GOA-ON Ocean Decade Programme

REQUEST FOR ENDORSEMENT OF DECADE ACTION: DECADE PROGRAMMES
Ocean Decade: Call for Actions 01/2020

1. Overview of Proponent and Proposed Decade Programme

*** 1. Lead Institution**

Global Ocean Acidification Observing Network (GOA-ON)

*** 2. Lead Institution Type**

International intergovernmental organisation
Regional intergovernmental organisation
Other regional organisation
National government
Sub-national government
University
Research institute
Private sector enterprise
Philanthropic Foundation
Corporate Foundation
Multilateral or bilateral funding agency
NGO / civil society organization
Working group / expert group / taskforce
Community group
Other (please specify)

*** 3. Lead institution physical address:**

GOA-ON has a distributed secretariat. The addresses below correspond to the three organizations hosting the GOA-ON Secretariat.

NOAA Ocean Acidification Program
1315 East-West Highway,
Silver Spring, MD 20910
United States of America

International Atomic Energy Agency
Ocean Acidification International Coordination Centre (OA-ICC)
4a Quai Antoine 1er
98000 Monaco
Principality of Monaco

Intergovernmental Oceanographic Commission
United Nations Educational, Scientific and Cultural Organization
7, Place de Fontenoy
75007 Paris
France

*** 4. Contact person:**
Kirsten Isensee

*** 5. Contact details**
Intergovernmental Oceanographic Commission
United Nations Educational, Scientific and Cultural Organization
7, Place de Fontenoy
75007 Paris
France
k.isensee@unesco.org

6. Partner details if relevant (for each partner please list Institution name, contact details including address & email and role of partner)

The preliminary list of partners below refers to some of the main partners already involved in GOA-ON activities. It is expected that this list will be updated throughout the programme as activities are planned and implemented.

NOAA Ocean Acidification Program
1315 East-West Highway,
Silver Spring, MD 20910
United States of America
libby.jewett@noaa.gov
NOAA Ocean Acidification Program is one of the main partners and funding agencies in GOA-ON, supporting the network's scientific and capacity development and providing secretarial support

International Atomic Energy Agency
Ocean Acidification International Coordination Centre (OA-ICC)
4a Quai Antoine 1er

98000 Monaco
Principality of Monaco
p.swarzenski@iaea.org
The OA-ICC of the International Atomic Energy Agency is one of the main partners and funding agencies in GOA-ON, supporting the network's outreach and capacity development and providing technical and secretarial support.

Intergovernmental Oceanographic Commission
United Nations Educational, Scientific and Cultural Organization (UNESCO)
7, Place de Fontenoy
75007 Paris
France
k.isensee@unesco.org
IOC-UNESCO is one of the three main partners and funding agencies in GOA-ON. IOC-UNESCO is the custodian agency for the SDG 14.3.1 Indicator, responsible for the collection of data towards the SDG 14.3.1 Indicator and reporting on the Indicator to the United Nations. IOC supports GOA-ON capacity development, data collection and provides secretarial support to the network

GOOD – GO2NE (Global ocean oxygen decade – Global ocean oxygen network
Collaboration with respect to capacity training and to ensure that outputs obtained during the duration of the programme will consider deoxygenation as one of the stressors happening at the same time as ocean acidification
Andreas Oschlies, co-chair of GO2NE, aoschlies@geomar.de

GOOS (Global Ocean Observing System)
Collaboration to further advance ocean acidification measurements among the GOOS community.
Albert Fischer a.fischer@unesco.org

IOCCP (International Ocean Carbon Coordination Project)
Collaboration to further advance and align ocean acidification measurements, the respective EOVs, to plan and conduct capacity training and work together on recommendations regarding sensors and measurements.
Maciej Telszewski m.telszewski@ioccp.org

The International Alliance to Combat Ocean Acidification
Leadership in working with the ocean acidification community to develop action plans at local, state and national government levels.
Jessie Turner jturner@cascadialaw.com

The Ocean Foundation
Expertise in implementing capacity building workshops and equipment delivery to developing countries through private and government support.
Alexis Valauri-Orton avalauriorton@oceanfdn.org

Marine Biodiversity Observation Network (MBON)
Collaboration to observe and assess biological responses, which can be interpreted in context of ocean acidification and multi-stressors in the environment.
Emmett Duffy DuffyE@si.edu

***7. Name of proposed Decade Programme**

Ocean Acidification Research for Sustainability - Providing society with the observational and scientific evidence needed to sustainably identify, monitor, mitigate and adapt to ocean acidification; from local to global scales

8. Short title / acronym of proposed Decade Programme for communications purposes (if any)

OARS - Ocean Acidification Research for Sustainability

*** 9. Summary description of proposed Decade Programme (100 words or less to be used on website and in communications – please use lay terms that can be understood by a wide audience)**

OARS will foster the development of the science of ocean acidification including the impacts on marine life and sustainability of marine ecosystems in estuarine-coastal-open ocean environments. The programme will address the SDG target 14.3 'Minimize and address the impacts of Ocean Acidification (OA), including through enhanced scientific cooperation at all levels'. Key components include: 1) enhancing regional collaborative efforts, 2) coordination of capacity building in science, 3) codesign and implement observation and research to address the threat of ocean acidification, and 4) communication and delivery of the outputs to policy makers and communities.

