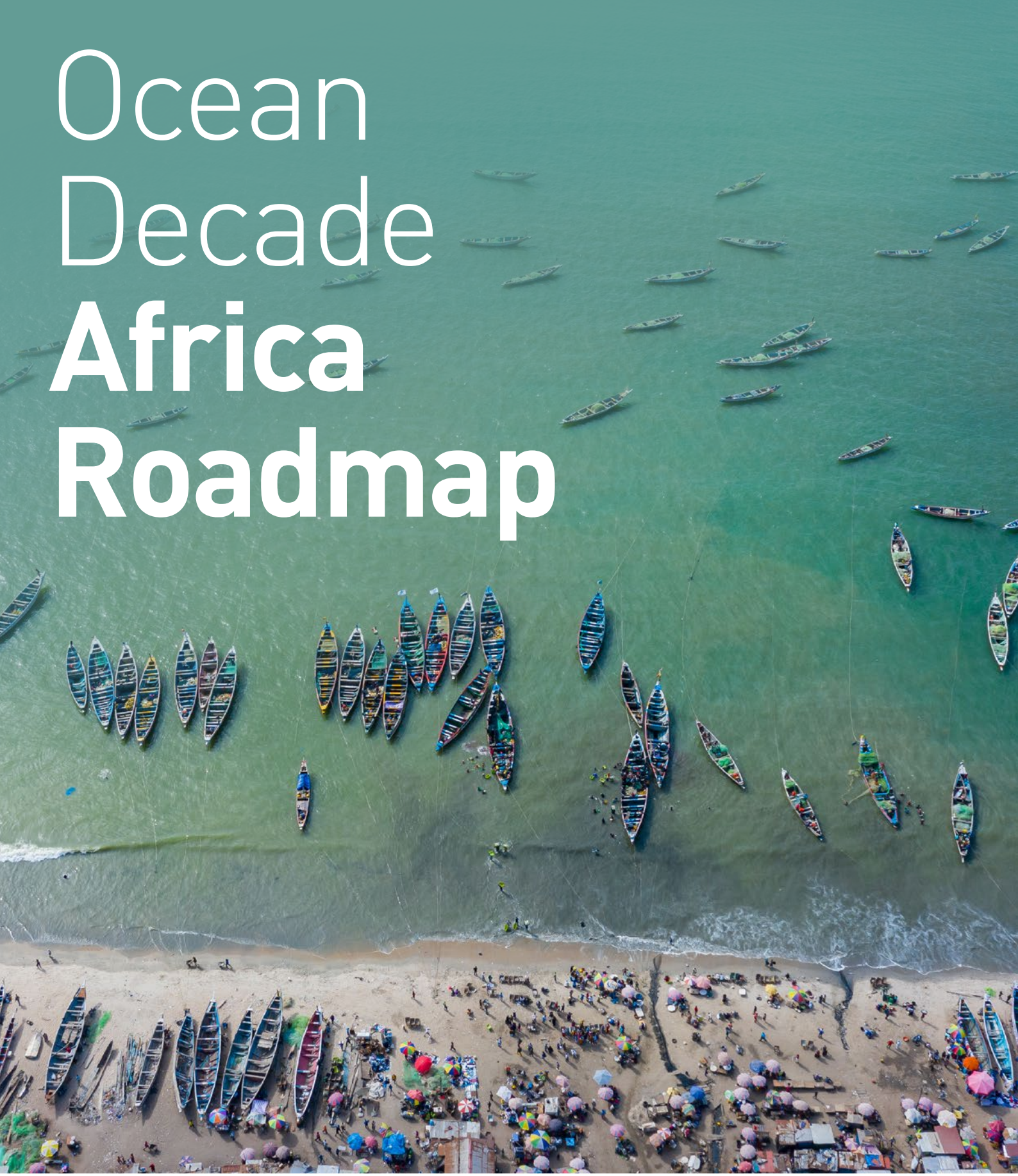
# Ocean Decade **Africa Roadmap**



The United Nations
Decade of Ocean Science
for Sustainable Development
**(2021-2030)**

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Published in 2022 by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organisation.
7, Place de Fontenoy, 75352 Paris 07 SP, France.





For bibliographic purposes, this publication should be cited as follows:
UNESCO-IOC (2022). *The United Nations Decade of Ocean Science for Sustainable Development 2021–2030. Ocean Decade Africa Roadmap*. Paris, UNESCO. (The Ocean Decade Series, 36).

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Graphic design: UNESCO

(IOC/2022/ODS/36 Rev.2)

# Foreword

A large number of African countries are highly dependent on the ocean and its rich resources. The ocean underpins coastal livelihoods, food security, and protects vulnerable coastal zones against extreme weather and climate events. Yet, the ocean is currently under increasing threat. Having recognized the potential for harnessing the ocean and the opportunities it offers, many African governments have identified the development of a sustainable ocean economy as a pillar of equitable economic development. To achieve these goals, while protecting the inherent values of the ocean, rigorous knowledge of the ocean, its biodiversity and resources, and its interaction with the atmosphere and across the land-sea interface, is fundamental.

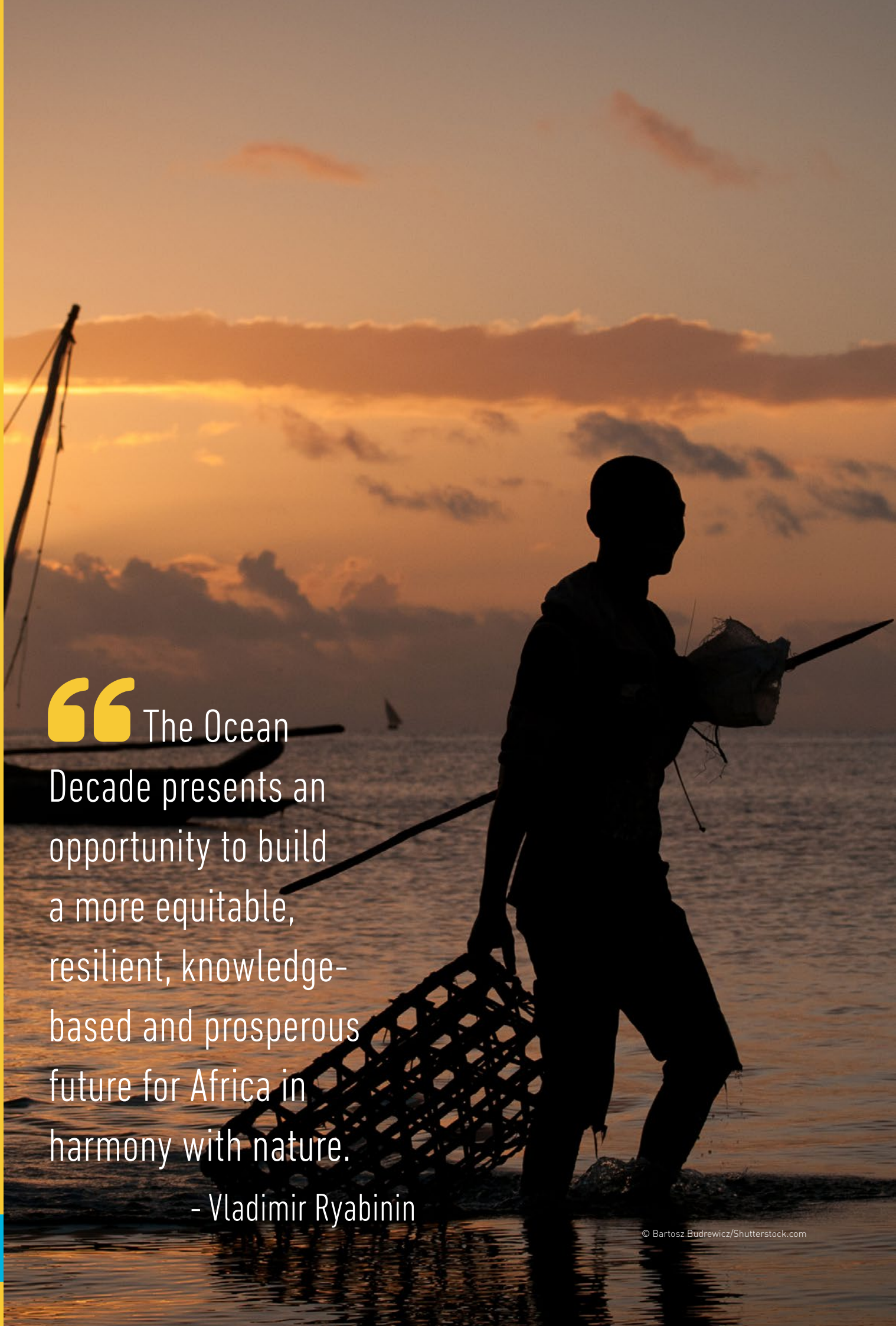
The United National Decade of Ocean Science for Sustainable Development, the 'Ocean Decade' (2021-2030), is a once-in-a-lifetime opportunity to trigger the ocean knowledge revolution that is much needed, especially in Africa where there are critical gaps in ocean data and knowledge. This body of knowledge is vital for the development of evidence-based ocean policies and science-based management decisions. For Africa, the generation of ocean data and knowledge is one of the most important endeavors of our time. With the vision of 'the science we need for the ocean we want', the Ocean Decade identifies Africa and Adjacent Island States as a priority area for the co-design and co-delivery of transformative ocean science resulting from the best available knowledge, including indigenous and local knowledge, and aided by innovation and technology. The Decade presents an opportunity to build a more equitable, resilient, knowledge-based and prosperous future for Africa in harmony with nature.

