document, the Implementation Plan will be updated regularly based on community feedback and identified user needs.

1 Synopsis of Objectives and Benefits

1.1 Importance of Ocean Observations to the Group on Earth Observations

The Group on Earth Observations (GEO) 2016-2025 Strategic Plan identifies eight societal benefit areas (SBAs): Disaster Resilience; Food Security and Sustainable Agriculture; Water Resources Management; Energy and Mineral Resources Management; Public Health Surveillance; Biodiversity and Ecosystem Sustainability; Sustainable Urban Development; and Infrastructure and Transportation Management [1]. Open ocean, coastal and large inland water body observing – henceforth collectively referred to as “ocean observing” – play a vital role in providing informed decision making in every one. For example, ocean-related hazards such as tsunamis, storm surges, and extreme waves require ocean observations for early warning systems and to prepare for and mitigate the effects of disasters. Because of their role in climate, ocean observations also provide important information for the forecasts of precipitation and drought, the source of replenishment of water supplies, and of climate events that can lead to public health incidents or changes in energy demand [2]. Ocean biological observations are critical in monitoring the health of ocean ecosystems and biodiversity, and the way ecosystem services are being impacted by a changing environment [3]. They are also important in managing fisheries and aquaculture [4, 5]. In addition, ocean observations help improve predictions of longer-range forecasts of weather [6]. Finally, ocean observing is involved in various cross-cutting initiatives in GEO, such as system architecture and capacity building.

1.2 Benefits and Expected Outcomes

As a GEO Initiative, Blue Planet will enable direct linkages between the ocean observing community and users within an agreed, yet flexible framework. This will benefit society by facilitating informed decisions and increasing public access to and support for sustained ocean observations and information. Specific outcomes include support from the ocean community for GEO's data management principles and the demonstration of prototype/pilot services that address GEO's societal benefit areas such as:

- Improved forecasts of local sea-level rise and associated increased risk of coastal inundation for better mitigation of flood-related disasters and management of sustainable urban development;
- Monitoring of marine debris for evaluating biodiversity and ecosystem sustainability, aquaculture and public health surveillance;
- Environmental monitoring of off shore and coastal industries for energy and mineral resources management as well as water resources management; and
- Managing of illegal, unreported and unregulated fisheries operations for evaluating biodiversity and ecosystem sustainability in addition to food security management.

When appropriate, Blue Planet will also facilitate the development of prototype/pilot services into GEO Flagships.

It is expected that the activities of the Blue Planet Initiative will support and address a variety of policy and sustainable development goals. Most relevant is the United Nations (UN) Sustainable Development Goal (SDG)14 that is explicitly targeted at the oceans, and accordingly the global community has prioritised the need for concerted action to ensure sustainable growth and management of blue or ocean economies, currently valued at USD 1.5 trillion and projected to double by 2030 [7]. SDGs 13 and 15 (climate action and life on land) further recognise that the future of our Blue Planet is increasingly reliant on the services delivered by marine, coastal and inland waters and on the development of effective, evidence-based decisions on sustainable development [8]. Both the 2015 and 2016 G7 meetings have recognised the importance of oceans, specifically the need to address the impacts of marine litter and deep sea mining and the need to maintain and enhance ocean observing and conduct regular ocean assessments [9].

More broadly the activities of Blue Planet have policy-relevance to a raft of international instruments (conventions, frameworks) and programmes that encompass disaster management (Sendai Framework for Disaster Risk Reduction), adaptation to climate change (UN Framework Convention on Climate Change, Conference of Parties, assessment processes under the Intergovernmental Panel on Climate Change), conservation and biodiversity (Convention on Biological Diversity, Ramsar Convention, Intergovernmental Platform on Biodiversity and Ecosystem Services, global agreement to establish an international representative network of marine protected areas), environmental protection (e.g. International Convention for the Prevention of Pollution from Ships, Espoo Convention on cross border Environmental Impact Assessment) sustainable development (targets for Integrated Water Resources Management, principles for Integrated Coastal Zone Management, UN Barcelona Convention on Sustainable fisheries) and maritime safety (UN Convention on the Law of the Sea). Many of these issues are also addressed at the regional (e.g. European Marine Strategy Framework Directive and

Integrated Maritime Policy, national and state level through instruments specific to these jurisdictions).

In response to these resolutions, and the grand challenges for our oceans and coasts associated with climate change, populations growth/food security, pollution and overexploitation of resources, the global oceans community recognises the need for a step change in the way in which we coordinate and “hardwire” the links between technological innovation and sustained observations of the oceans, the data, information and services they provide, and approaches to ecologically sustainable development and ocean policy. There is therefore an urgent need for the scientific community to work together to leverage resources and agree on the variables that need to be measured (Essential Variables) and to implement these in a systematic, sustained and globally-distributed manner [10]. Blue Planet will address this need by bringing various ocean observing organisations, programs and projects into the Group on Earth Observations System of Systems (GEOSS) to work together to achieve common objectives. As stated by the European Space Agency (ESA), “What is needed now, that GEOSS will help achieve, is to integrate the outputs from these various marine monitoring and observation efforts into a cohesive system of systems which will enable researchers, resource managers and policy makers to rapidly assess what is known about a particular marine region” [11].

1.3 Vision

Blue Planet envisions an informed society that recognises the oceans’ crucial role in Earth's life-support system and is committed to stewardship of the oceans for a healthy, safe and prosperous future for all.

1.4 Mission

Blue Planet’s mission is to advance and exploit synergies among the many observational programmes devoted to ocean and coastal waters; to improve engagement with a variety of users for enhancing the timeliness, quality and range of services delivered; and to raise awareness of the societal benefits of ocean observations at the public and policy levels.

1.5 Goal and Objectives

The goal of the Blue Planet Initiative is to ensure the sustained development and use of ocean and coastal observations for the benefit of society. The objectives to achieve this goal are:

Objective 1: Increase integration of and access to in situ and remote sensing ocean observation data

Objective 2: Conceptualize, promote and facilitate the development of end-to-end ocean information services

Objective 3: Improve connections between the producers and providers of ocean observation data, products and information and the end users