*** 10. Start & end date of proposed Decade Programme**

Start Date 30/06/2021
End Date 31/12/2030

*** 11. Estimated total budget of proposed Decade Programme**

The total budget of the coordination of OARS is composed of the coordination activities and concrete actions related to the implementation, as well as in-kind contributions of the GOA-ON Executive Council. The coordination office will require financial support of 120.000 USD per year covering personnel costs, as well as one annual meeting of the GOA-ON Executive Council and programme partners (see 24). Project activities will cost between 500.000-1.000.000 USD per year. The proposal is to establish a programme to guide and integrate the many aspects of ocean acidification research from observing and impacts and merging these with end-user needs. As such, the many individual amounts contributed by national programs to ocean acidification research and delivery are not specified.

12. Percentage of estimated budget that is secured

The supporting organizations of the GOA-ON Secretariat, namely IOC-UNESCO, IAEA and NOAA, make available 50-75% of the budget estimated to be required for the coordination, as part of it could be sustained by the GOA-ON distributed secretariat. The project activities, however, will require additional funding. It is expected that 10-20% of the required financial resources will be secured by the organizations supporting the Secretariat and other organizations such as private foundations, governmental support, universities, research institutes and associated programmes.

13. Secured funding sources (donor name and approximate amount secured)
IOC-UNESCO, NOAA-OAP, IAEA

*** 14. Do you require support to find additional resources for your Decade Programme?**
Yes
No

***15. Would you like to be put in touch with partners working on similar issues or proposing Decade Actions that could have synergies with your proposed Action?**

Yes

No

*** 16. Countries in which the proposed Decade Programme will be implemented**

Global

*** 17. Ocean basins in which the proposed Decade Programme will be implemented**

Indian Ocean
North Pacific Ocean
South Pacific Ocean
North Atlantic Ocean
South Atlantic Ocean
Arctic Ocean
Antarctic Ocean

2. Description of the proposed Decade Programme

*** 18. What is the high-level objective(s) of your proposed Decade Programme?**

The programme aims to provide systematic evidence of the impacts of ocean acidification on the sustainability of marine ecosystems, enhance the communication to policy makers and communities and to facilitate the development and evaluation of strategies to offset future impacts. Major components of OARS are to:

1. Provide a platform for scientists, policymakers, industries, coastal managers, local communities and ocean resource users to identify data and knowledge needed to develop and implement applicable solutions, and to facilitate the collection of such data, including indigenous and traditional knowledge.
2. Co-design the ocean acidification observing strategy to incorporate and expand observations that target end user requirements, as well as to contribute to integrated global ocean observing.
3. Identify ways to address end-user needs to reduce local, regional, and global impacts of ocean acidification, and support decision makers in the establishment and implementation of efficient strategies that help to mitigate and adapt towards ocean acidification at global, regional, and local levels in both short and long-terms.
4. Increase and augment the capacity of ocean scientists globally to conduct and synthesize research on ocean acidification at local and regional scales.
5. Identify geographic and thematic areas of the greatest vulnerability to OA to improve the efficient flow of attention, human, technical, and financial resources to where it is needed most.
6. Support initiatives on sustainable management of land-based activities to reduce coastal acidification.
7. Provide data necessary to identify and verify new innovative ways of ocean acidification mitigation through marine interventions.
8. Provide the knowledge and understanding needed to contribute to predictive models, employing new cyber technology such as digital twins.
9. Support evidence-based public and political awareness and action towards ocean acidification, its sources, and impacts, achieved via ocean literacy and public outreach.

*** 19. What are the key expected outcomes of your proposed Decade Programme?**

The proposed programme will build on the success and lessons learnt from the Global Ocean Acidification Observing Network (GOA-ON) in supporting the ocean acidification community and will expand to address broader community needs, such as interactions with multiple ocean stressors, and greater engagement and knowledge delivered to regions, industry, and policy.
GOA-ON has established successful collaborations with an array of stakeholders, data and knowledge producers and end-users around the world. The network will remain at the forefront of the global effort to expand the understanding of ocean acidification conditions, based on measurements detecting the status and spatial / temporal patterns of carbon chemistry and assessments of the generality of responses to ocean acidification.
However, GOA-ON and its partners propose to broaden the network's scope within the OARS programme proposed here. OARS is expected to achieve the following outcomes by 2030:

1. **Enable the scientific community to provide ocean acidification data and evidence of known quality,** via capacity development, mentoring of early career researchers, facilitating data sharing, and growing regional collaborations, and increased communication through meetings and workshops, allowing for a holistic analysis considering all stakeholder perspectives.