Starting with the preparatory phase of the Ocean Decade in 2018, UNESCO's Intergovernmental Oceanographic Commission together with the Western Indian Ocean Marine Science Association (WIOMSA) and other regional partners, have embarked on a journey to identify the main regional scientific gaps, capacity-development needs and cross-cutting priorities. The outcomes of this participatory process have been consolidated in the Ocean Decade Africa Roadmap, a strategic document that provides a vision and plan around nine tangible knowledge priorities that could be transformed into future Ocean Decade Actions. These initiatives, which include *inter alia* sustainable ocean planning, ocean observations, development of a digital twin of the ocean, fisheries management, and a regional ocean literacy programme, would collectively generate the much-needed ocean knowledge for the region and ensure its use in decision- and policy-making. They would also support the development of essential capacity and skills with a focus on Early Career Ocean Professionals.

I am very happy that the Ocean Decade Africa Roadmap was launched at the 'African Conference on Priority Setting & Partnership Development for the UN Decade of Ocean Science for Sustainable Development', hosted by Egypt in May 2022, as a major milestone for the region.

The development and endorsement of Decade Actions with a high societal impact is critical for sustainable development in Africa. I hope that the Ocean Decade Africa Roadmap will inspire and motivate African organizational and individual champions to take initiatives for a more sustainable and prosperous future. The priorities in the Roadmap were identified through a robust co-design process and because of that they can offer a pathway for efficient investments in science-based solutions that truly respond to the needs of African stakeholders. I encourage you all to join us in the implementation of the Roadmap and call on national governments, international financial institutions, donors, industry and philanthropy to support these transformative actions so that together we can create the ocean we want for current and future generations!

**Vladimir Ryabinin**
Executive Secretary
Intergovernmental Oceanographic Commission
of UNESCO



# Summary

## Introduction

The Ocean Decade Africa Roadmap provides a vision and plan for diverse stakeholders to convene around a common set of priorities for the implementation of the Ocean Decade in Africa. It provides a coordinated framework for ocean science planning and uptake, and is a foundation to monitor the achievement of priorities and outcomes. In the long term, the Roadmap will be used to establish and clarify institutions' ocean science strategies and to help in the prioritization of investments in scientific infrastructure, such as observations, monitoring, and data management.

A set of nine priority future Decade Actions lie at the heart of the Ocean Decade Africa Roadmap. With the support and engagement of diverse actors from the region, it is envisaged that these are developed into Decade programmes and projects through a process of co-design and co-delivery in coming years.

## Developing the Ocean Decade Africa Roadmap

The development of the Roadmap derived from a highly participatory process that commenced in 2018 as part of the preparatory phase of the Ocean Decade. The key milestone for Africa included the Regional Consultation for Africa and Adjacent Island States (the 'Nairobi Consultation') held in Nairobi, Kenya in early 2020, the preparation of a Regional Gap Analysis in 2021 and the organization of a series of online multi-stakeholder workshops in early 2022. This process provided the foundation for the current Roadmap that was launched at the 'African Conference on Priority Setting & Partnership Development for the UN Decade of Ocean Science for Sustainable Development' (10-12 May 2022, Cairo, Egypt).

## Nine priority future Decade Actions

The extensive stakeholder engagement process culminated in the identification of nine priority future Decade Actions. These are:

- Sustainable Ocean Management in Africa
- Ocean and Human Health in Africa
- Unlocking the Blue Carbon Potential of Africa
- Fisheries and Illegal, Unreported and Unregulated (IUU) Fisheries in Africa
- Strengthening Multi-hazard Early Warning Systems and Community Resilience
- Ocean Observations and Forecasting Systems for Africa
- Digital Twin for Africa - Establishing an African Ocean Knowledge Hub
- Strengthening capacities and skills of African Early Career Ocean Professionals (ECOPs)
- Regional Ocean Literacy Programme for Africa

## Enabling environment for Roadmap implementation

The Roadmap highlights the important elements of the enabling environment for the implementation of the Ocean Decade in Africa, in terms of capacity development of youth and emerging professionals, equitable and inclusive partnerships, and resource mobilization. A regional taskforce has been set up to ensure coordinated and effective implementation of the Roadmap.

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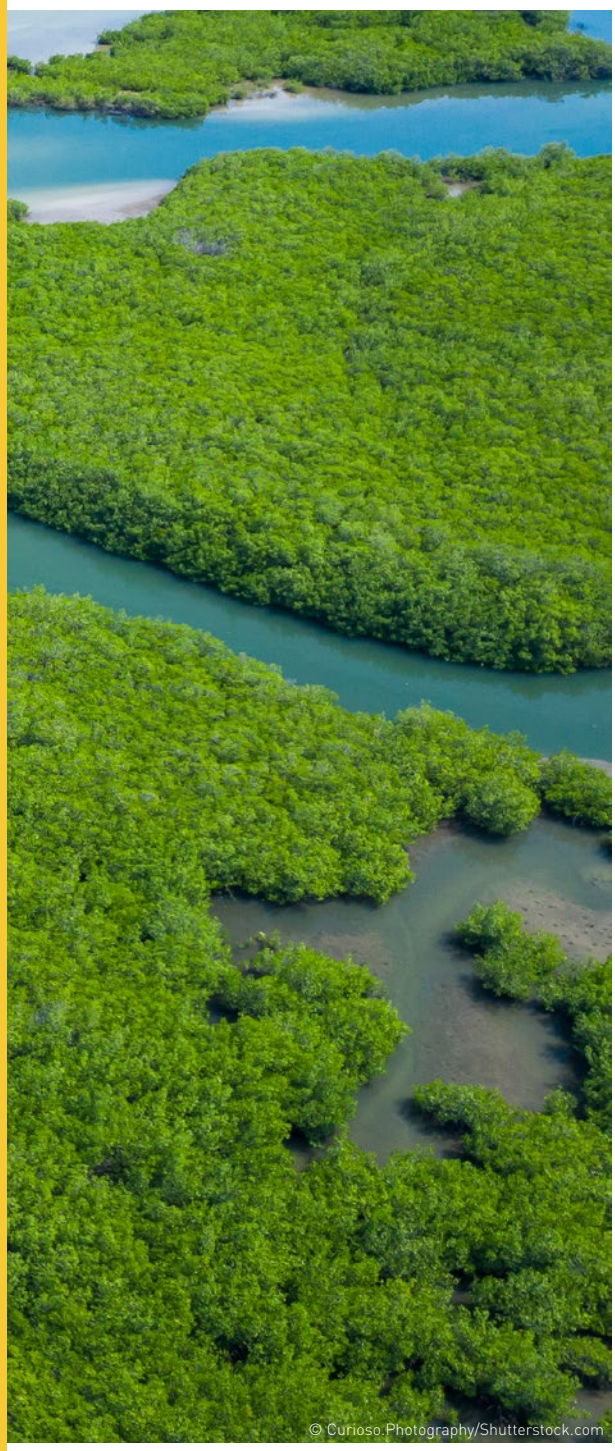
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## Acknowledgements