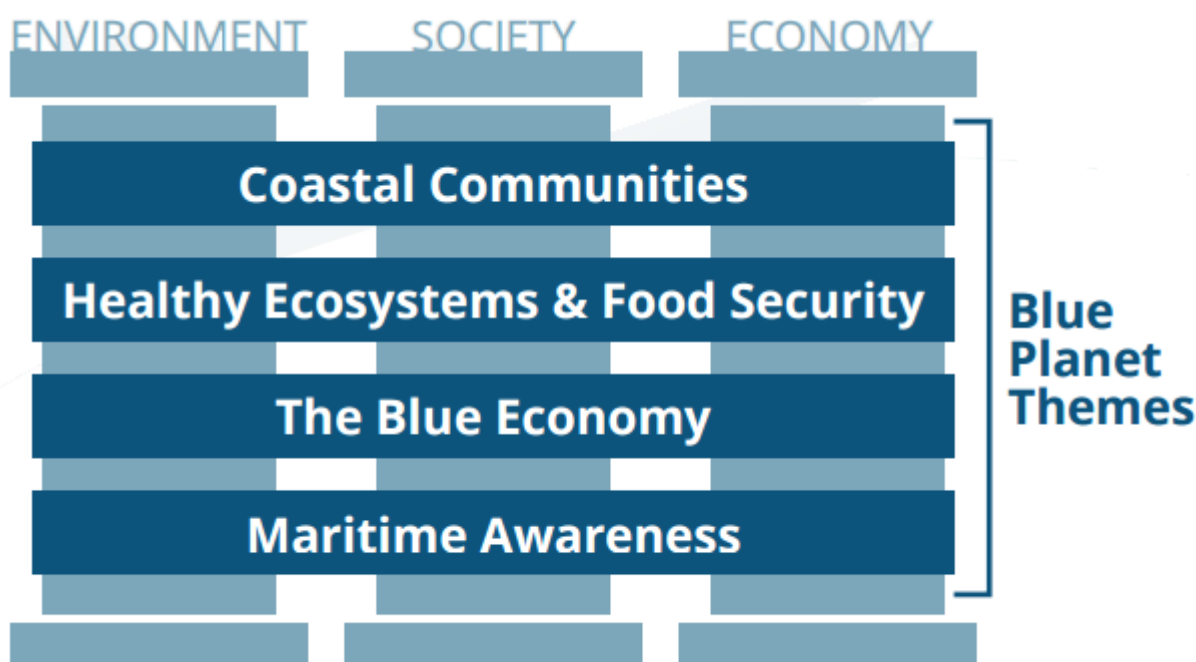
Objective 4: Increase societal support and build capacity for ocean observations

1.6 Components

To achieve these objectives, Blue Planet activities will be organized into four major components. These components align with the four objectives and will be composed of working groups tasked with identifying priorities, producing prototype/pilot projects and coordinating with related GEO activities. Where possible, these activities will also address international mandates and SDGs.

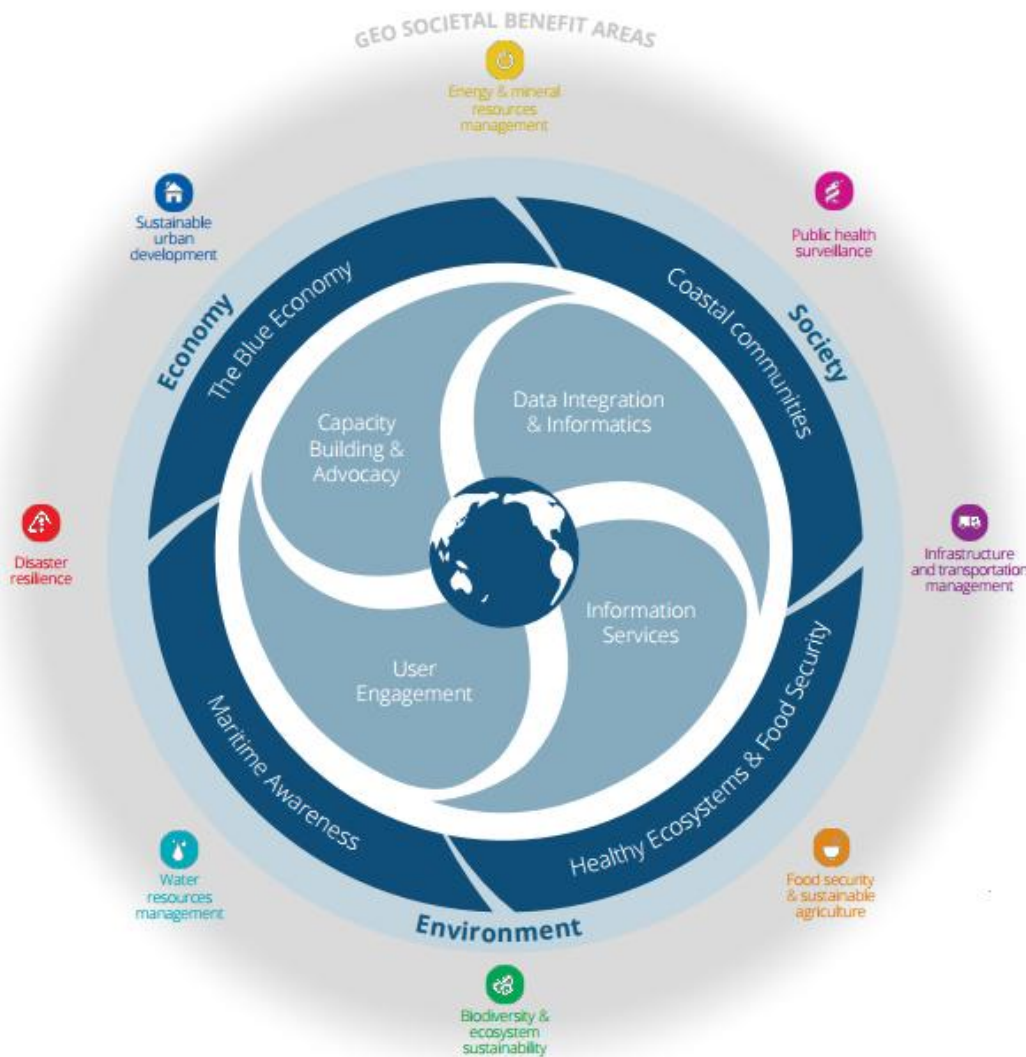
Component activities will be focused on four themes that address the three pillars of sustainable development (Figure 1) [13].

Figure 1: Blue Planet Thematic Focus Areas. The four themes (coastal communities, healthy ecosystems & food security, the blue economy and maritime awareness) will address the three pillars of sustainable development – environmental protection, societal development and economic development [13].



As presented in the below conceptual diagram (Figure 2), Blue Planet components work together on activities within the four themes. These activities ultimately link to GEO's SBAs and work to facilitate informed decision making and address policy mandates.

Figure 2: Blue Planet Conceptual Diagram. The inner circle illustrates the components that work together within four thematic areas to address GEO's eight SBAs.



1.6.1 Data Integration and Informatics

Significant investment has been made in a range of ocean data, modeling and analysis at regional, national and global scales. A key challenge remains, however, in the integration, accessibility, discoverability and transformation of data. This requires integration of satellite and in situ data and the delivery of data to diverse users.