2. **Identify data and evidence needs for mitigation and adaptation strategies, from local to global, by 2022.** Communicate these needs to the scientific and science policy community to ensure that science is prioritized (to ensure efficient and quick implementation of actions).

3. **Co-design and implementation of observation strategies in collaboration with data/information producers and end-users by 2025**. Identify factors limiting collection of data and implementation of solutions and use OARS activities under 1. as a tool to fix some of those, by for example, continuing to build capacity in developing countries (with a strong user participation). Augment OARS supported by GOA-ON by proactively designing and implementing observation strategies to ensure vulnerable areas are adequately monitored. Provide ocean acidification baseline information for newly developed carbon removal strategies.

4. **Increase understanding of ocean acidification impacts to protect marine life by 2030.** Implementation of the newly established framework for biological observation within the ocean acidification monitoring framework (Dupont et al., in review) providing the possibility to improve predictions of vulnerability and resilience to ocean acidification at all temporal and spatial scales.

5. **Provide appropriate data and information necessary to the development of societally relevant predictions and projections,** employing new technologies such as digital twins, for all ocean 'users' of the impacts of ocean acidification in order to implement adaptation and mitigation by 2030.

6. **Increase public awareness of ocean acidification, its sources and impacts,** achieved via ocean literacy and public outreach.

7. **Develop strategies and solutions to enable countries and regions to include measures to reduce ocean acidification in their respective legislation**. This outcome is based on achieving the outcomes 1-6.

***20. Please describe the activities that will be implemented as part of the proposed Decade Programme (600 words or less)**

Under each envisaged outcome several activities are planned.

Outcome 1:

- Ensure ocean acidification observations and research data are comparable by enabling equitable access to quality control procedures, materials, technology and training, including the development of sustainable and affordable alternatives for the currently used Certified Reference Materials (CRM) for OA measurements.
- Build communication through meetings and workshops and participation in key international events.
- Promote development of next generation methods, particularly new technology and data collection strategies to enhance the ability to quantify the range of natural variability in diverse marine ecosystems; the organismal response to different biogeochemical conditions; long-term trends in biogeochemical parameters.

Outcome 2:

- Identify the main ocean 'users' potentially affected by ocean acidification at regional and global levels by convening multiple multi-stakeholder meetings.
- Include experts from multiple disciplines providing different types of knowledge, including indigenous and traditional knowledge, and numerous nations. This will allow holistic analysis considering all stakeholder perspectives.
- Increase the number of developing countries involved in OA research to cover the under-studied areas, better assess OA effects on their marine resources, and tailor strategies to sustain these resources and the most vulnerable people's livelihoods.
- Develop a stakeholder database with respective data and information needs at local, national, regional and global levels in collaboration with regional GOA-ON networks.
- Apply the knowledge to produce science outputs visualizing and communicating the knowledge for communities, industry and policy makers.

Outcome 3:

- Support the enhancement of networks tackling local, national, regional, global specific OA issues.
- Provide a platform to enable continued communication and more open access between different stakeholders to ensure governmental, private and UN support to OA observing efforts and the application of the produced data and information.
- Develop countries' capacity to report OA data as part of the SDG indicator 14.3.1 process and to achieve the SDG target14.3.
- Promote greater integration between the global OA observing network and other observing networks, focusing on related measurements and maximum use of infrastructure.
- Produce observation/research-based informational products useful for decision making, e.g., tools and mechanisms visualizing the impacts of OA on marine life.
- Identify baseline OA observing needs in areas of potential marine intervention for carbon removal and provide evidence-based guidance on the development and implementation of such projects.

Outcome 4:

- Coordinate chemistry, biology, technology development researchers from across the globe, in co-locating chemical and biological measurements to build capacity to develop indices, metrics, and risk assessments; articulating biological metrics and the needs and requirements for monitoring; and developing a theoretical framework linking chemical changes to biological responses.
- Improve OA research knowledge for commercially important organisms to highlight the potential effects of OA on edible/commercial marine species/iconic ecosystems and the need for ongoing support to find solutions, actions and management strategies.

Outcome 5:

- Provide knowledge and data to 'digital twins' ensuring that climate change projections include the effects of OA.

- Adapt global and regional scale models and projections for local and regional use.
- Develop capacity enabling local 'users' to access relevant future scenario models and projections.
- Incorporate OA baseline data in newly developed recommendation for CO_2 removal and nature-based solutions contributing to the mitigation of climate change.

Outcome 6:

- Collaborate with ocean literacy programmes and GOA-ON regional hubs to conduct annual outreach events on the latest science and what it entails.
- Support non-science publications with evidence-based advice to inform the general public about OA and its impacts.

Outcome 7:

- Provide scientific advice to governments and organizations on the needs to support and implement OA research and options to minimize the impacts of OA
- Provide scientific advice to UN organizations to establish enforce the legal framework for OA action for sustainability at the global level.