Thanks are extended to all lead and contributing authors, reviewers and all those involved in preparing this publication. IOC/UNESCO and WIOMSA gratefully acknowledges the support of regional consultants, Dr. Kwame Koranteng (lead expert), Prof. Cherif Sammari (Mediterranean and Red Seas), Dr. Issufo Halo (Western Indian Ocean) and Dr. Jacques Abe (Eastern Atlantic Ocean) who prepared the Regional Gap Analysis, as well as Dr. Claudette Briere Spiteri, for their contribution to the pre-conference workshops, leading to this publication.

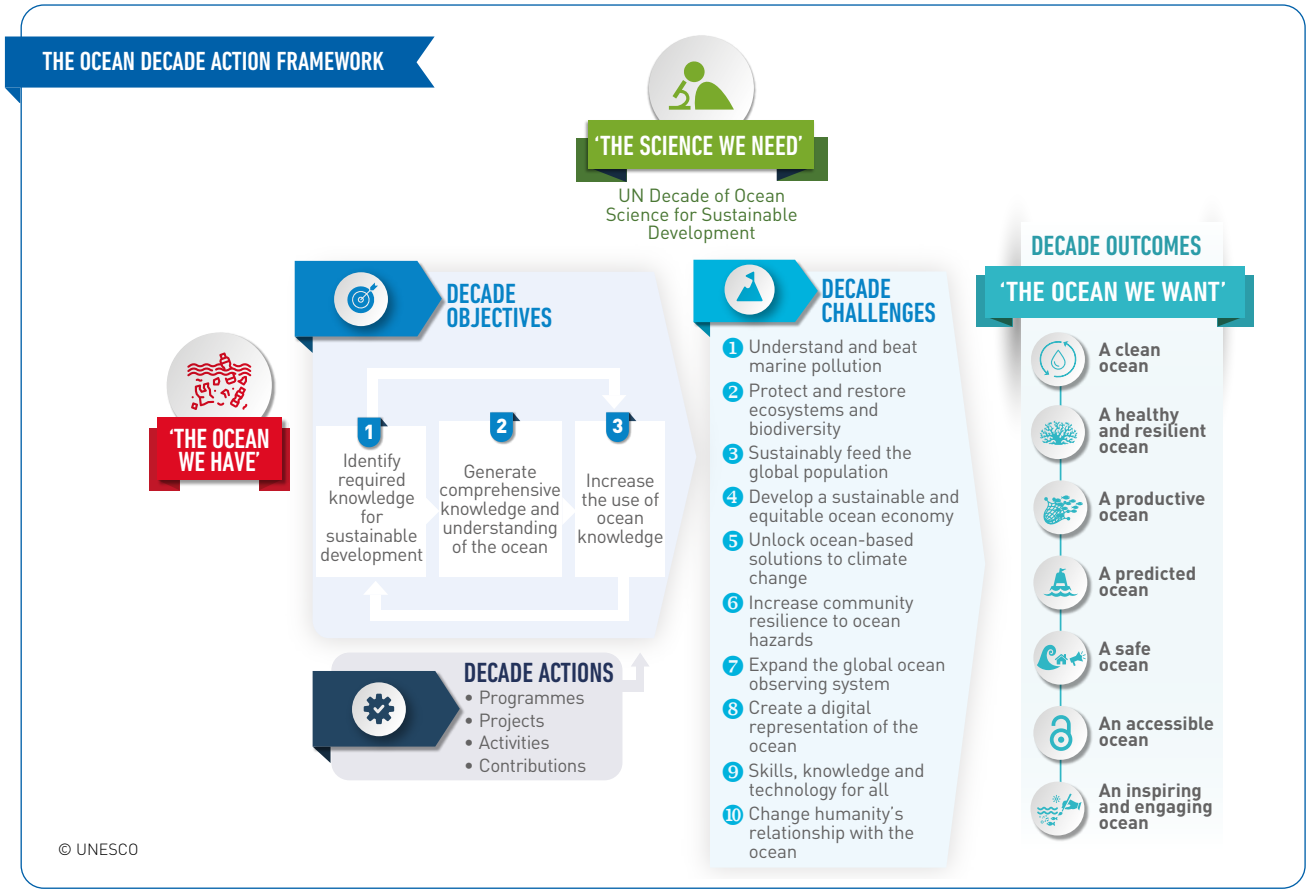
# 1. The Ocean Decade in Africa

The **vision** of the United Nations Decade of Ocean Science for Sustainable Development 2021-2030 (the 'Ocean Decade') is 'the science we need for the ocean we want'. Through its **mission** 'to catalyse transformative ocean science solutions for sustainable development, connecting people and our ocean',[1] the ultimate goal of the Ocean Decade is to provide a **global framework** to help generate ocean-based solutions to societal problems and challenges for sustainable development (see Box 1).

## BOX 1. THE OCEAN DECADE ACTION FRAMEWORK

The Ocean Decade Action Framework is the operational framework that guides the design and implementation of Actions throughout the Ocean Decade. It comprises three process-based **Objectives** and ten high-level **Ocean Decade Challenges** for 'the science we need', leading to the seven **Decade Outcomes** that describe 'the ocean we want'. Underlying the Ocean Decade Objectives, Challenges and Outcomes are the **Decade Actions** – tangible initiatives carried out across the globe to fulfil the Decade vison. Ocean Decade Actions include programmes, projects, activities and other contributions, and are implemented at different levels.

Within the framework of the Ocean Decade, 'ocean science' encompasses natural and social science disciplines, including interdisciplinary topics; the technology and infrastructure that supports ocean science; the application of ocean science for societal benefit, including knowledge transfer and applications in regions that are lacking science capacity; and the science-policy and science-innovation interfaces.




1 IOC-UNESCO. 2021. *The United Nations Decade of Ocean Science for Sustainable Development (2021–2030): Implementation Plan*. Paris, UNESCO. (IOC Ocean Decade Series, 20). https://unesdoc.unesco.org/ark:/48223/pf0000377082


The Ocean Decade is especially opportune for Africa as its coastal and ocean waters are increasingly gaining importance as a potential source of economic growth and employment. With over 30,000 km of coastline and over 1.5 million km$^2$ of Exclusive Economic Zones (EEZs), African countries are highly dependent on the ocean. The ocean is under threat in the region, yet it underpins coastal livelihoods and food security, and protects coastal zones against extreme weather and climate events. The African Union Commission has developed regional frameworks to support the development of the ocean economy, including the African Union Agenda 2063: 'The Africa We Want', the 2050 Africa's Integrated Maritime Strategy (2050 AIM Strategy) and the Africa Blue Economy Strategy (2019). These strategic documents recognize that the blue economy shall be a major contributor to the continent's transformation and growth, outline actions to foster increased wealth creation from Africa's Ocean regions and provide guidance to Member States and regional institutions to develop an inclusive and sustainable blue economy. The African Union has also declared 2015-2025 as the "Decade of African Seas and Oceans", and 25 July as the "African Day of Seas and Oceans". These commitments demonstrate that the continent recognizes the importance of its ocean resources and is determined to ensure that they are sustainably used for development. The Ocean Decade will augment these efforts and provide the framework for the region to address the large knowledge gaps with regard to available resources and the impact of different types of pressures on the ocean ecosystems.