This component will work towards achieving Blue Planet objective 1 – increase integration of and access to in situ and remote sensing ocean observation data – and the GEO strategic objective – deliver. This component will present data and products to users in ways that are

relevant to their interests and needs. This will be achieved through the use of modern data interoperability, integration and visualisation methodologies and will leverage the various efforts – such as the GEO Carbon and Greenhouse Gas Initiative, the Ocean Data Interoperability Platform (ODIP) and the Intergovernmental Oceanographic Commission's International Oceanographic Data and Information Exchange (IOC/IODE) – that are being made in the semantic web and linked open data domains. Most importantly, this will not replace or duplicate existing efforts. This component will work with existing projects and initiatives to value add and integrate, allowing greater data discovery, access and reuse for a variety of purposes including comprehensive world ocean assessments. User groups expected to benefit from this component include the ocean observing community, scientists and the end-users of ocean observations.

It is envisioned that working groups for this component will include representatives from ODIP, the Ocean Biogeographic Information System (OBIS), IOC/IODE, the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), and the Committee on Earth Observation Satellites (CEOS).

Activities are expected to broadly encompass:

1. Networking existing regional and international efforts in improving data interoperability and access.
2. Encouraging and facilitating registration of databases within the GEOSS Common Infrastructure.
3. Coordinating various initiatives that are making available research cruise information to ensure that efforts are not being duplicated, and broaden the input to these efforts.
4. Developing the Blue Planet website into an online resource for policy makers, scientists and the general public.
5. Working with data providers to generate user friendly interfaces for services and products.

While specific activities will be developed during 2018-2019, the activities of this component are expected to add value by:

- Providing discoverable, integrated and accessible ocean observation data
- Providing a framework to enable comprehensive world ocean assessments
- Building on and adding to GEOSS infrastructure

1.6.2 Information Services

The transformation of ocean observations into actionable information is crucial for society and sustainable development and use of ocean resources. While many ocean observing organisations and programmes produce ocean information services, there remains a significant challenge in scaling up these services across regions, ensuring user needs are being met and promoting the use of services.

This component will work towards achieving Blue Planet objective 2 – conceptualize, promote and facilitate the development of end-to-end ocean information services – and the GEO strategic objective – deliver. This component will work to with users and information service providers to improve and expand upon available ocean information services. User groups expected to benefit

from this component include industry, managers and planners at national, regional and local levels.

Working groups within this component are expected to align with the four thematic areas. The envisioned composition of these working groups is outlined below.

Coastal Communities: climate change scientists, disaster risk experts and coastal ecosystem scientists, managers and planners drawn from government, industry and the research and observing community.

Healthy Ecosystems and Food Security: ecosystem scientists, aquaculture and fisheries industries, drawn from government, industry the research and observing community.

The Blue Economy: industry representatives (particularly aquaculture, ocean renewable energy and oil and gas), government regulators, Small Island Developing States representatives (e.g. Indian Rim Association, Asia-Pacific Economic Cooperation), and the observing and scientific community including commercial satellite representatives.

Maritime Awareness: representatives from international and national maritime bodies/authorities with responsibilities within the maritime safety, environmental, security, commerce, transportation and operation domains as well as marine/maritime Earth observation development experts drawn from government, industry and the research and observing community.

Activities are expected to broadly encompass:

1. Demonstrating the use and functionality of prototype services.
2. Facilitating technology transfer of existing information services to other regions.
3. Facilitating and demonstrating the upscaling of information services.
4. Conceptualizing the development of new GEO Flagship services based on identified user needs and data availability.

While specific activities will be developed during 2018-2019, the activities of this component are expected to add value by:

- Promoting and facilitating the development of ocean information services through technology transfer, upscaling of existing products and conceptualizing new services

1.6.3 User Engagement

There are many types of end-users of ocean observations, including data users such as scientists, ocean synthesis and forecast systems, and seasonal and long-term climate forecasts and projections, and information service users such as civil protection authorities, regulators, industry, policy makers and recreational users. Ocean observations also feed into Conventions such as the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity and the European Marine Strategy Framework Directive, as well as Assessments such as those of the Intergovernmental Panel on Climate Change and the World Ocean Assessment, and monitoring of the United Nations Sustainable Development Goals.

The user engagement component will work towards achieving Blue Planet objective 3 – improve connections between producers of ocean observation data, products and information and end users – and the GEO strategic objective – engage. This component will evaluate various feedback and early-input mechanisms between data and information providers and various user communities. User groups expected to benefit from this component include the ocean observing community, scientists and the users of ocean observation information.

It is envisioned that working groups for this component will include United Nations programme representatives, the World Ocean Council, industry associations, professional bodies, learned societies, government agency user liaisons, Earth observation programme user engagement specialists, fisheries representatives, environmental policy specialists, international nonprofits, and international non-governmental organisations.

Activities are expected to broadly encompass:

1. Development of a framework describing users and user archetypes, use cases, data and information requirements, constraints and opportunities.
2. Create pathways for engagement (early conceptual input and life-cycle feedback) between the ocean observation science community and the potential users and beneficiaries.
3. Compiling a growing portfolio of cases detailing the societal benefits of ocean observation science.

While specific activities will be developed during 2018-2019, the activities of this component are expected to add value by:

- Creating an improved understanding of the potential beneficiaries of ocean observations
- Improving the mutually beneficial relationship between the ocean observing community, intermediary organisations and users of observation-derived products, information and knowledge
- Improving the bidirectional feedback mechanisms between the ocean observation science community, decision- and policy-makers and society at large
- Reducing the cost and effort to delivering usable information by shortening the science to policy pathway
- Benefiting society by creating conditions that support better environmental decision-making
- Facilitating more effective and frequent use of ocean observation data in monitoring and implementation of critical international frameworks and policy goals

1.6.4 Capacity Building and Advocacy

Because the ocean transcends national boundaries, and because it is so vast and challenging to access, oceanographic research requires international collaboration by its very nature. Capacity building for the use of ocean observation data and information provides a larger pool of trained personnel, more representation at the world scale and fulfils demand for such personnel. Capacity building in terms of data collection and analysis infrastructure and availability and access to integrated data sets is also critical to ensure adequate monitoring of the marine

environment on local, regional and global scales. At present, there are large gaps in ocean observations in many parts of the world due to the imbalance in ocean observation capabilities (human resources and infrastructure/technology). Capacity building requires at the very least two-way interaction between developing and developed countries, for example through exchange of personnel, knowledge and expertise between countries. Such exchanges are facilitated by international organisations such as the Partnership for Observation of the Global Ocean (POGO), IOC/IODE and the Scientific Committee on Oceanic Research (SCOR). Capacity building can be most effective through the participation of scientists from developing countries in training programmes and research projects run in collaboration with developed countries. The success of ocean observations also requires advocacy, at the public and policy levels, on the importance of ocean observations and integrated and accessible data.