*21. Please describe the theory of change that underpins your proposed Decade Programme i.e. how will the activities being carried out achieve the outcomes and objectives that you envisage (400 words or less)

The overarching vision of this programme is to enable countries to 'Manage, mitigate and reduce the impacts of ocean acidification on marine ecosystems, the goods and services they provide and the human communities that rely on them" by providing society with the observational and scientific evidence needed to sustainably identify, monitor, mitigate and adapt to ocean acidification; from local to global scales.
By delivering this we will create a number of Ultimate Benefits; the provision of a clean, diverse, productive oceans capable of supporting the health, well-being and livelihoods of human societies dependent on marine resources. These benefits will be derived from the project Outcomes leading directly to specific Impacts:

Impact 1: Improved environmental policy achieved via greater provision of environmental evidence tailored to local and regional needs, enhanced communication between scientists and policy makers and co-design of related research and observation activities.

Impact 2: Better management decisions achieved via better understanding of OA impacts and vulnerabilities via evidenced based products focusing on the impact of OA on commercially and iconic species in the marine environment.

Impact 3: Improved global monitoring and observing capability achieved via the creation of an enhanced OA observing global network, increased observing capability and geographic distribution of monitoring, advancement of sensor technology and coordination with other ocean and atmospheric observation systems.

Impact 4: Increased stakeholder awareness of OA issues achieved via scientific publications and science communications products, applying the knowledge to produce science outputs visualizing and communicating the knowledge for communities, industry, and policy makers.

Impact 5: Increased capability for data access and visibility achieved via collaboration among relevant existing and emerging data centres, at the project, national, regional, and global level.

This programme will enable these outcomes through:

1. the provision of scientific expertise and training by GOA-ON members and partners,
2. support from our project partners, the shared facilities and capabilities between network members,
3. comparable ocean acidification observations and research data, by enabling equitable access to quality control procedures, materials, and technology the development of sustainable and affordable alternatives for the currently used Certified Reference Materials (CRM) for OA measurements.
4. Establishment of a multi stakeholder dialogue.

*22. Will your proposed Decade Programme enhance the sustainability of ocean science initiatives, including infrastructure or individual / institutional capacity, in light of the current Covid-19 pandemic?

Yes
No

23. If yes, how will your proposed Decade Programme enhance the sustainability of ocean science initiatives, including infrastructure or individual / institutional capacity, in light of the current Covid-19 pandemic (200 words or less)?

With **t**he development of new capacities, technologies, guidelines, and best practices for ocean acidification science affiliated observation and research, various ocean-dependent groups and institutions will become more resilient to interruption that comes from ocean acidification impacts on natural resources. Such interruptions will increase as carbon pollution grows. Effects are local to the area (species, human dependencies, etc), thus, locally available expertise will enable sustaining ongoing observations and experiments and enable the provision of required knowledge independently of external human intervention and/or international support.
Improved online access to data and information will further ensure that knowledge can be disseminated without direct contacts, allowing to increase the understanding of ocean acidification even during sanitary crises.

24. Please describe the coordination / management structure for the proposed Decade Programme (400 words or less)

OARS will especially in the beginning benefit from the coordination/management in place for GOA-ON. GOA-ON relies on global participation, enthusiasm, and the will to make a difference. The paragraphs below outline the preliminary coordination/management structure, planned to be in place for the first three years. After GOA-ON and other partners will reevaluate the structure and adapt if required.

Multiple GOA-ON Regional Hubs have self-assembled and add to the support for focused and regionally relevant community activity. GOA-ON is guided by an Executive Committee who represent the leadership of the Regional Hubs as well as subject matter experts who have been elected to the position, under published Terms of Reference. Topical working groups are established to address issues in specific projects, according to needs identified by the EC. Two elected co-chairs and a distributed Secretariat from the funding agencies (IOC, IAEA, NOAA) provide the organizational leadership and management, and will expand their contributions to the coordination of the programme's activities. However, full implementation of the OARS will require additional assistance. It is expected that depending on available funding a part time programme office will be established. In the meanwhile, the GOA-ON Secretariat will expand its mandate to include the coordination of the targeted activities, support of the expert working groups and topical task teams, and reporting on the progress on the identified objectives of the programme.
To ensure multi-stakeholder participation in the proposed programme, the programme coordination structure will, in addition to the GOA-ON EC, the co-chairs and the secretariat, invite 3 stakeholders from the UN, national governmental agencies and industries on a rotating basis (3 years) as well as highly involved OARS partners (up to 5) to evaluate progress made with respect to the identified objective, sub-objectives and outcomes. It is expected that

these stakeholders will be nominated and appointed following a consultation process within the wider ocean acidification and ocean observation community, as well as within the relevant stakeholder groups, to ensure the inclusion of the most relevant expertise required for the successful achievement of the outcomes and objectives in each stage of the programme. In addition to their expertise, stakeholders will also be nominated to ensure a balanced representation of gender and geographic regions.