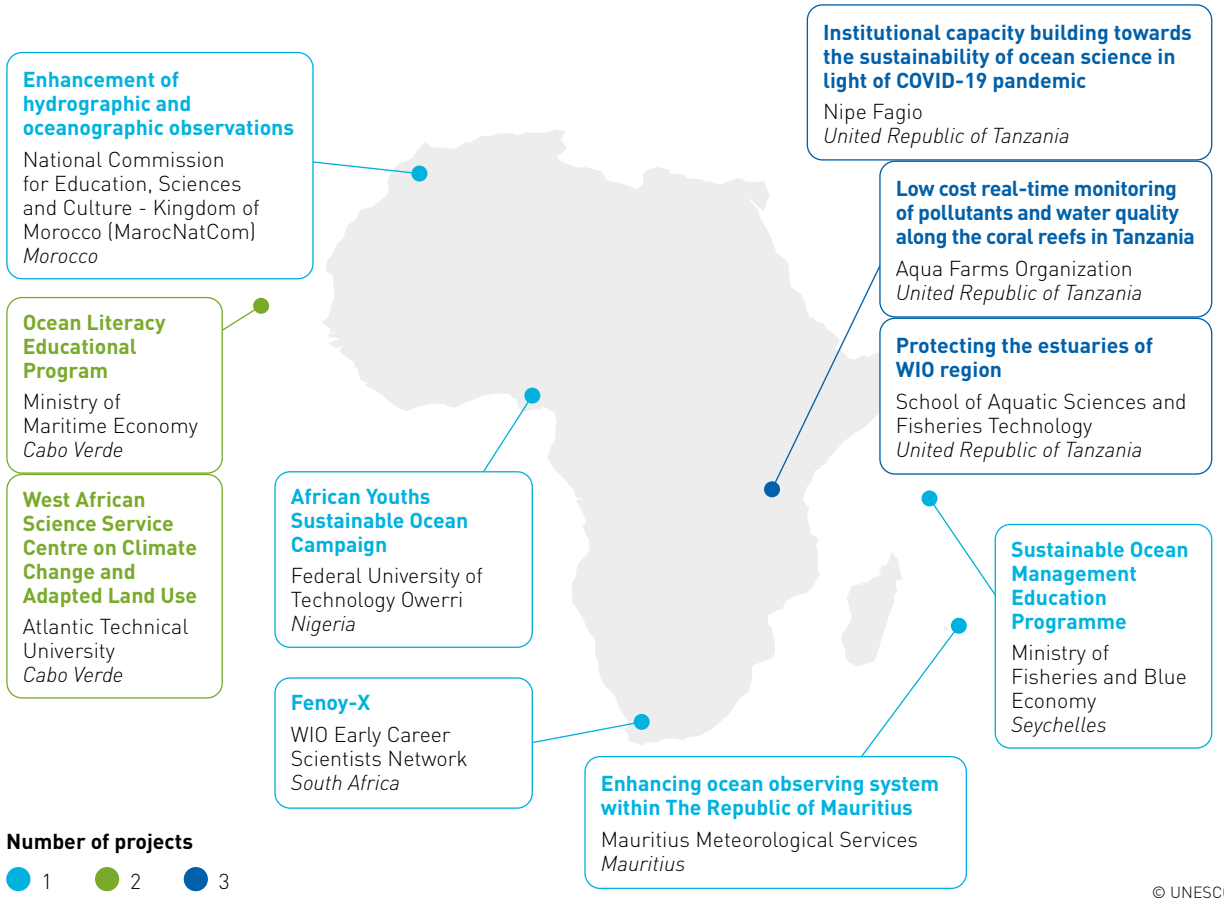
To date, the implementation of the Ocean Decade in Africa has lagged behind many other regions of the world. The results of the first Call for Decade Actions (No. 01/2020) led to the endorsement of **more than 160 Ocean Decade Actions** in the form of programmes, projects and contributions. The endorsed Actions were characterized by a **wide geographic reach**, both in terms of the distribution of lead institutions, as well as the implementation locations. One of the main gaps identified concerned the **under-representation of African organizations** in the endorsed Actions. None of the currently endorsed Decade Programmes are led by African institutions (Figure 1). Nevertheless, several African organizations are engaged in a handful of programmes, either as partners and/or in their implementation (Annex).

**FIGURE 1** **Geographic distribution of endorsed Decade Programmes resulting from the first Call for Decade Actions (No. 01/2020).**




**Ten Decade Projects** are currently led by African organizations and are being implemented in Africa as a result of the first Call for Decade Actions (No. 01/2020) (Figure 2).

**FIGURE 2** **Number of Decade Projects resulting from the first Call for Decade Actions (No. 01/2020) led by African organizations.**




# 2. Purpose and structure of the Ocean Decade Africa Roadmap

The Ocean Decade Africa Roadmap provides a vision and plan for diverse stakeholders from government, industry, philanthropy, UN agencies, civil society and the scientific community, to convene around a common set of priorities for the implementation of the Ocean Decade in Africa. Derived from a highly participatory process that commenced in 2018, the Roadmap documents key gaps and issues in ocean science (Section 4).

The Roadmap provides a coordinated and optimized framework for ocean science planning and delivery. It will enhance coordination between agencies and build synergies between research initiatives, and users of ocean science and knowledge. It will also provide a foundation to monitor the achievement of priorities and outcomes. The processes of co-design and co-delivery that have been essential to the Roadmap's development, and which will continue through its implementation, will ensure stronger integration of knowledge systems in ocean management.

In the long term, the Roadmap will be used to establish and clarify institutions' ocean science strategies. It will help in the prioritization of investments in scientific infrastructure, such as observations, monitoring, and data management, and in the identification and guidance on investments in long-term capacity needs.

At its heart it describes a set of nine priority future Decade Actions that could foreseeably be extended into Decade programmes and projects through a process of co-design and co-delivery involving diverse actors from the region (Section 5).

It also provides a discussion of the priority needs to ensure that a robust enabling environment exists for the co-design and co-delivery of Decade Actions in Africa in relation to capacity development, resource mobilization and partnerships (Section 6).

The development and endorsement of Decade Actions with a high societal impact is critical for sustainable development in Africa. The Ocean Decade Africa Roadmap serves as a call for African organizational and individual 'champions' to take the initiative and lead the co-design and co-delivery of Decade Actions to tackle the pressing challenges in Africa.

# 3. Preparing the Ocean Decade Africa Roadmap

The Roadmap had its genesis in the preparatory phase of the Ocean Decade that ran from 2018 to 2020. From that time onwards a participatory and inclusive process has been carried out as described below.

**FIGURE 3** **Steps in the development of the Ocean Decade Africa Roadmap.**




## Engaging regional stakeholders

During the preparatory phase for the Ocean Decade from 2018 to 2020, a series of 11 regional planning workshops were organized worldwide. This included the Regional Consultation for Africa and Adjacent Island States (the 'Nairobi Consultation') held in Nairobi, Kenya from 27–29 January 2020 (IOC-UNESCO, 2020). Participating in the workshop were ocean leaders, key stakeholders and communities of experts in various ocean science disciplines. The workshop provided an opportunity to take stock of current ocean science activities in Africa, and identify high-level ocean knowledge gaps. It also identified needs for capacity building and other cross-cutting priorities including engaging Early Career Ocean Professionals in ocean science, and increasing investment in ocean science in Africa.