The capacity building and advocacy component will work towards achieving Blue Planet objective 4 – increase societal support and build capacity for ocean observations – and the GEO strategic objective – advocate. This component will link existing capacity building efforts and expand on advocacy efforts for integrated and open access data and support for sustained ocean observation. Groups expected to benefit from this component include developing countries, the ocean observing community, scientists and decision makers.

It is envisioned that working groups for this component will include representatives from POGO, IOC/IODE, SCOR, informal science education experts, science policy nonprofits and nongovernmental organisations and CEOS. Activities are expected to broadly encompass:

1. Working with stakeholders to expand capacity in the field of ocean observations by advocating for and linking existing programs such as POGO's professional training initiatives, Nippon Foundation-POGO Centre of Excellence training programmes, IOC/IODE OceanTeacher training activities and SCOR capacity building activities.
2. Identifying infrastructure needs and advocating for resources to meet these needs.
3. Communicating with decision makers and the general public on the societal benefits of ocean observations.
4. Championing for enhanced access to and integration of ocean observation data.

While specific activities will be developed during 2018-2019, the activities of this component are expected to add value by:

- Providing additional exposure and visibility to existing ocean observing programmes
- Promoting communication with decision makers and the general public on the societal benefits of ocean observations
- Working with stakeholders to expand capacity in the field of ocean observation
- Championing for enhanced access to and integration of ocean observation data

2 Previous Developments and Results

The creation of the “Oceans and Society: Blue Planet” Task was an initiative of POGO in 2011, to coordinate all the existing ocean observation programmes within GEO, to add new ones to the GEO portfolio, and to create synergies between them. Over the next two years, the new Task was developed further by POGO, in collaboration with other organisations, notably CEOS, the GEO

Coastal Zone Community of Practice (CZCP), GODAE OceanView and the Global Ocean Observing System (GOOS). It was introduced formally into the GEO Work Plan in 2012 (as SB:01) [12].

To date, Blue Planet has hosted symposiums in 2012 and 2014 that brought together various stakeholders in the ocean observing community to discuss the role of Blue Planet in GEO. Following the 2012 Symposium, a Steering Committee was assembled under the leadership of Prof. Trevor Platt (at the time POGO Executive Director). The Committee has worked to produce a White Paper outlining Blue Planet and a book titled “Oceans and Society: Blue Planet” [14, 15]. The Blue Planet Steering Committee also previously supported the development and implementation of the Chlorophyll Globally Integrated Network (ChloroGIN) and the Societal Applications in Fisheries and Aquaculture of Remotely-Sensed Imagery (SAFARI) Initiative.

During the GEO-X Plenary which took place in January 2014, a joint European Commission-Blue Planet Side Event was held entitled “Towards an Integrated Atlantic Ocean Observation System aided by GEO's Blue Planet Initiative”. In addition, Blue Planet contributed to the script and content of the Demonstrator's Showcase video entitled “GEOSS: addressing the post-2015 Global Agenda” which was shown at the GEO Ministerial in January, 2014. Following on from this a video specifically about Blue Planet was produced by Prof. Roland Doerffer which was distributed at the second Blue Planet Symposium.

Following the second symposium, several meetings of the Blue Planet Steering Committee were held, and some firm commitments were made by the participating organisations to develop Blue Planet further. It was agreed that Blue Planet would apply to be an *Initiative* in the new GEO structure, aspiring to spin off a number of end-to-end services as GEO Flagships. To support these goals, the Blue Planet Secretariat was established in late 2015 by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the U.S. National Oceanic and Atmospheric Administration (NOAA). To increase awareness and engagement, Blue Planet participants have given presentations about the importance of sustained ocean observations and the role of Blue Planet at a variety of venues. These efforts were supplemented by the production of a video by POGO, titled “Ocean observations for the benefit of society” that won best video at the GEO-XII Plenary and Mexico City Ministerial Summit. In addition, Blue Planet has set up a website (see: www.geoblueplanet.org) and Twitter account (see: @GEOBluePlanet).

In order to move forward with Blue Planet as an Initiative, an ad hoc Board was established in 2016 to provide direction for the transition. Members of the ad hoc Board represent the major participating organisations to date – CEOS, the CZCP, GODAE OceanView, GOOS and POGO – and the principal financial sponsors – CSIRO and NOAA.

3 Participants and contributors

To date, Blue Planet has had participants from a large variety of international organisations, regional organisations, national institutes, universities, government agencies, project groups and other interested parties. These participants are part of the Blue Planet network and contribute to Blue Planet in a variety of ways depending on their interests and availability.

Blue Planet leadership: Leadership for the Initiative is currently provided by an ad hoc Board consisting of representatives from CEOS, the CZCP, CSIRO, GODAE OceanView, GOOS, NOAA and POGO. The Blue Planet primary point of contact and GEO liaison is Sophie Seeyave of POGO. The ad hoc Board is supported by an evolving ad hoc Steering Committee and the Secretariat.

Secretariat: Blue Planet's Secretariat is currently staffed by a Scientific Coordinator (Emily Smail – NOAA) and a Technical Manager (Jonathan Hodge – CSIRO). The Secretariat provides overall coordination and manages the website and day-to-day tasks.

To succeed as an Initiative, Blue Planet needs to extensively engage with the ocean observing community, user groups and industry. Growing the Blue Planet network and increasing participation with various international, national, non-profit, nongovernmental and industry groups will be the primary focus of the Initiative for the next year.

4 Activities

Blue Planet activities will be conducted on a global scale with some prototype/pilot projects being focused at the local and regional scale. Management and coordination activities will be conducted initially by the ad hoc Board, Secretariat and ad hoc Steering Committee members. Starting in 2017, these tasks will be the responsibility of the strategy and management bodies outlined in section 9. Activities aimed at meeting Blue Planet's primary objectives will be articulated, prioritized and executed by component working groups.