3. Contribution of Proposed Decade Programme to the UN Decade of Ocean Science for Sustainable Development (refer to the Ocean Decade Implementation Plan for details)

*25. To which Sustainable Development Goal(s) (SDG) will your proposed Decade Programme contribute?

Please select a maximum of three SDGs
GOAL 1: No Poverty.
GOAL 2: Zero Hunger
GOAL 3: Good Health and Well-being
GOAL 4: Quality Education
GOAL 5: Gender Equality
GOAL 6: Clean Water and Sanitation
GOAL 7: Affordable and Clean Energy
GOAL 8: Decent Work and Economic Growth
GOAL 9: Industry, Innovation and Infrastructure
GOAL 10: Reduced Inequality
GOAL 11: Sustainable Cities and Communities
GOAL 12: Responsible Consumption and Production
GOAL 13: Climate Action
GOAL 14: Life Below Water
GOAL 15: Life on Land
GOAL 16: Peace and Justice Strong Institutions
GOAL 17: Partnerships to achieve the Goal

*26. How will your proposed Decade programme will contribute to the SDGs selected? Please Explain (200 words)

First and foremost, efforts commenced by GOA-ON will continue and broadened by OARS to serve multi stakeholder needs towards the achievement of the SDG 14, in particular the target 14.3. The SDG 14.3 target aligns with the three goals of GOA-ON: Improve understanding of global OA conditions; Improve understanding of ecosystem response to OA; Acquire and exchange data and knowledge necessary to optimize modeling for OA and its impacts. GOA-ON has been instrumental in the development of the SDG 14.3.1 Indicator methodology, under the custodianship of IOC-UNESCO, and has been since a strong advocate for it and the target itself. OARS will help to apply the newly gained knowledge to solutions for sustainable development. The global reach of GOA-ON will help to raise awareness for SDG 14 and the target 14.3, not last through GOA-ON's lead role in the COA on OA and its numerous VCs.

Through its structure and inherently global nature, its regional hubs and focus on capacity building, as well as the strong links with the ocean observing community, GOA-ON is and so will be OARS well placed to contribute to Goals 13, 14 and 17, coordinating OA science fostering partnership and addressing climate change.

*27. How will your proposed Decade Programme contribute to the vision and mission of the Decade (400 words)?

The science we need for the ocean we want: We want a more resilient ocean where ecosystems can thrive and resources can be used and managed sustainably. This cannot happen without understanding one of the main threats facing our oceans, now and in the future: ocean acidification.

GOA-ON has developed from a shared scientific idea that a collaborative international effort is required to understand the drivers of ocean acidification in all regions of the world's ocean, the impacts of ocean acidification on organisms and ecosystems, and to make this information available to all for early warnings and modeling of future scenarios to enable the development of mitigation and adaptation strategies. From this vision, GOA-ON has grown to a global network encompassing over 800 members from more than 100 countries, comprising researchers, stakeholders, industry, and policy representatives. The network has been at the forefront of the global effort to understand ocean acidification. OARS will build on the experiences and successes learned from GOA-ON and partners to deliver knowledge to end users to allow informed decision making and actions. In addition to providing a platform for exchanging data and discussing current and future issues in the field of ocean acidification, OARS has a strong focus on capacity building, aiming to develop scientific capacity and understanding of OA globally, with a particular emphasis on developing countries and Small Island States. While these countries may not yet have the capacity to assess ocean acidification and its impacts, their populations and economy are often heavily reliant on the ocean and its resources, rendering knowledge and understanding of ocean acidification and its impacts all the more urgent. The actions and activities described in the programme document that the fostering of the international scientific community, open data sharing, the identification of information and policy gaps, and capacity development, are aligned with the vision and mission of the Decade, contributing **to catalyze transformative ocean science solutions for sustainable development, connecting people and our ocean**.

28. To which Decade outcome(s) will your proposed Decade Programme * contribute?

Outcome 1: A clean ocean where sources of pollution are identified and reduced or removed.

Outcome 2: A healthy and resilient ocean where marine ecosystems are understood, protected, restored and managed.

Outcome 3: A productive ocean supporting sustainable food supply and a sustainable ocean economy.

Outcome 4: A predicted ocean where society understands and can respond to changing ocean conditions.

Outcome 5: A safe ocean where life and livelihoods are protected from ocean-related hazards.

Outcome 6: An accessible ocean with open and equitable access to data, information and technology and innovation.

Outcome 7: An inspiring and engaging ocean where society understands and values the ocean in relation to human wellbeing and sustainable development.