## Developing a Regional Gap Analysis

To further explore the issues identified in the Nairobi Consultation, IOC/UNESCO in partnership with Western Indian Ocean Marine Science Association (WIOMSA), commissioned a Regional Gap Analysis in 2021. The key objectives of this analysis were to develop a participatory and common vision of the priority gaps and needs for Africa under the Ocean Decade and to identify the key barriers, opportunities and actions to meet those gaps and needs, including initial proposals and suggestions for future priority Decade Actions. The Regional Gap Analysis assessed the **current status** of ocean science at the regional and the three subregional levels i.e. Eastern Atlantic Ocean (west coast), Red Sea and Mediterranean Sea (north and north-east coast) and Western Indian Ocean (east coast). It then identified the **gaps** between the current status and the ocean science we need for the ocean we want, as defined in the Ocean Decade Implementation Plan. It also identified the **areas for improvement** and proposed appropriate solutions and initiatives to meet the Ocean Decade Challenges. A summary of the key findings of the analysis in terms of key gaps are presented in Section 4. The findings of Nairobi Consultation and the Regional Gap Analysis provided the foundation for the current Roadmap.

## Identifying priority future Decade Actions

The outcomes of the Regional Gap Analysis process were presented and discussed extensively during a series of multi-stakeholder pre-conference workshops. These workshops, held in early 2022, were structured around the Ocean Decade Challenges and a series of priority cross-cutting themes. They aimed to:

1. Use the results of the Regional Gap Analysis to facilitate the development of potential Decade Actions, in the form of Decade programmes and projects; and
2. Catalyse partnerships among regional stakeholder communities, including funding partners, in view of implementing identified priority Decade programmes and projects.

The results of the pre-conference workshops were analysed and consolidated by IOC/UNESCO, WIOMSA and key partners to identify a series of nine, priority future Ocean Decade Actions that form the heart of this Roadmap, and which are presented in Section 5.

## Launching the Roadmap and ensuring its implementation

The African Conference on Priority Setting & Partnership Development for the UN Decade of Ocean Science for Sustainable Development took place from 10 to 12 May 2022 in Cairo, Egypt. The aim of the conference was to provide a forum to take stock of the status of ocean science and technology in the region, and to deliberate on how ocean science in Africa should be supported and focused on delivering the required societal outcomes. It was also an opportunity to seek the interest and commitment of the ocean science community and a broader set of actors from governments, industry, philanthropy, UN agencies and the scientific community to embark on a number of research directions which are critical for sustainable ocean management.

The Ocean Decade Africa Roadmap was launched during this conference and represented a watershed moment in terms of the implementation of the Ocean Decade in Africa. Discussions and networks created during the conference will be used to kick-start a process of detailed co-design and resource mobilization for the delivery of the priority Decade Actions over the next eight years. IOC/UNESCO, WIOMSA and partners will coordinate that process to support the successful delivery of the Roadmap. To ensure its success, it will be crucial that the Roadmap is known and recognised outside the scientific community. Support for its implementation by key regional organisations, including the African Union Commission, Regional Economic Commissions, Regional Seas Programmes, Regional Fisheries Bodies and other regional and continent-wide organizations, will be important.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# 4. Priority needs and gaps in transformative ocean science in Africa

The Regional Gap Analysis highlighted the issues and gaps for each of the ten Decade Challenges. Most of these issues were common to the three subregions. The topics falling under the scope of each Challenge pertinent to the African context were also described and prioritized. A synthesis of the key topics, associated issues and gaps identified in the Regional Gap Analysis is presented in Table 1.

**TABLE 1. IDENTIFIED ISSUES AND GAPS MAPPED TO OCEAN DECADE CHALLENGES**

| Ocean Decade Challenge | Scope of the Challenges relevant to Africa | Identified issues and gaps |
|---|---|---|
|  **1. Understand and beat marine pollution** | ▶ Understanding causes and impacts of the decline of water quality due to marine litter and microplastics, oil spills, chemical pollution and eutrophication<br>▶ Identifying multi-stressor hotspots | ▶ Inadequate **harmonized methodology** for regional assessments<br>▶ Different **capabilities** to respond to marine pollution<br>▶ Limited **source-to-sink** understanding and assessment of pollutants, including **impacts on human health** |
|  **2. Protect and restore ecosystems and biodiversity** | ▶ Understanding healthy and resilient marine ecosystems<br>▶ Biodiversity, including species diversity and taxonomy<br>▶ Alien and invasive species<br>▶ Structure and functioning of the ocean<br>▶ Linkages between ecosystem services and people | ▶ Insufficient **fundamental knowledge/research** on species diversity and taxonomy<br>▶ Insufficient understanding of **ecosystem functions and services** supported by different ecosystems at the scale required by relevant management<br>▶ Limited **mapping** of marine and coastal ecosystems (e.g. for marine protected areas - MPAs) |
|  **3. Sustainably feed the global population** | ▶ Fisheries and aquaculture, including data, assessments, ecosystem-based approach to fisheries management, enforcement and governance | ▶ Key knowledge gaps related to **data on fish catch and fishing effort**<br>▶ **Irregular assessments** of fish stocks<br>▶ Limited **reliable information** on the nature and extent of illegal, unreported and unregulated (**IUU**) fishing in the EEZ, high seas and Areas Beyond National Jurisdiction (ABNJ)<br>▶ Limited understanding of the effects of **unsustainable exploitation of resources, other anthropogenic factors, climate variability and change on marine ecosystems**<br>▶ Weak **enforcement** of national and international laws and regulations; impacts of **ineffective governance** on marine ecosystems |
|  **4. Develop a sustainable and equitable ocean economy** | ▶ Ocean science in support of the development of a sustainable ocean economy, including data and observations, evaluation of environmental change scenarios | ▶ Inadequate recognition of the **role of relevant partnerships**, public-private alliances and university networks as engine of environmental research, understanding and management, and providing the competent work force in a fast-changing environment<br>▶ Inadequate capacity for and development of **entrepreneurship in sustainable ocean economy** |

| Ocean Decade Challenge | Scope of the Challenges relevant to Africa | Identified issues and gaps |
|---|---|---|
|  **5. Unlock ocean-based solutions to climate change** | ▶ Trends/changes in environmental conditions and long-term monitoring<br>▶ Numerical modelling, forecasting, indicators<br>▶ Impacts on marine ecosystems<br>▶ Climate processes at local and regional scales, and for different time scales | ▶ Highly variable **ocean modelling expertise and resources**<br>▶ Limited **high-resolution weather and climate information**<br>▶ Limited **forecast modelling** of extreme events and their impacts on coastal zone management; and projections of warming in view of MPAs |
|  **6. Increase community resilience to ocean hazards** | ▶ Early warning systems for ocean-related hazards and extreme events, including vulnerability to flooding, enhanced frequency and duration of tropical cyclones, storm surges, tsunamis, etc. | ▶ Limited comprehensive **assessments of climate-related risks**, including extreme weather events in a changing climate, sea level rise, temperature increase, flooding, and incidence of invasive species<br>▶ Inadequate **operational platforms and decision support systems** to address tsunamis generated by different sources, e.g. seismic activity, volcanoes, landslides, atmosphere<br>▶ Need for the **integration of operational platforms** with progressive geological processes such as erosion or burial, and the undersea environment<br>▶ Need for **assessments of the risk** of climate change on the ecosystem and human environment in the coastal zone and deep sea |
|  **7. Expand the Global Ocean Observing System (GOOS)** | ▶ Ocean observations and monitoring<br>▶ Modelling and forecasting of ocean processes and ecosystems, including coupled ocean-atmosphere models<br>▶ Ocean data and information management<br>▶ Emerging technologies for ocean observations and monitoring | ▶ Inadequate **common platforms for data sharing; incompatible metadata formats; incompatible data** (data existing in printed format/file type)<br>▶ Key shortcomings related to **access to data** (ownership e.g. lack of access to oil and gas industry data), data quality, lack of standardized observing parameters, and gaps in the types of data collected<br>▶ Gaps in sustained **in situ observations for several Essential Ocean Variables (EOVs)**<br>▶ Weak **multidisciplinary approaches** to observation, monitoring and modelling |

