

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

## Regional Consultation for Africa and the Adjacent Island States

*Nairobi, Kenya, 27-29 January 2020*



*Participants in the Regional Consultation workshop for the UN Decade of Ocean Science for Sustainable Development for Africa and the Adjacent Island States, Nairobi, Kenya, 27-29 January 2020*

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## 1. INTRODUCTION AND BACKGROUND

The United Nations General Assembly (UNGA) at its session in December 2017, proclaimed the “United Nations Decade of Ocean Science for Sustainable Development” for the 10-year period beginning on 1 January 2021 and called upon the Intergovernmental Oceanographic Commission (IOC) of UNESCO to prepare an Implementation Plan for the Decade in consultation with Member States, specialized agencies, funds, programmes and bodies of the United Nations, as well as other intergovernmental organizations, non-governmental organizations and relevant stakeholders. “The Decade” offers the ocean community a once in a lifetime opportunity to join efforts, mobilize resources, create innovative partnerships, and engage governments in moving towards the *Ocean We Need for the Future We Want*. Building on the several decades of international cooperation in ocean research and observations, as well as the policy-relevant goals defined by the 2030 Agenda and other ocean frameworks, the Decade aims to catalyze action to achieve high level scientific and technological breakthroughs.

The vision of the UN Decade of Ocean Science is ‘the science we need for the ocean we want’ and the Decade will convene multiple stakeholders to generate, communicate and use ocean science to *develop a range of solutions to support the Sustainable Development Goals of the 2030 Agenda*.

## 2. AIMS AND OBJECTIVES

The regional workshop for Africa and Adjacent Island States was an integral part of the overall planning process for the Decade and offered a crucial opportunity to co-design mission-oriented research strategies and actions in line with the 2030 Agenda and continental and regional initiatives such as the Agenda 2063 and Africa’s 2050 Integrated Maritime Strategy. The outputs of the workshop have been used to inform the development of the Decade Implementation Plan and will underpin the development of regional initiatives and partnerships during Decade implementation.

This workshop gathered ocean leaders, champions and key stakeholders and facilitated regional, interdisciplinary discussions across different sectors and industries to identify concrete deliverables and partnerships to meet the Decade’s six societal outcomes. Discussions were centered on regional needs and priorities in terms of transforming knowledge systems, accelerating transfer of technology, enabling training and education, and fostering science-policy dialogues and thus ensure consideration of these needs in the overall Decade preparation process. Specifically, the Workshop aimed to:

- a. Communicate the purpose and expected results of the Decade to all stakeholders, and generate interest in participating in the Decade.
- b. Brief the participants on proposed arrangements for the Decade, including structure and governance, and solicit feedback.
- c. Engage and consult the ocean community concerning the implementation plan for the Decade, including identifying priorities in research or in capacity development and training.
- d. Discuss priority themes or topics that may be part of the Decade in line with the six identified societal outcomes.
- e. Identify initial opportunities for investment, partnerships, and resource mobilization for the Decade.
- f. Identify ways in which Decade can synergize Africa’s priorities as identified by 2050 AIMS, AU Agenda 2063, Decades of African Seas and Oceans and other regional and continental processes.
- g. Identify ways to ensure Africa’s effective participation in the Decade.



### **3. CONDUCT OF THE WORKSHOP**

The workshop structure comprised plenary sessions discussing cross-cutting issues, and a series of Working Group sessions organized around the six societal outcomes that the Decade aims to fulfil.

The Working Groups addressed both deep disciplinary understanding of ocean processes and solution-oriented research to generate new knowledge needed to achieve a given societal outcome. They mapped existing networks and science initiatives that can contribute, identified major knowledge gaps that are hindering sustainable development, and prioritized research priorities and data requirements. They also delineated a number of potential partnerships with concrete deliverables in terms of ocean sustainability that should be further developed in the framework of the Decade. Aspects related to marine technology and capacity development were also addressed.

The plenary sessions considered cross-cutting issues. In particular, four expert panels were established to look at the following topics: Setting a regional vision for the Decade; Innovative models to mobilise resources and create partnerships; Capacity development and transfer of marine technology; and Communications and ocean literacy.