*** 29. How will your proposed Decade Programme contribute to the Decade outcomes selected (200 words)?**

Outcome 2: An enhanced OA programme will help society to understand, protect, restore, and manage ocean resources. OARS will provide a central contact point on this emerging threat to marine life and will identify the mechanisms altered by OA and develop strategies to mitigate and adapt to the expected environmental, economic and societal damages. Best practices and SOPs are now available to assess spatial and temporal patterns in OA, to quantify trends and rates of change. However, globally applicable approaches to assess the impacts of OA on marine life, through measurement of biological variables and indicators do not yet exist. OARS will facilitate the delivery of knowledge on biological impacts, including the combined effects of multiple stressors including OA, deoxygenation and warming, at the same time providing more detailed information at local and regional scales to inform communities of high vulnerability.

Outcome 6: OARS will expand the current capability to access OA data of defined quality and the effects of OA; via capacity building efforts to train scientists and providing plans (Requirements and implementation), mentoring access, and regional infrastructure through 'regional hubs' of GOA-ON. These activities will further benefit from increasing interoperability of the GOA-ON explorer and the SDG 14.3.1 Ocean acidification data portal with other data collections.

*** 30. To which Ocean Decade Challenge(s) will your proposed Decade Programme contribute?**

Challenge 1: Understand and map land and sea-based sources of pollutants and contaminants and their potential impacts on human health and ocean ecosystems, and develop solutions to remove or mitigate them.

Challenge 2: 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.

Challenge 3: Generate knowledge, support innovation, and develop solutions to optimise the role of the ocean in sustainably feeding the world's population under changing environmental, social and climate conditions.

Challenge 4: Generate knowledge, support innovation, and develop solutions for equitable and sustainable development of the ocean economy under changing environmental, social and climate conditions.

Challenge 5: Enhance understanding of the ocean-climate nexus and generate knowledge and solutions to mitigate, adapt and build resilience to the effects of climate change across all geographies and at all scales, and to improve services including predictions for the ocean, climate and weather.

Challenge 6: Enhance multi-hazard early warning services for all geophysical, ecological, biological, weather, climate and anthropogenic related ocean and coastal hazards, and mainstream community preparedness and resilience.

Challenge 7: Ensure a sustainable ocean observing system across all ocean basins that delivers accessible, timely, and actionable data and information to all users.

Challenge 8: Through multi-stakeholder collaboration, develop a comprehensive digital representation of the ocean, including a dynamic ocean map, which provides free and open access for exploring, discovering, and visualizing past, current, and future ocean conditions in a manner relevant to diverse stakeholders.

Challenge 9: Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology across all aspects of ocean science and for all stakeholders.

Challenge 10: Ensure that the multiple values and services of the ocean for human wellbeing, culture, and sustainable development are widely understood, and identify and overcome barriers to behaviour change required for a step change in humanity's relationship with the ocean.

***31. How will your proposed Decade Programme contribute to the Decade Challenges selected (200 words)?**

2. Joins other networks in studying the effects of multiple stressors, ensuring that OA is interpreted in the context of hypoxia (GO-ONE), biological impacts (MBON), and other climate and ocean stressors (IOCCP, GOOS). We propose to strengthen these connections during the Decade to meet this Challenge.

5. OARS will act to strengthen its integration with social scientists and other experts who can advise on adaptation and mitigation strategies during the Decade. Leadership will come from projects conducting co-design of vulnerability assessment with communities. The activities will also provide data allowing development of forecast models that are an important adaptation tool informing managers and decision makers. Increasing synergies between observations and modeling and increasing capability for modeling worldwide is an activity that can serve this challenge.

7, 8 & 9. GOA-ON has developed an interactive portal where users post and retrieve timely and actionable data, metadata, and access multiple data sources and products. GOA-ON has focused on capacity building worldwide, enabling members to archive measurements for understanding OA and its effects. OARS will continue the development of these efforts, expand the stakeholder base and capacity building, and support the further development and interoperability of the GOA-ON, SDG 14.3.1 Data Portal and other data repositories.

***32. To which Decade Objective(s) will your proposed Decade Programme * contribute?**

Objective 1: Identify required knowledge for sustainable development, and increase the capacity of ocean science to deliver needed ocean data and information

Objective 2: Build capacity and generate comprehensive knowledge and understanding of the ocean including human interactions, and interactions with the atmosphere, cryosphere and the land sea interface.

Objective 3: Increase the use of ocean knowledge and understanding, and develop capacity to contribute to sustainable development solutions.

***33. How will your proposed Decade Programme contribute to the Decade Objective(s) selected (200 words)?**

GOA-ON is already contributing to these three objectives and this OARS programme will enhance the contribution over the Decade, following the value chain from assessing knowledge gaps and needs, to generating the required knowledge and finally its application. This will only be possible by re-evaluating how GOA-ON can develop beyond its current status of serving (primarily) OA scientists to mobilizing more biologists, social scientists, and modelers with the goal to go beyond the collecting of data and begin working intentionally on how to apply the knowledge to serve society and its needs for adaptation and mitigation of OA and its effects. To do this, we will use the visibility of the Decade to shine a light on this need and to work, ground up, to meet these objectives in the context of OA and multiple stressors. While this is ambitious, we note that GOA-ON has developed from an idea in early 2012 to now 800 members from 100 nations with 8 self-assembling regional hubs. OARS will leverage the passion and expertise

of the GOA-ON membership, to increase its diversity, and to focus on the societal applications of the scientific findings, a process that GOA-ON initiated during its 2019 Workshop (Hangzhou, China).