Blue Planet activities will link and coordination with many other GEO activities including:

GEO Community Activities: AquaWatch; GEO Great Lakes Activity, Global Flood Risk Monitoring; Using Geospatial Data to Identify and Monitor Ecosystem Services and Track in a Natural Capital – Ecosystems Accounts Framework; Harmful Algal Bloom Early Warning; For Global Mangrove Monitoring

GEO Community Developments: Capacity building Coordination; Reinforcing engagement at the National and Regional Level; Assess the Benefits from EOs and of their Socio-economic Value

GEO Foundational Tasks: Advancing GEOSS Data Sharing principles; GCI Operations; Global Observing and Information Systems; GEONETCast Development and Operations; In-situ Earth Observation Resources; SBAs Process: Systematic Determination of User Needs/Observational Gaps; Knowledge Base Development; Communication Networks

GEO Initiatives: GEOGLAM-Global Agricultural Monitoring and Early Warning; GEO BON-Global Biodiversity Observation; Reinforcing engagement at regional level: AfriGEOSS for Africa; GECO: the GEO Global Ecosystem Initiative; Global Urban Observation and Information; Earth Observations in Service of the 2030 Agenda for Sustainable Development; Carbon and Greenhouse Gas; GEO Wetlands; AmeriGEOSS; Asia-Oceania GEOSS

4.1 2016

- Communication and Engagement: Activities for the remaining months of 2016 will focus on engaging with the ocean observing community and user groups to garner support and increased participation in Blue Planet. This will be accomplished through the production and initial implementation of a communication and engagement strategy by the Secretariat in consultation with the current ad hoc Board and ad hoc Steering Committee. The engagement and communications strategy will aim to: 1) raise awareness among ocean observation operators, users and the GEO community about the goal of Blue Planet and opportunities for engagement, involvement and collaboration; 2) increase collaborative efforts among Blue Planet shareholders and stakeholders; and 3) establish a platform to market support of ocean observations to governments and other potential end users of Blue Planet services.

Implementation of the communication and engagement strategy will involve substantial outreach efforts to Blue Planet stakeholders through a variety of means including formal letters, teleconferences, presentations and in person meetings. Through this process, Blue Planet stakeholders will be informed of how they can contribute to and benefit from involvement in Blue Planet. This will be an ongoing effort that will continue through 2019.

- 3rd Symposium Planning: Blue Planet will plan and arrange for the 3rd Blue Planet Symposium – “The Role of the Oceans in Earth’s Life-Support System”.
- Symposium Planning: Blue Planet will begin planning and arranging a symposium for June of 2017.
- Special Issue: Blue Planet will arrange for the production of a special issue of the Journal of Operational Oceanography on ocean observing for societal benefit (publication expected to occur in 2017).

4.2 2017

- Transition to Updated Governance Structure: Blue Planet will transition to the formal governance structure outlined in section 9. The current ad hoc Board will moderate a process where relevant communities are invited to nominate members for the Advisory Board, Steering Committee and Component Working Groups.
- Update of Implementation Plan: The Steering Committee, with support from the Management Committee and in consultation with the Advisory Board and Working Groups, will update the Implementation Plan.
- 3rd Symposium: Blue Planet will host the 3rd Blue Planet Symposium – “The Role of the Oceans in Earth’s Life-Support System” – in College Park, Maryland, U.S. The 3rd Blue Planet Symposium will address four specific subthemes: sustainable use of ocean

resources; threat from pollution, warming and acidification; the changing ocean; and processes and life at the interfaces with the oceans. The 3rd Blue Planet Symposium will provide the forum for a discussion of the science in these four subthemes and the research, monitoring and forecasting/prediction needs resulting from the societal information needs. The 3rd Blue Planet Symposium will also be a unique opportunity to provide input from a range of communities to the further development of the Blue Planet Initiative in the GEO Work Programme and to improve coordination between observational networks and users.

- Role of the Oceans in Earth's Life-Support System Book: Following the 3rd Symposium – a book based on the theme of the symposium will be submitted to GEO for publication. The production of this book will be led by editor Hans-Peter Plag and produced by Blue Planet participants and associated experts. The goal of the book will be to comprehensively consider the research and infrastructure needs for monitoring the physical, chemical and biological ocean systems, the development of forecasting capabilities, the societal information needs related to the open ocean and the interface between the land and oceans.

4.3 2018

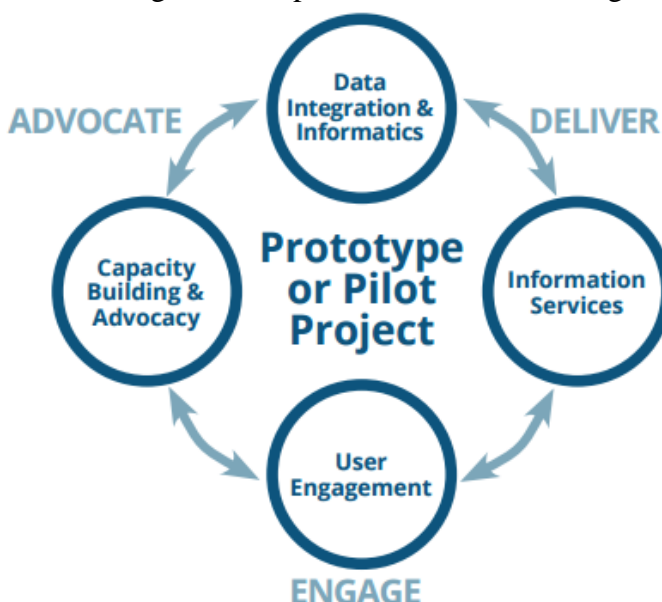
- Prototype/pilot Project Proposals: Working Groups will be tasked with submitting proposals for specific prototype/pilot projects to the Steering Committee.
 - Potential prototype/pilot project focus areas are outlined below.
 - Coastal Communities:
 - Improved forecasts of local sea-level rise and associated increases in coastal inundation
 - Services focusing on the state and potential degradation of coastal ecosystems, including loss and modification of crucial habitats such as mangroves, coral reefs and estuaries
 - Support GEO water quality services as a key partner in AquaWatch
 - Healthy Ecosystems and Food Security:
 - Maintenance of OceanSites, the Marine Biodiversity Observation Network (MBON) and the animal telemetry network
 - Services focused on marine debris, monitoring of aquaculture operations, assessments of blue carbon potential and assessment frameworks of estuaries and large inland water bodies
 - The Blue Economy:
 - Facilitate the development of new goods and services as part of the Blue Economy
 - Environmental and sea-state forecasting for Small Island States and coastal industries.

- Access to bathymetric, habitat and biodiversity data to assist with spatial planning of industry development
 - Environmental monitoring of large and offshore aquaculture industries
- Maritime Awareness:
 - Focused real-time environmental conditions for tides and water levels
 - Short-term forecasts of winds and currents
 - Climate predictions (e.g. sea level change, diminishing sea ice in the Arctic) for high density traffic areas, Polar Regions and environmentally sensitive areas
 - Monitoring of illegal, unreported and unregulated fisheries operations
 - Detection of pollution occurrences at sea and the subsequent monitoring of these incidents
 - CO₂, NO_x and SO_x air emission trend maps
- Prototype/pilot project selection: The Steering Committee will review the proposals and select projects based on identified priorities and resources.
 - Coastal Zone Report: The Steering Committee will lead the production of a coastal zone report. This report, titled “Preparing the urban and rural coasts for climate change” will seek to identify hazards for coastal communities, summarize the existing science, identify knowledge gaps and management requirements, and identify knowledge services needed for society to manage climate change in coastal areas.