| Ocean Decade Challenge | Scope of the Challenges relevant to Africa | Identified issues and gaps |
|---|---|---|
|  **8. Create a digital representation of the ocean** | ▶ Digital representation of the ocean, mapping of the ocean floor in Africa including a dynamic ocean map | ▶ Need for **training on data collection, analysis and interpretation** (including capacity building in programs and software to analyse different environmental datasets)<br>▶ Inadequate **common platforms** for data sharing, adaptation of technologies, facilities and infrastructure within Africa<br>▶ Identified gaps in **research programmes on ocean policy agenda** in order to analyse objectives, identify priorities, align teaching/ research/outreach activities capable of impacting on policy<br>▶ Need to better **manage, develop and transfer know-how** within the contributing research community |
|  **9. Skills, knowledge and technology for all** | ▶ Ocean training, research capacities and opportunities<br>▶ Equitable access to data, information, knowledge and technology<br>▶ Transformative partnerships for the sustainable development of oceans | ▶ Challenges in data sharing due to **lack of common platforms**, and incompatible metadata and data formats<br>▶ Insufficient **standardized policies** in relation to access and sharing of data<br>▶ Limited **trust between organizations** to share data<br>▶ Limited technical capacities and resources<br>▶ Need to empower local/regional scientists with **skills and tools** to enable them to analyse and interpret the **large number of data sets** available in the region |
|  **10. Change humanity's relationship with the ocean** | ▶ Improved ocean literacy and better communication to improve humanity's relationship with the ocean, recognition and better understanding of the multiple values of the ocean for human well-being, culture and sustainable development | ▶ Insufficient appropriate tools for the **dissemination of climate information** related to coastal and oceanic areas<br>▶ Inadequate **effective communication** between science and policy; need for improved **ocean literacy** and better communication<br>▶ **Limited funding** available to promote outreach programmes to educate the public on issues of sustainability and conservation |
| **Cross-cutting themes** | ▶ Marine spatial planning (MSP) and integrated coastal zone management (ICZM)<br>▶ Ocean science-policy interface<br>▶ Ocean governance, including Areas Beyond National Jurisdiction (ABNJ) | ▶ **Limited participation** of African countries in the Biodiversity Beyond National Jurisdiction (BBNJ) treaty negotiations |


# 5. Priority Ocean Decade Actions for Africa

The extensive stakeholder engagement process described in the previous sections culminated in the identification of **nine priority future Decade Actions** (Figure 4). These Actions could be developed as new Decade programmes, projects that fit within existing Decade programmes, and/or contributions by multiple stakeholders.

This targeted and tangible list of proposed Decade Actions is intended to facilitate discussions, foster ideas, catalyse partnerships and stimulate commitment to embark on the process of co-design and co-development of Decade programmes and projects, with the ultimate aim of generating ocean-based solutions to societal challenges in achieving sustainable development in Africa.

FIGURE 4 **Overview of the nine priority future Decade Actions.**

| Brief description | Ocean Decade Challenges addressed |
|---|---|
| **1. Sustainable ocean management in Africa** | |
| This Decade Action will strengthen the data, knowledge-base and expertise required to develop and implement sustainable ocean plans in Africa. This will include innovative monitoring, coordinated and transboundary marine spatial planning (MSP) plans, taking into account future socio-economic development pathways. The Action will also focus on developing African capacities and entrepreneurship skills in sustainable ocean economy sectors, and tailored university programmes and blue skills actions, e.g. internships, institutional exchange programs, oriented to bridge employability, and meeting the needs of industry and society. |   |
| **2. Ocean and human health in Africa** | |
| This Action will identify priority knowledge gaps and policy needs in relation to the links between human health and the ocean. It will enhance the understanding of the links between ocean pollution (e.g. oil or chemical pollution) and ocean risks (e.g. harmful algal blooms) on human health in specific African subregions. The results will be used to influence policy and management decisions including in the context of increasing demands for the provisioning of sustainable blue food and nutrition. |   |
| **3. Unlocking the blue carbon potential of Africa** | |
| This Action will advance the mapping of blue carbon, identify mangrove and seabed restoration needs, and provide an assessment of the blue carbon potential at the regional level, bridging the Ocean Decade to the UN Decade for Ecosystem Restoration. It will work with the finance sector, industry and site managers to develop and test innovative financing mechanisms linked to blue carbon. It will engage government partners and local communities to develop participatory subnational and national policy to optimize the role of blue carbon as a sustainable source of financing and as a generator of economic and social co-benefits. The programme will include capacity development and ocean literacy elements. |   |
| **4. Fisheries and IUU in Africa** | |
| The aim is to identify the scientific gaps in monitoring IUU, upscale the gathering and analysis of data and information on IUU fishing in the EEZ, the high seas and ABNJ, and impacts. This will enhance our understanding of the nature and extent of the ecological and socio-economic impacts of IUU in the region. The Action will work with actors in the technology and innovation sector to identify adapted technological solutions to data collection and analysis. It will provide knowledge to policy-makers, fisheries managers and authorities to influence decision making on strategies to address IUU in Africa. |   |

## 5. Strengthening multi-hazard early warning systems and community resilience

This Action aims to close the gaps on observation data between subregions, develop tools for observing, forecasting, warning and anticipating climatic hazards, e.g. operational platform and decision-support systems to address tsunamis generated by different sources, e.g. seismic activity, volcanoes, landslides, etc. It will also promote research on extreme events (extreme cyclones and swells, etc.) through the development of coupled sea-atmosphere modelling tools. The Action will work with policy-makers, local communities and disaster risk management authorities to influence policy and planning for community resilience. It will contain capacity development and ocean literacy components to increase awareness and understanding of risks and response measures.


## 6. Ocean observations and forecasting systems for Africa

This Action will strengthen the Africa components of the ocean observations network as part of the overall development of the GOOS. It will address specific needs to develop a network of ocean observation systems and regional forecasting models of ocean circulation, to provide baseline information on the oceanographic, biogeochemical and ecological state, changes and trends of the large marine ecosystems in Africa, and long-term coastal observations at key locations. It will also include harmonized approaches to data standards, metadata and processing of big data. It will work with industry and other stakeholders to optimize the collection of ocean observations by private or commercial vessels to feed into the observations system.


## 7. Digital twin for Africa - Establishing an African ocean knowledge hub

This Action will establish and advance the development of a regional 'digital twin' for Africa for centralizing marine data, modelling and simulations with artificial intelligence (AI) algorithms, specialized tools, and best practices. This will provide access to data and information required to develop human, environmental and economic scenarios, addressing issues such as energy, mining, fisheries, tourism and nature-based solutions, thus contributing to the knowledge base required for the development of sustainable ocean plans. The Action will involve a strong element of co-design to ensure that the priority datasets, applications and services that were developed as part of the digital twin respond to the needs of ocean users. The Action will include a specific focus on indigenous and local knowledge. Capacity development will be integrated into all aspects of the Action both in the development of the digital twin and in the use of the applications and services. Engagement with actors from technology and innovation sectors will ensure that the technology used is adapted to the local context.


## 8. Strengthening capacities and skills of African Early Career Ocean Professionals (ECOPs)

The aim is to develop essential capacities and skills in Africa related to ocean science, with a focus on scientific and technical skills of ECOPs. This Action will form part of the global ECOP programme and will build on the findings of the global survey of ECOP needs and priorities to provide targeted support via the African ECOP regional hub. It will include support for: short- and long-term training; mentorship and professional development programmes; leadership training; support to engage international policy processes and discussions; a match-making service for access to research vessels and infrastructure; and other priority elements.

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## 9. Regional ocean literacy programme for Africa

This cross-cutting programme will promote participatory research and co-design approaches, and improve connections and collaboration with existing networks working on science communication and outreach. Policy- and decision-makers will be a key target group of this Action and much of the focus will be on initiatives to strengthen the science-policy interface by increasing awareness and skills to access and interpret science for its use in policy design. Among other issues, the Action will develop appropriate tools for the dissemination of climate information related to coastal and oceanic areas, and bolster understanding of the role of indigenous and local knowledge as a complementary, equally valued knowledge source.