***34. With respect to the Decade Objectives selected above, to which Decade Sub-Objective(s) will your proposed Decade Programme contribute?**

1.1: Provide the scientific basis for regular integrated assessments of the state of the ocean and identify priority gaps at

different scales and in different geographies to frame efforts in exploration, observations and experimentation.

1.2: Promote new technology development and enhance access to technology to generate ocean data, information and knowledge.

1.3: Enhance and expand existing ocean observing systems across all ocean basins to deliver information on standardized essential ocean variables including social and economic, geological, physical, chemical, bathymetric, biological, ecological parameters, and observations on human interactions with the ocean.

1.4: Develop mechanisms that support community-led science initiatives and the recognition and inclusion of local and indigenous knowledge as a fundamental source of knowledge.

1.5: Undertake regular assessments of the state of ocean science capacity to identify and overcome barriers to generational,gender and geographic diversity, and promote sufficient and sustainable investment.

2.1: Generate a comprehensive inventory, mapping, and understanding of the role and function of ocean components including their human interactions and interactions with the atmosphere, cryosphere and the land sea interface.

2.2: Generate a comprehensive understanding of thresholds and tipping points for ocean components, including human interactions.

2.3: Innovate and expand the use of historical ocean knowledge to support sustainable development solutions.

2.4: Improve existing, and develop new generation ocean models for improved understanding of the past, current and future states of the ocean, including human interactions.

2.4: Improve prediction services and increase predictive capability for oceanic hazards or events including extreme weather and climate.

2.5: Expand cooperation in ocean-related education, training, capacity development and transfer of marine technology.

3.1: Broadly communicate and promote the role of ocean science for sustainable development across diverse stakeholder groups including through formal and information education and an expansion of ocean literacy approaches across stakeholder groups.

3.2: Develop interoperable, open access platforms and applications to share data, information and knowledge in a format that connects knowledge generators and users.

3.3: Undertake interdisciplinary, multi-stakeholder co-design and co-delivery of ocean solutions including policy, decisionmaking, integrated ocean management frameworks, applications and services, and technology and innovation.

3.4: Expand and enhance spatial planning processes to contribute to sustainable development across regions and scales.

3.5: Expand and enhance inclusive and integrated management frameworks and tools, including nature-based solutions, to maintain ecosystem functioning, provide for adaptive processes under changing ocean conditions, and incorporate community values and needs.

3.6: Expand and enhance services, applications and management tools for building and mainstreaming preparedness and adaptive responses to multiple stressors and hazards.

3.7: Expand and enhance tools, applications and services that integrate and facilitate use of data, information, and knowledge on ocean-related natural capital including the social, cultural, environmental, and economic characteristics of the ocean.

***35. How will your proposed Decade Programme contribute to the Decade sub-objectives selected (200 words)?**

1.1: OARS, GOA-ON and its regional hubs are uniquely placed to identify scientific needs and gaps, to develop strategies to meet these needs, and to provide an assessment of the state of OA and its impacts.

1.3: OARS with GOA-ON proposes to continue its capacity building efforts (funding permitting), which have already provided 856 capacity building opportunities for 749 scientists from 107 nations. EOV measurements were made possible through the provision of “GOA-ON in a box”.

2.2 Observations conducted by GOA-ON members are critical for providing the data for the investigation of these complex scientific derivations.

2.5 GOA-ON has prioritized and seeks to expand capacity building through training and mentor-mentee opportunities.

3.1 The communication efforts are an important part of OARS See Q38

3.2 GOA-ON has an interactive open-access platform to visualize OA data, capable of data sharing. The SDG 14.3.1 Data Portal permits the submission of data towards the Indicator, storage and open-access. OARS will also support the development of necessary QA/QC protocols for data providers.

3.3 The organizations behind OARS stand to contribute by providing an engaged, globally distributed community of ocean, biological, and forecast scientists studying OA and a multi stakeholder platform.

***36. Please check which of the following criteria are relevant to your proposed Decade Programme as far as they are relevant to your proposal:**

Accelerate the generation or use of knowledge and understanding of the ocean, with a specific focus on knowledge that will contribute to the achievement of the SDGs and complementary policy frameworks and initiatives.

Is co-designed or co-delivered by knowledge generators and users, and does it facilitate the uptake of science and ocean knowledge for policy, decision making, management and/or innovation.

Will provide all data and resulting knowledge in an open access, shared, discoverable manner and appropriately deposited in recognized data repositories consistent with the IOC Oceanographic Data Exchange Policy[1] or the relevant UN subordinate body data policy.