4.4 2019

- Prototype/pilot Projects Begin: Work on prototype/pilot project(s) begins. Activities of each project are expected to flow through the components as outlined in Figure 3.

Figure 3: Blue Planet project workflow. Data is integrated, made accessible and transformed into information services. Users are engaged and in turn provide feedback influencing the development of services and data processing. Capacity needs are identified and addressed. Data collectors, providers and users advocate for integrated and accessible data and sustained ocean observations.



- 2020-2023 Implementation Plan: The Advisory Board will review the strategic direction and available resources of Blue Planet and provide feedback to the Steering Committee. The Steering Committee will then lead the production of a 2020-2023 Implementation Plan.
- OceanObs'19: Blue Planet will support and participate in OceanObs'19.

5 Involvement of end-users

Understanding the needs of the user community and creating bidirectional communication pathways to foster and influence the production of information by the science community is central to Blue Planet's objectives. There are many types of end users and user-groups of services derived from ocean observations, including civil protection authorities, regulators, climate services, industry and recreational users. Ocean observations also feed into monitoring of the SDGS and conventions such as the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD) and the European Marine Strategy Framework Directive (MSFD), as well as Assessments such as those of the Intergovernmental Panel on Climate Change (IPCC) and the World Ocean Assessment. These users need services and information tailored to their unique needs. User needs include integrated and readily available data and informational products that are accessible to non-scientists. Users also have an increased need for near real time data and forecasts.

Blue Planet will meet these user needs by first identifying priority and actively involving them in the Advisory Board, Steering Committee and Working Groups. Users will be encouraged to help design the outputs of ocean observation information services in order to support informed decision making. The user engagement component will lead end-user identification and coordination efforts and will work to create pathways for engagement by working to understand the value chain from ocean observation data, to product to actionable information.

6 Implementation, Milestones and Deliverables

Implementation activities for August 2016 – December 2019 are outlined in section 4. Milestones and deliverables are presented in the below Gantt chart.

Monitoring and evaluation in 2016 will be conducted by the current ad hoc Board and direct financial contributors. The ad hoc Board will hold monthly conference calls for monitoring purposes to track the progress of communication and engagement and the expansion and increased involvement of stakeholders in Blue Planet.

During the 2017 – 2019 time period, monitoring will be conducted by the Steering Committee. The Committee will regularly track implementation, milestones and deliverables and will report results to the Advisory Board. The Advisory Board will be responsible for evaluating the overall progress and resource needs.

August 2016 – December 2019 Blue Planet Gantt Chart

Implementation Activity, Milestone or Deliverable	2016		2017				2018				2019			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Engagement and communication strategy developed														
Journal of Operational Oceanography special issue produced														
Communication and engagement strategy implemented														
Blue Planet network expanded and engaged														
Advisory Board, Steering Committee and Working Groups formed														
Implementation Plan reviewed and updated														
3 rd Blue Planet Symposium preparation														
"The Role of the Oceans in Earth's Life Support System" book produced														
Working Group prototype/pilot projects proposals submitted														
Coastal zone report produced														
Prototype/pilot projects selected														
Prototype/pilot projects underway														
2020 - 2023 Implementation Plan produced														
OceanObs'2019														

7 Data management and data policy

Blue Planet will primarily be a data consumer rather than a data producer. For the most part, Blue Planet components will leverage existing systems and services from numerous organisations and will work to encourage other data providers to contribute to existing systems. Data types and categories will include a large range of ocean data and other supporting datasets including traditional geospatial data (e.g. management boundaries), time series monitoring data (e.g. ocean moorings), gridded datasets (e.g. satellite remote sensing products) and complex multi-dimensional data cubes (e.g. ocean models). End products will aim to bring many of these data types to end users in useful, usable ways which connect directly to the source data services.

Blue Planet will adopt and promote all of the GEOSS Data Sharing and Data Management Principles. A key focus will be to help socialize and educate end users about concepts of open data, data services and data interoperability. Blue Planet will engage with many other GEO initiatives and other national, regional or global activities to help develop tools and products designed to bring ocean observations to end users. Part of this collaboration is to leverage the support of groups focusing on data interoperability such as GEOSS and ODIP. This will allow Blue Planet to keep up to date with the latest developments in the world of Linked Open Data, controlled vocabularies and the Semantic Web. Blue Planet will also aim to socialize many of these topics across the ocean and earth observation communities. Where Blue Planet does produce new data products, all data will be linked to the GEOSS Common Infrastructure where it is appropriate to do so. Data and metadata will be managed and delivered by leveraging existing information platforms which are hosted by supporting agencies.

8 Risk assessment

The task that lies ahead of Blue Planet is not trivial. Collaboration and coordination is in itself a challenge, to which are added the dimensions of international, cross-cultural and cross-disciplinary work. Blue Planet seeks to integrate the work of scientists, regulators, industry and governments, and many international and regional observing programmes. Blue Planet focuses not only on observations, but also capacity building, communication, outreach and user engagement. Bringing together organisations that may feel they are in competition with each other for funding and for recognition is also a significant challenge that may make it difficult to attract potential partners to Blue Planet. Blue Planet also faces challenges associated with its volunteer, best-effort nature. This means that resources (financial and human) are a limiting factor that may hinder its progress. Risk will be identified and managed by the Technical Steering Committee co-chairs and the Initiative Leader. Regular reporting and coordination with the GEO Secretariat will be used as a mechanism to manage risk.

9 Management and governance

Blue Planet is a network of networks composed of organisations and members working together towards a common goal. The Initiative is primarily supported by in-kind contributions and minimal direct staffing. Blue Planet is currently governed by an ad hoc Board and ad hoc Steering Committee supported by a distributed Secretariat. During the remaining months of 2016 and early months of 2017, Blue Planet will transition to the governance structure outlined below (Figure 4).

Figure 4: Blue Planet Governance Structure



1. **Advisory Board:** The Advisory Board will be composed of high level individuals representing foundational ocean observing organisations and users. The Advisory Board will be responsible for providing the strategic direction for Blue Planet, advocating for Blue Planet and identifying funding.
2. **Steering Committee:** The Steering Committee will consist of the chairs and co-chairs of Working Groups and other contributing shareholders and stakeholders. The Steering Committee is responsible for project development and coordination.
3. **Management Committee:** Management Committee will be composed of the Secretariat and the three co-chairs of the Steering Committee and two representatives at large. The daily operations and activities of Blue Planet are managed by the Management Committee.
4. **Secretariat:** The Blue Planet Secretariat will provide scientific and technical coordination for Blue Planet Components as well as logistical support for Blue Planet activities. The Blue Planet Secretariat will have a Scientific Coordinator and a Technical Manager. Other roles

may be created as the need arises and depending on the availability of funds/contributions from the shareholders.

5. Component Working Groups: Working Groups will be populated based on interest and need and will implement the specific activities of the four components.