### **4. OPENING AND KEYNOTE ADDRESSES**

Dr. Medhin Tsehaiu (Country Director for Kenya, UNAIDS) in her welcoming remarks, presented on behalf of Mr Siddharth Chatterjee (United Nations Resident Coordinator in Kenya), emphasized the need of a strategic, pragmatic and joint approach to ensure sustainable use of Ocean resources for people and planet. UN agencies and governments must come together and merge their resources to fight against climate change and the repercussion it has on human lives, planet and the infrastructure. Scientists must also work with the private sector, donors, policy-makers and civil society to promote inclusive human and socio-economic growth, preservation of livelihoods and strengthening of communities' resilience. The energy of the youth should be deliberately utilized to come up with new ways of ensuring sustainability of the ocean economy. Technology is one sure way of attracting young people. She concluded by reaffirming the United Nation's support and its commitment using its "convening" role to mobilize partners and collaboratively working with governments, communities, private sector, and civil society, to deliver the Agenda 2030. The UN in Kenya will continue to support the Government in accelerating its commitment to the Oceans Economy, ensuring that the actions leave no one behind.

The IOC Executive Secretary, Mr. Vladimir Ryabinin (video address) thanked the government of Kenya, in particular the Kenya Marine and Fisheries Research Institute for hosting and providing support for the workshop. He noted that the region already has various frameworks such as the Africa Union's Agenda 2063 and the 2050 AIMS, and the regional seas conventions to guide the development and management of the oceans and coastal zones. The Decade will provide an excellent opportunity to develop the science required for addressing challenges in management of the oceans and exploitation of the blue economy. This will include ocean observations, data management and the development of decision support systems. He acknowledged the support provided by various partners in the region, especially the Western Indian Ocean Marine Science Association (WIOMSA) and the secretariat of the Nairobi Convention (UN Environment Programme).

The Principal Secretary for the State Department of Fisheries, Aquaculture and Blue Economy, Prof. Micheni Ntiba read the opening speech on behalf of Hon. Peter Munya, the Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries. He noted that Kenya recognises the importance of international collaboration in ocean research, as there are many issues that are transboundary in nature. To this end, Kenya has continued to work with partners to strengthen ocean sciences and research in the region. Kenya has offered its oceanographic research vessel,

the RV Mtafiti for regional cruises in the framework of the Second International Indian Ocean Expedition (2015-2020). The regional training centre for the Ocean Teacher Global Academy programme, hosted by the Kenya Marine and Fisheries Research Institute has provided training on a wide range of ocean-related topics to scientists from the region. Kenya has also worked with other organizations such as the UN Environment Programme, the Food and Agriculture Organization and WIOMSA in implementation of key regional projects such as WIOSAP and SAPPHIRE. He reiterated the importance of such collaboration, as they enable the development of the capacity and the ocean-science base necessary for harnessing the Blue Economy potential in the region. He highlighted the following topics that the session should give attention to: (i) African still lags behind in capacities – both human and infrastructure, for ocean science and research. The development of capacities for marine science and technology must, therefore, be an important area of focus of this session, (ii) The development of an African Ocean Observing System contributing to human and economic security, and (iii) Ensuring that the information generated from such a system would enable us to manage our resources better, provide input for improved weather prediction, and mitigate the impacts of ocean related hazards such as cyclones and storm surges on our coastal populations. He concluded by emphasizing the importance that Kenya attaches to the Forum, and informed the participants that he looked forward to receiving the workshop recommendations, and presenting them to relevant meetings such as the Ocean Summit that Kenya will jointly host with Portugal in Lisbon in June 2020.

The opening session was also addressed by the Prof. Mohamed Said (Chair of IOC's Sub Commission for Africa and the Adjacent Island States), Dr. Jacqueline Uku (President of WIOMSA), Mr. Mika Odido (representing the Director of the UNESCO Regional Office for Eastern Africa), Dr. Tim Andrew (representing the secretariat of the Nairobi Convention, UN Environment Programme), and Mr. John Safari Mumba (Chair of the Board of Management of the Kenya Marine and Fisheries Research Institute).

**Keynote Address: Results and recommendations of the Global Sustainable Blue Economy Conference and their relevance to the Decade planning** (*Prof. James Njiru, Director, Kenya Marine and Fisheries Research Institute*)

The Global Sustainable Blue Economy Conference was hosted by Kenya, Japan and Canada in Nairobi, Kenya from 26-28 November 2018, with the theme: *The Blue Economy and the 2030 Agenda for Sustainable Development*. The conference comprised the following events: Leaders Commitment Segment, Nine Signature Thematic Sessions, Science and Research Symposium, Civil Society Forum, Business and Private Sector Forum, Governors and Mayors Convention, Side Events, and a Leaders Circle and Closing Segments.