# 6. Creating a robust enabling environment for the Ocean Decade in Africa

The development of the Roadmap also considered elements of the enabling environment for the implementation of the Ocean Decade in Africa and identified priority areas for strengthening.

**Capacity development**, **equitable and inclusive partnerships** and **resource mobilization** emerged as the priority needs for the region in this sense. Technological innovation, including access to technology, was also highlighted as an important priority in relation to several Ocean Decade Challenges.

Acknowledging that human capacity to carry out ocean science is unequally distributed across Africa, across generations, and across genders, **capacity development** is recognized as an essential tenet of the Ocean Decade. To ensure that future capacity-development actions result in sustainable and real benefits for ocean science and African scientists, a paradigm shift is needed to prompt joint efforts that result in the transfer of capacities to develop young scientists and the enhancement of current capacities in reskilling or retooling to transform Africa's engagement with the ocean. The Ocean Decade in Africa should be considered as an opportunity to develop the necessary capacities to undertake innovative work to move towards patentable work, and to boost the number of scientific publications by African scientists through the establishment of state-of-the-art regional research facilities.

Capacity development should focus on young and emerging ocean professionals in Africa. This could be achieved through various means, e.g. robust mentoring programmes; establishment of a visiting scholar/exchange programme; scholarship programmes across partner universities; small grants to access training; or development and deployment of specific capacity-development programmes in areas where lack of skills has been identified. The training course on co-design in the context of the Ocean Decade, which is currently being developed as part of the

Ocean Teacher Global Academy, is an example of this latter approach. The Ocean Decade Early Career Ocean Professionals programme is developing an African hub for ECOPs in the Ocean Decade. Further support to individuals and institutions via this Programme is an important means of reinforcing capacity-development efforts in the region. In addition, ensuring that all Decade programmes in Africa fulfil the Decade endorsement criteria to incorporate elements of capacity development will enable specific needs relating to each Ocean Decade Challenge to be addressed. The Ocean Decade Network - the online community platform for the Decade - can support coordination across capacity-development efforts and help match the offer and demand from individuals and organizations.

Access to in-kind resources and technology, e.g. ship time on research vessels, access to research laboratories or access to supercomputing facilities, is limited in many African countries. As part of capacity-development and transfer of marine technology initiatives under the Ocean Decade, it is proposed to develop an inventory of existing in-kind resources and to provide a 'match-making' service to connect individuals or institutions requiring such support to available facilities.

The implementation of programmes in ocean science in most countries in Africa is hampered by limited financial resources. Many governments have to balance funding for ocean science and research with other competing needs. Funding for ocean science in Africa will need to be increased in order to meet the ambition of the Ocean Decade. In addition to the more traditional pathways of national funding or overseas development assistance (ODA), innovative resource mobilization mechanisms, funding and partnerships for ocean science will be required for Africa to actively participate in and benefit from the Ocean Decade. This could include market-based financing mechanisms including for example, via blue carbon; stronger links to private sector research and development funding; funds or levies linked to maritime activities; or blended private-public financing tools. The Ocean Decade provides certain mechanisms, such as sponsored calls for Decade Actions, that will allow for funds to be directed towards African initiatives, and is experimenting with the development of new models that could prove beneficial in the medium term.

Currently, national financial resources for ocean science in Africa are very limited, yet in the longer term a shift from the dependence on foreign financial and technical funds to national financial resources from improved public sector governance and Pan-African financing schemes is required to increase sustainability of investment. Partnerships, cooperation and networks via the Ocean Decade are key, not only within Africa, but also for collaboration with the African diaspora worldwide, for example through twinning programmes.

Indigenous and local knowledge is an integral part of the co-designed ocean science that the Ocean Decade in Africa aims to deliver. The Ocean Decade is working with Indigenous peoples and local communities to create an enabling environment for equitable capacity exchange, where different knowledge systems can work together and be respected. The active engagement of other underrepresented groups in ocean science, for example through endorsed Decade Programmes (e.g. Empowering Women for the Ocean Decade and Early Career Ocean Professionals), will help promote gender and intergenerational equity, both of which are essential for Africa's future leadership in the Decade.

African partners and individuals are well represented in the governance structure of the Ocean Decade, e.g. in the Decade Advisory Board and various informal working groups. Several National Decade Committees have been established in Africa notably in Angola, Cabo Verde, Madagascar and Nigeria. Individuals with an interest and expertise in ocean science in Africa are encouraged to register on the Ocean Decade Expert Roster and thus engage in global and regional discussions about strategic ambition setting for the Ocean Decade Challenges.

In addition, to ensure coordinated and effective implementation of the Roadmap, provide a regional networking platform for National Decade Committees and continue the momentum for engagement of African partners in the Ocean Decade, a regional taskforce was established in late 2022. This taskforce comprises ocean leaders from African governments, private sector, UN agencies, philanthropy and the scientific community. Its role is to oversee and promote the implementation of the Roadmap and the enabling environment necessary for its success. The taskforce was established taking into account the need for gender, geographical and generational diversity.

# Annex

**TABLE A1. OVERVIEW OF ENDORSED PROGRAMMES THAT INCLUDE AFRICAN PARTNERS AND/OR AFRICAN COUNTRIES IN THEIR IMPLEMENTATION SCOPE AND THE CHALLENGES THEY ADDRESS**

| Name of Decade Programme | Summary description | Lead partner and country | African countries | Challenges | Links to... |
|---|---|---|---|---|---|
| **Challenger 150 – A Decade to Study Deep-Sea Life** | Challenger 150 is a global cooperative devoted to delivering the science we need to sustainably manage the deep ocean. At its heart is the development of deep-ocean expertise, particularly in economically developing nations, in order to achieve a global generation of stewards working together to maintain the integrity of deep-ocean ecosystems. Furthermore, through supporting the development of new technologies and the expansion of observations, Challenger 150 aims to advance understanding of the diversity, distribution, function and services provided by deep-ocean biota, and to use this new knowledge to educate, inspire and promote better management and sustainable use of the deep ocean | Deep Ocean Stewardship Initiative (DOSI) | All African countries. Namibia, Nigeria, Mauritania, Morocco and South Africa are active members of the Atlantic Ocean regional group. Comoros, Kenya, Mauritius, France, Seychelles, South Africa and United Republic of Tanzania are active members of the Indian Ocean regional group | 1, 2, 3, 4, 5, 7, 8, 9, 10 | ▶ Early Career Ocean Professionals |
| **Deltas associated with large rivers: Seeking solutions to the problem of sustainability** | This Programme aims to study the present status and threats of 25 representative deltas, the methodology for new delta blueprints, the blueprints dealing with critical delta characteristics, and the sustainability of the delta system and its capacity to support regional sustainable development for deltas of different physical processes, ecological and economic importance | State Key Laboratory of Estuarine and Coastal Research (SKLEC), East China Normal University, China | Egypt | 2, 6, 9 | |
| **Digital Twins of the Ocean (DITTO)** | DITTO will establish and advance a digital framework on which all marine data, modelling and simulations, along with artificial intelligence (AI) algorithms and specialized tools (including best practice), will enable shared capacity to access, manipulate, analyse and visualize marine information. It will enable users and partners to create ocean-related development scenarios addressing issues such as energy, mining, fisheries, tourism and nature-based solutions | GEOMAR Helmholtz Center for Ocean Research Kiel and Kiel University, Germany | Cabo Verde, South Africa | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | |

| | | | | | |
|---|---|---|---|---|---|
| **Early Career Ocean Professionals (ECOP)** | The ECOP Programme's mission is to incorporate new ways of thinking into global ocean sustainability and stewardship challenges through diverse engagement. The programme will achieve this by empowering ECOPs with meaningful networking and professional development opportunities to engage with each other and with local to global institutions through the framework of the UN Ocean Decade. The vision of the ECOP Programme is to elevate and strengthen the diverse perspectives of new generations of ocean professionals in a collective voice, ensuring that knowledge is transferred between experienced and early-career ocean professionals, to promote ocean sustainability for 'the ocean we want' | Ocean Decade Informal Working Group for Early Career Ocean Professionals | Global | 2, 3, 4, 9, 10 | ▶ Indigenous and Local Knowledge<br>▶ Early Career Ocean Professionals |
| **Empowering Women for the United Nations Decade of Ocean Science for Sustainable Development** | The Empowering Women for the Ocean Decade Programme will enhance capacity to explore and promote women's empowerment and gender equality in the conduct of ocean science and in science-dependent governance systems. Research findings will identify key barriers and good practice contributing to a proposed Strategy and Action Plan to help deliver equal opportunities for full participation and leadership by women at all levels of ocean science | World Maritime University – Sasakawa Global Ocean Institute, Sweden | Global, with specific case studies in Kenya | 2, 4, 9, 10 | ▶ Indigenous and Local Knowledge<br>▶ Gender |
| **Global Ocean Corps and Conveyor** | Motivated by the example of the US Peace Corps, 'An Ocean Corps for Ocean Science' is proposed as a unifying concept for sustaining long-term education and research collaborations between scientists from under-resourced nations and higher-resourced nations | University of Michigan, USA | Coastal Ocean Environment Summer School in Ghana and Nigeria. Ambition to work in more African countries | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | ▶ Indigenous and Local Knowledge<br>▶ Gender |
| **Observing and Predicting the Global Coastal Ocean (CoastPredict)** | CoastPredict will transform the science of observing and predicting the Global Coastal Ocean, from river catchments (including urban scales) to the oceanic slope waters. It will integrate observations with numerical models to produce predictions of natural variability and human-induced changes in the coastal areas – from extreme events to climate – for the coastal marine ecosystems (their services) and biodiversity. It will upgrade the infrastructure for exchange of data with standard protocols and co-design transformative responses to science and societal needs | Alma Mater Studiorum University of Bologna, Italy | Ghana, Morocco, Namibia, South Africa | 5, 6, 7, 8, 9 | |
| **Ocean Biomolecular Observing Network (OBON)** | The Biomolecular Ocean Observing Network (OBON) will transform how we sense, harvest, protect and manage ocean life, which faces multiple stresses including pollution, habitat loss and climate change. It will also help communities detect biological hazards like harmful algal blooms and pathogens, and be a key component of next-generation ocean observing systems | The Partnership for Observation of the Global Ocean (POGO), USA | Benin, Cabo Verde, Côte d'Ivoire, Ghana, Morocco, Nigeria | 2, 6, 7, 9 | ▶ Indigenous and Local Knowledge |

| | | | | | |
|---|---|---|---|---|---|
| **Ocean Cities, an international network of cities in harmony with the marine environment (OC-NET)** | Ocean Cities (OC-NET) is a network of marine cities committed to sustainability, permeability and regeneration of natural marine environments, for and with its population. OC-NET is an interdisciplinary and bottom-up transformative programme, which will change how coastal cities and their inhabitants perceive, interact and evolve with the ocean, from the surrounding waters to the single global ocean. OC-NET will combine scientific knowledge, research synergies and social awareness to effectively impact the city's evolution and the ocean's sustainability | Mediterranean Center for Marine and Environmental Research (CMIMA-CSIC) | South Africa and north African countries through Medcities network | 1, 2, 4, 5, 7, 9, 10 | |
| **Sustainability of Marine Ecosystems through global knowledge networks (SMARTNET)** | SMARTNET will establish a global knowledge network (GKN) for ocean science by strengthening and expanding the collaboration of ICES/PICES and partner organizations. It will support and leverage ICES/PICES member countries' activities related to the Ocean Decade by emphasizing areas of mutual research interest, including:<br>▶ climate change<br>▶ fisheries and ecosystem-based management<br>▶ social, ecological and environmental dynamics of marine systems<br>▶ coastal communities and human dimensions<br>▶ communication<br>▶ capacity development | International Council for the Exploration of the Sea (ICES)<br>The North Pacific Marine Science Organization (PICES), Denmark | South Africa, through its formal affiliation with ICES and PICES. Expected to develop partnerships with countries in Africa (e.g. Angola, Cabo Verde, Mozambique and Sao Tomé and Principe) | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | ▶ Indigenous and Local Knowledge |
| **The Coral Reef Sentinels: A Mars Shot for Blue Planetary Health** | The Coral Sentinel System is a transformative programme to deploy autonomous, low-cost robots to monitor the health of coral reefs around the world in near real-time | The Smithsonian Institution, Panama | Madagascar | 1, 2, 3, 4, 8, 9, 10 | |
| **The Ocean Prediction Capacity of the Future (ForeSea)** | ForeSea aims to:<br>(i) improve the science, capacity, efficacy, use and impact of ocean prediction systems, and<br>(ii) build a seamless ocean information value chain, from observations to end users, for economic and societal benefit<br>These transformative goals aim to make ocean prediction science more impactful and relevant | OceanPredict, Canada | Global, covering all Africa | 7, 8, 9 | |
| **The Science We Need for the Mediterranean Sea We Want (SciNmeet)** | The SciNMeet Programme will address major Mediterranean challenges and gaps in scientific knowledge. The aim is to better understand and manage impacts of climate change, pollution, overexploitation of resources, and marine hazards on the marine environment to contribute to ecosystem function maintenance and the sustainability of relevant economic operations. The Programme will address the Ocean Decade's seven Outcomes and contribute to the implementation of Agenda 2030 by increasing education, awareness and international collaboration, and mobilizing the scientific community, policy-makers, private sector and society at large | Italian Oceanographic Commission (COI), particular CNR, CMCC, CoNISMa, DPC, ENEA, IIM, INGV, ISPRA, OGS and SZN, Italy | African countries bordering the Mediterranean Sea: Algeria, Egypt, Libya, Morocco and Tunisia | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | |
| **1000 Ocean Start-ups Coalition (Contribution)** | The coalition brings together the global ecosystem of incubators, accelerators, competitions, matching platforms and venture capitalists supporting start-ups for ocean impact. The objective is to scale at least 1,000 transformative start-ups by the end of the Ocean Decade to restore ocean health and achieve SDG14 | 1000 Ocean Start-ups | All Africa, with hubs in Kenya, Mauritius, Rwanda, (soon) Senegal and South Africa | 1, 2, 3, 4, 5 | |

## LEAD OR PARTICIPATE IN A DECADE ACTION

Decade Actions will be implemented by a wide range of proponents throughout the Decade. Regular Calls for Actions will be released twice per year. Visit oceandecade.org to learn more about Calls for Decade Actions.

## JOIN THE OCEAN DECADE NETWORK

The Ocean Decade Network serves as the primary engagement mechanism for the Ocean Decade, announcing opportunities for funding and partnerships, workshops and trainings, meetings, conferences, and input on calls for future Decade Actions. Sign up today to join the Ocean Decade Network at forum.oceandecade.org.


## BECOME A MEMBER OF THE OCEAN DECADE ALLIANCE

The Ocean Decade Alliance is a key mechanism for resource mobilization during the Decade and will act as a matchmaker between resource providers and proponents of Decade Actions – in line with the priorities of the Decade. Visit oceandecade.org/ocean-decade-alliance to learn more.

## ESTABLISH OR JOIN A REGIONAL OR NATIONAL DECADE COMMITTEE

Coordination at the national and regional level will foster inclusion, engage national stakeholders and facilitate regional and national contributions to the Decade, as well as promote awareness and interest. These voluntary and multi-stakeholder platforms will be key in linking national action to the international Ocean Decade framework. Learn more about national and regional groups on oceandecade.org.

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