10 Summary of committed resources

10.1 Direct contributions

Human resources:

- For management and representation within GEO: POGO Secretariat (approx. 30% FTE)
- For coordination and communications:
 - Blue Planet Secretariat node hosted by NOAA (Scientific Coordinator, 1 FTE)
 - Blue Planet Secretariat node hosted by CSIRO (data/informatics expert and communications/graphic design support)

Infrastructure:

- IT, website, database infrastructure provided by CSIRO

10.2 In-kind contributions

Human resources:

- In-kind contributions from various international, national and regional ocean observation-related programmes, organisations and individuals

Infrastructure:

- An estimated USD >1 billion in direct support to ocean observations, data management and analysis activities, including contributions from space and in situ observations, from a broad variety of countries (European Union, national and institutional funding)

Annex A – Acronyms and Abbreviations

CBD	Convention on Biological Diversity
CEOS	Committee on Earth Observation Satellites
ChloroGIN	Chlorophyll Globally Integrated Network
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CZCP	Coastal Zone Community of Practice
ESA	European Space Agency
GEO	Group on Earth Observations
GEOS	Global Earth Observation System of Systems
GOOS	Global Ocean Observing System
OBIS	Ocean Biogeographic Information System
ODIP	Ocean Data Interoperability Platform
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange
IPCC	Intergovernmental Panel on Climate Change
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology
MBON	GEO Global Biodiversity Observation Network thematic Marine Biodiversity Observation Network
MSFD	European Marine Strategy Framework Directive
NOAA	National Oceanic and Atmospheric Administration
POGO	Partnership for Observation of the Global Ocean
SAFARI	Societal Applications in Fisheries and Aquaculture of Remote-sensing Imagery
SBAs	Societal Benefit Areas
SCOR	Scientific Committee on Oceanic Research
SDGs	Sustainable Development Goals
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

Annex B – List of References

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- [5] S. Saitoh, R. Mugo, A. S. T. F. Radiarta, T. Hirawake, Y. Ishikawa, T. Awaji, T. In and S. Shigeki, “Some operational uses of satellite remote sensing and marine GIS for sustainable fisheries and aquaculture,” *ICES Journal of Marine Science*, vol. 68, pp. 687-695, 2011.
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<http://www.oceansandsociety.org/files/white-paper.pdf>
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Annex C – CV of Project Leader

Blue Planet leadership comes from foundational ocean observing programmes and organizations with direct funding for the Secretariat provided by CSIRO and NOAA. Sophie Seeyave of POGO serves as the Blue Planet Point of Contact and primary GEO liaison.

SOPHIE SEEYAVE

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Date of birth: 20/04/1982
Nationality: Dual British/ French

PROFILE

An experienced and highly professional international programme Executive Director with a background in marine science, strong leadership skills, a track record of publications in peer-reviewed journals, experience in programme and budget management, capacity building, communication and outreach.

QUALIFICATIONS

- 2009 PhD ‘Nitrogen nutrition of Harmful Algal Blooms in upwelling systems’**
University of Southampton, UK
Supervisors: Drs. D.A. Purdie (University of Southampton), T.A. Probyn (Marine & Coastal Management [MCM], Cape Town) and M.I. Lucas (University of Cape Town).
Grant awarded by the Natural Environment Research Council (NERC).
- 2004 BSc (Hons) Oceanography with Marine Biology (First Class)**
University of Southampton, UK
- Modules included Marine Biology/Taxonomy, Ecology, Biochemistry, Statistics, Mathematics, Physical and Chemical Oceanography.
 - Year out in 2002-2003 to conduct 3rd year research project at MCM (Cape Town) on “Photoadaptation by Harmful Algal Bloom species of phytoplankton in the Southern Benguela upwelling system”.
- 2000 Scientific Baccalauréat, ‘Mention Très Bien’ (80 % average)**
Lycée Pardailhan, Auch, France
9 subjects, with emphasis on Maths, Physics, Chemistry and Biology.

SKILLS & PERSONAL ATTRIBUTES

- Demonstrated ability to lead a complex and high-level programme with multiple stakeholders.
- Excellent written communication (manuscripts, proposals, reports, newsletters).
- Ability to communicate science to different types of audience.
- IT skills: MS Office, various statistical packages (SigmaPlot, Surfer, PRIMER-E), web authoring (Dreamweaver), design software (Adobe Creative suite), accounting software (Sage Line 50), different operating systems (Windows, Apple, Linux).
- Languages: English (fluent), French (fluent), German (good), Spanish (good).
- Excellent organisational/time management skills, self-motivation, ability to work independently and in a team, ability to adapt and learn new skills.

EMPLOYMENT

2014-present	<p>Executive Director, Partnership for Observation of the Global Oceans (POGO) Secretariat, Plymouth Marine Laboratory, UK</p> <p><i>Line manager: Prof. Stephen de Mora</i></p> <ul style="list-style-type: none"> • Leadership and delivery of the POGO programme • Representing the programme at the international level • Running of POGO annual meetings in close cooperation with the Chair • Oversight of POGO finances • Leading outreach programme • Development and management of POGO capacity building programme • Managing the Secretariat staff (Scientific Coordinator, Administrative Assistant)
2013-2014	<p>Assistant Director, Partnership for Observation of the Global Oceans (POGO) Secretariat, Plymouth Marine Laboratory, UK</p> <p><i>Line managers: Prof. Trevor Platt FRS, Dr Shubha Sathyendranath</i></p> <ul style="list-style-type: none"> • Contributing to the delivery of the POGO agenda • Managing and representing the Secretariat in various international fora • Planning and co-ordinating key POGO events • Developing and implementing an international outreach strategy • Developing relationships between POGO and key stakeholders • Ensuring delivery of the POGO Capacity Building Programmes • Supervising Scientific Coordinator and Administrative Assistant.
2010-2013	<p>Scientific Coordinator, Partnership for Observation of the Global Oceans (POGO) Secretariat, Plymouth Marine Laboratory, UK</p> <p><i>Line managers: Prof. Trevor Platt FRS, Dr Shubha Sathyendranath</i></p> <ul style="list-style-type: none"> • Supporting the delivery of the POGO agenda • Contributing to the planning, execution and reporting of key POGO events • Monitoring and responding to incoming communications

- Managing the POGO budget and liaising with the Finance Department; and supervising administrative support as and when required.
- Developing communication materials to support emerging strategies as well as presenting them in major outreach events.
- Supporting, developing and maintaining the public face of POGO to the outside world through coordinating press releases, media monitoring to determine impact of POGO, and by serving as webmaster on the POGO site
- Advertising, annually, for candidates for POGO's capacity building programme; supporting the candidate selection procedure; supervising the administration of the programme; and preparing an annual report on the programme.