The purpose of the Leaders Commitment segment was to: Enhance global collaboration, create an enabling environment for investments in order to harness the full potential of the oceans, to create jobs and fight poverty, implement an inclusive approach for development of the Blue Economy, and the promotion of gender equality to ensure participation of women and youth in the Blue Economy.

The Science and research symposium focussed on the generation of knowledge, information, technologies and innovation. The development of the Sustainable Blue Economy requires evidence-based science to inform policy and implementation.

The conference provided an opportunity to galvanize and deepen the collaboration between and among Governments and Stakeholders on the Blue Economy in order to:

- Align the Blue Economy with the societal needs and aspirations.
- Unlock the full potential of the ocean, seas, lakes and rivers to accelerate economic growth, job creation & poverty alleviation.

- Amplify the ongoing efforts aimed at protecting and conserving the environment and aquatic resources for the present and future generations.

In Kenya, the conference has resulted in intensified ocean research, the launch of the Kenya Coast Guard Service, implementation of laws/ conventions to protect the Oceans (Fisheries Management and Development Act, 2016.), and the launch of the Bandari Maritime Academy.

**Keynote Address: Introduction to the UN Decade of Ocean Science for Sustainable Development & overview of the preparation phase 2018 – 2020** (Mika Odido, UNESCO/IOC Coordinator in Africa)

The IOC Secretariat, supported by the IOC Officers, developed the first draft 'Roadmap' document that provided an initial guide for the steps and processes needed to develop an Implementation Plan for the Decade. This was approved by the 51<sup>st</sup> session of the IOC Executive Council, which also established the Executive Planning Group (EPG) to guide the development of the Implementation. The EPG organized the first Global Planning Meeting (Copenhagen, Denmark, 13-15 May 2019) and endorsed a revised version of the Roadmap, including the following six outcomes of the Decade:

- *Outcome 1: A clean ocean where sources of pollution are identified & removed.*
- *Outcome 2: A healthy and resilient ocean where marine ecosystems are mapped and protected.*
- *Outcome 3: A predictable ocean where society has the capacity to understand current and future ocean conditions.*
- *Outcome 4: A safe ocean where people are protected from ocean hazards.*
- *Outcome 5: A sustainably harvested and productive ocean ensuring the provision of food supply and sustainable livelihoods.*
- *Outcome 6: A transparent and accessible ocean with open access to data, information and technologies.*

These are linked to the following four strategic objectives of the Decade:

- *Objective 1: Increase transformative science capacity & capability globally to enable informed decision making and societal engagement to attain the 2030 Agenda.*
- *Objective 2: Expand, innovate and integrate ocean knowledge systems globally, including ocean observing networks, data systems and other infrastructure.*
- *Objective 3: Understand and predict fundamental aspects of the whole ocean system, including the human component, to provide critical knowledge to support sustainable development and nimble responses to ocean related change and hazards across multiple scales.*
- *Objective 4: Secure a healthy, resilient and sustainably used ocean by developing and enabling integrated assessment and decision support systems and other transformational tools and processes.*

The Nairobi workshop is part of the series of about 10 regional workshops organized to get input from a broad range of stakeholders for development of the Implementation Plan. The draft Implementation Plan will be presented to the IOC Governing Bodies in June 2020, before presentation to the United Nations General Assembly in late 2020.

## 5. SETTING THE REGIONAL VISION FOR THE UN DECADE OF OCEAN SCIENCE

*Keynote* Dr. Jared Bosire, secretariat of the Nairobi Convention, UN Environment Programme

*Panelists* Dr. Karim Hilmi, Institute National de recherche Halieutique, Morocco, and IOC Vice Chair Group V

Dr. Rezah Badal, Department of Continental Shelf, Maritime Zones Administration and Exploration, Prime Minister's Office, Mauritius

Dr. Angelique Paponneau, Seychelles' Conservation and Climate Adaptation Trust

Dr. Riaan Cedras, University of Western Cape, South Africa and Chair of Western Indian Ocean Early Career Scientists Network

*Moderator:* Dr. Julius Francis, Western Indian Ocean Marine Science Association

**Objective:** To present a broad vision of ocean science in the region, and incite discussion on why and how the Decade could advance ocean science in the region, particularly in line with key regional strategies such as 2050 AIMS and Agenda 2063.