If you check this criteria, please provide in the question below details of where data will be deposited and where it exists, attach a data management plan.

Strengthen existing or create new partnerships across nations and/or between diverse ocean actors, including users of ocean science.

Contribute toward capacity development, including, but not limited to, beneficiaries in Small Island Developing States, Least Developed Countries and Land-locked Developing Countries.

Overcome barriers to diversity and equity, including gender, generational, and geographic diversity.
Collaborate with and engage local and indigenous knowledge holders.

37. How will your proposed Decade Programme contribute to the Decade criteria selected * (no word limit)?

By enhancing the data-portal and broadly increasing the capacity to make OA observations, by forging new partnerships with stakeholders and including novel co-design strategies for the development of chemical and biological ocean observations to determine the effects of ocean acidification on organisms, ecosystems and the communities relying on the ocean and its resources, OARS will generate knowledge about OA conditions and effects in our oceans which will inform decision-makers on how to achieve sustainable use and management of ocean resources under threat of ocean acidification.
The GOA-ON website and data porta, also the future home of the OARS webpages, will be a focal point for the presentation and dissemination of ocean science, OA research and observation, and existing policy that can inform stakeholders. Our Decade Actions will result in more data and resources becoming and being made available through the website and associated communication channels, which will be a lasting resource for both knowledge generators and users, policy makers and the general public.
The open-access GOA-ON portal is an important tool and resource for OA researchers, enabling them to easily share and discover OA data from their region and the rest of the world, enabling comparisons and cooperation. The GOA-ON portal and the SDG 14.3.1 Data Portal are vehicles for the community, where data can be made freely available, stored, linked, shared, and searched. By highlighting their observations and data in these portals, researchers can increase the visibility of their work and emphasize the importance of sustained and global observations of ocean acidification for the modeling and mitigation of, and adaptation to, the changes in ocean carbon chemistry and the associated effects.
OARS will include capacity building for researchers from all continents, to help them connect to OA data centers like the GOA-ON data portal, to collect data according to the SDG 14.3.1 Indicator Methodology and to submit it towards the Indicator, thus contributing their data to the global effort of observing, understanding and quantifying ocean acidification and the achievement of SDG Target 14.3. We will also be sharing evaluations of the results of our capacity building efforts online with our members, interested parties and partner organizations, as well as through publications in open-access journals.
Our decade actions specifically call for focusing data and training products developed through OARS on applied uses, and even solutions, designed for scientists, policy makers, and ocean resource users.

4. Communications

***38. Please describe how you plan to communicate about your proposed Decade Programme including the main target audiences and methods of communications (400 words or less).**

***The scientific community (OA community and beyond):** via specialized sessions in big conferences, international and regional workshops and well-targeted events. Such events will help to better understand the different aspects of OA and improve the methodologies and technology dedicated to quantifying this global issue. Webinar series are planned to ensure representation of scientists and their research from all continents. The webinar series will also provide a platform for early-career scientists and students to share their research experience and questions with a wider audience, to gain exposure and receive feedback, as these particular researchers often cannot afford to travel to larger conferences.

***Policy-makers and stakeholders:** via targeted events in which they are invited to listen to scientists and to be actively involved in presenting their points of view. This is crucial to create a common ground between scientists and policy-makers/stakeholders in order to find efficient solutions and tailor long-term strategies and legislations. These exchanges will be scheduled regularly and be focused around specific topics within the programme.

***Public audience (non-scientists):** via social media platforms (Facebook, Twitter, Instagram), and short and informative videos and infographics that can be shared on a dedicated YouTube channel as well. This will increase the range of people who are knowledgeable about OA and climate change consequences, and will facilitate their integration in any action or solution. Experience has shown that the use of short texts, animations and videos to introduce a particular topic increases engagement and traffic to sites linked in these posts. These types of posts will be used to introduce a variety of topics, methods and issues throughout the programme, from carbonate chemistry to open ocean observations and the challenges ocean acidification poses to aquaculture, among many others.

***39. Have you developed a communications strategy or plan as part of your proposed Decade Programme?**
If so, please attach it as part of the supporting documentation.
Yes
No
No file chosen

5. Supporting Documentation

41. Please attach any relevant supporting documents to your submission that will aid in its evaluation e.g., project log frame, research proposal, high-level budget, data management plan, communications strategy, or letters of support. Please note that none of these documents are obligatory, but can be provided at the discretion of the proponent if they feel it will help in the understanding of their request.

Attach for reference:

- Global Ocean Acidification Observing Network: Requirements and Governance Plan
- GOA-ON (Global Ocean Acidification Observing Network), 2019. "Global Ocean Acidification Observing Network (GOA-ON) Implementation Strategy, 2019.
- Tilbrook et al. 2019 An Enhanced Ocean Acidification Observing Network: From People to Technology to Data Synthesis and Information Exchange. Frontiers in Marine Science 6:337.