2009-2010 Project Officer, Surface Ocean Lower Atmosphere Study (SOLAS) International Project Office, University of East Anglia, Norwich, UK

Line managers: Dr. Emilie Breviere/ Prof. Peter Liss FRS

- Facilitation of communication between SOLAS and related programmes, strategic partners and sponsors, as well as within the SOLAS community.
- Organisation of international events (e.g. SOLAS Open Science Conference 2009).
- Administration of the European CoOperation in Science and Technology (COST) Action 735 grant, for workshops and short research visits for early career scientists.

2004-2005 Phytoplankton Ecologist, National Oceanography Centre, Southampton, UK

Line managers: Dr. Michael Lucas, Prof. Raymond Pollard, Dr. Richard Lampitt

- Measurement of size-fractionated primary production and photosynthesis vs irradiance curves (using ^{14}C tracer technique), photosynthetic pigments (HPLC) and phytoplankton counts for 2 research projects, (1) Carbon export at the Porcupine Abyssal Plain (PAP) Site and (2) CROZet natural iron fertilisation and EXport experiment (CROZEX).
- Participation in 2- to 12-week cruises, sample and data analysis, presentation of data at international conferences and preparation of publications.

CONFERENCES & MEETINGS ORGANISED

2nd “Oceans and Society: Blue Planet” Symposium, Cairns, Australia, May 2015 (100 participants)

Member of Organising Committee, report writing, presentations.

“Oceans and Society: Blue Planet” Kick-Off Symposium, Ilhabela, Brazil, November 2012 (80 participants)

Member of Organising Committee, report writing, presentation.

POGO Annual Meetings in January 2011/12/13/14/15/16 (60 participants)

Meeting organisation, preparation of agenda, minute-taking, presentations.

NF-POGO Alumni Network for Oceans (NANO) Meetings in 2010/11/12/13/14/15 (20-30 participants)

Meeting organisation, presentations, strategic discussions on the development of the network of alumni,
guiding students on drafting research proposals.

International Quiet Ocean Experiment Open Science Meeting, Paris, France, August 2011 (75 participants).

Member of Planning Committee and Science Plan Drafting Committee.

SOLAS Open Science Conference, Barcelona, Spain, November 2009 (250 participants).

Conference organisation.

PRESENTATIONS AT INTERNATIONAL CONFERENCES

2nd “Oceans and Society: Blue Planet” Symposium, Cairns, Australia, May 2015

Oral presentations “Overview of Oceans and Society: Blue Planet” and “The Partnership for Observation of the Global Oceans (POGO) as a facilitator of international cooperation for ocean observations”.

“Oceans and Society: Blue Planet” Kick-Off Symposium, Ilhabela, Brazil, November 2012

Oral presentation “Towards sustained ocean observations in developing countries”.

13th International Conference on Harmful Algae, Hong Kong, China, November 2008

Oral presentation ‘Seasonal variability in nitrogen uptake of harmful and benign phytoplankton assemblages in the Ría de Vigo (NW Spain)’.

ASLO/AGU 2008 Ocean Sciences Meeting, Orlando, USA, March 2008

Oral presentation ‘Nitrogen nutrition and toxicity of *Pseudo-nitzschia* spp., *Alexandrium catenella* and *Dinophysis acuminata* blooms off the west coast of South Africa’.

Challenger Society for Marine Science Conference, Oban, UK, September 2006

Oral presentation 'Nitrogen nutrition of Harmful Algal Blooms in the Benguela upwelling system'.

GEOHAB Open Science Meeting on HABs in Stratified Systems, Paris, France, December 2005

Oral presentation 'Photoadaptation of a *Gyrodinium zeta* bloom on the west coast of South Africa'.

GEOHAB Open Science Meeting on HABs in Upwelling Systems, Lisbon, Portugal, November 2003

Poster presentation on 'Photoadaptation by harmful algal bloom species of phytoplankton in the Southern Benguela upwelling system off the west coast of South Africa'.

PEER-REVIEWED JOURNAL PUBLICATIONS

Seeyave S, Probyn T, Álvarez-Salgado XA, Figueiras FG, Purdie DA, Barton ED, Lucas M (2013). Nitrogen uptake of phytoplankton assemblages under contrasting upwelling and downwelling conditions: The Ría de Vigo, NW Iberia. *Est. Coast. Shelf Sci.* 124: 1-12.

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Lampitt RS, Sanders R, Saw K, Boorman B, Turnewitsch R, Brown L, Lucas MI, Seeyave S, Thomalla SJ, Salter I (2008) Particle export from the euphotic zone: Estimates using a novel drifting sediment trap, ²³⁴Thorium and new production. *Deep-Sea Res I* 55: 1484-1502

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Fielding S, Ward P, Poulton AJ, Pollard RT, Seeyave S, Read JF, Hughes JA, Smith T, Castellani C (2007) Community structure and grazing impact of mesozooplankton during the spring/ early summer 2004/2005 in the vicinity of the Crozet Islands (Southern Ocean). Deep-Sea Res II 54: 2106-2125

Lucas MI, Seeyave S, Sanders R, Moore CM, Williamson R (2007) Nitrogen uptake responses to a naturally Fe-fertilised phytoplankton bloom during the 2004/5 CROZEX study. Deep-Sea Res II 54: 2138-2173

Moore CM, Seeyave S, Hickman AE, Allen JT, Lucas MI, Planquette HF, Pollard RT, Poulton AJ (2007) Iron-light interactions during the CROZet natural iron bloom and EXport Experiment (CROZEX) I: phytoplankton growth and photophysiology. Deep-Sea Res II 54: 2045-2065

Moore CM, Hickman AE, Poulton AJ, Seeyave S, Lucas MI (2007) Iron-light interactions during the CROZet natural iron bloom and EXport experiment (CROZEX) II: taxonomic responses and elemental stoichiometry. Deep-Sea Res II 54: 2066-2084

Poulton AJ, Moore CM, Seeyave S, Lucas MI, Fielding S, Ward P (2007) Phytoplankton community composition around the Crozet Plateau, with emphasis on diatoms and *Phaeocystis*. Deep-Sea Res II 54: 2085-2105

Sanders R, Morris PJ, Stinchcombe MC, Seeyave S, Venables HJ, Lucas MI (2007) New production and the f-ratio around the Crozet Plateau in austral summer 2004/5 diagnosed from seasonal changes in inorganic nutrient levels. Deep-Sea Res II 54: 2191-2207

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Tyack P, Frisk G, Boyd I, Urban E, Seeyave S (2015). International Quiet Ocean Experiment Science Plan.

Seeyave S, Platt T (2012). POGO –Joining Forces to Observe the Ocean for Science and Society, Marine Scientist 38: 8-11.

Annex D – Addresses of Project Leadership and Secretariat Staff

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