The importance of coastal and marine resources and environment in Africa is increasing, with the rapidly increasing coastal populations and the establishment and strengthening of ocean-based industries such as fisheries, energy extraction, and tourism. The intense competition for the use of coastal and marine areas and resources by different sectors, industrial and municipal pollution, coastal change and modification, destructive fishing and over-fishing have exacerbated natural degradation of coastal and marine ecosystems resources due to storm surges, droughts, floods and erosion. Only science-based ecosystem management can help to reverse this environmental degradation.

In May 2013, the African Union adopted its “Agenda 2063: The Africa We Want: A Shared Strategic Framework for Inclusive Growth and Sustainable Development”, in order to achieve its vision of “an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena”. The agenda recognises that Africa’s Blue economy shall be a major contributor to continental transformation and growth, advancing knowledge on marine and aquatic biotechnology, the growth of an Africa-wide shipping industry, the development of sea, river and lake transport and fishing, and exploitation of and beneficiation from deep-sea mineral and other resources.”

The African Union has also adopted the **2050 Africa’s Integrated Maritime Strategy (2050 AIMS)** and its Plan of Action, which outlines the actions to foster increased wealth creation from Africa’s oceans and seas by developing a sustainable thriving blue economy and realizing the full potential of sea based activities in an environmentally secure and sustainable manner. The African Union has also retained the 2015-2025 decade as the “Decade of African Seas and Oceans”, and the date of 25 July as the African Day of Seas and Oceans. The relevant issues highlighted by the 2050 AIMS include the development of fisheries and aquaculture; disaster risk management; development of hydrography, oceanography and meteorology; marine spatial planning; environmental and biodiversity monitoring; integrated coastal management; and capacity building and establishment of an Oceans and Seas Research Institute of Africa.

The following were identified as key issues that should be kept in mind during the discussions in the working groups and the panel discussions so as to determine how they could best be addressed during the Decade implementation:

- Ocean research undertaken in the region should inform national developments. To this end, governments should invest in research and form strategic alliances addressing national priorities rather than relying on external partners who might not have the same priorities.



- The existing capacity should be mobilized to analyse available data and use it for management. Regional centres of excellence should be established for each of the Decade outcomes.
- There should be a paradigm change in the organization of oceans sciences, with greater focus on having clear objectives, consolidating efforts to ensure implementation of all conventions, addressing the funding dilemma to assure sustainability, and ensuring the cooperation between agencies at national and regional levels.
- The Decade should catalyse research in the following fields: marine renewable energy and deep ocean water applications; bioprospecting, biotechnology and pharmaceuticals; mariculture and offshore aquaculture; climate change impacts and the oceans-climate nexus; baseline monitoring of essential ocean variables; mapping ecosystems and habitats; and linking the research results to societal applications.
- Africa is a young continent with more than 60% of the population aged below 30 years. The region should harness the demographic dividend by empowering this huge pool of human resource potential. The focus should be on getting them into ocean sciences through focussed ocean literacy programmes, supporting skills development and mentoring to enable them fit in the job market and creating new opportunities for employment. This will facilitate the unlocking of scientific excellence and the creation of the new generation of ocean experts.
- The African realities, facilities and experiences should guide the interventions developed. We should make optimal use of existing capacities to analyse available data and use it to inform development initiatives. New projects should build on the results of previous projects. Effective communication of research results generated in the region, and its application is important.
- There is a disconnect between the political system and the scientists that should be bridged. African experts and governments must believe in themselves. The region has demonstrated its potential and that it can offer ideas, which are picked by other regions (e.g. Mpesa, bluebonds). The region should implement and report on the “Decade of African Oceans and Seas (2015-2025)” that was adopted by the African Union.

## 6. SUMMARY RESULTS OF WORKING GROUP DELIBERATIONS

Below is a summary of the deliberations of the Working Groups on the proposed Decade Outcomes. Detailed reports for each group is available in Annex I

### ***Working Group 1: A clean ocean where sources of pollution are identified & removed***

- Co-convenors:   ▪ Prof. Suzan Kholeif, National Institute of Oceanography and Fisheries, Egypt
- Ms. Gina Bonne, Indian Ocean Commission
- Rapporteur:     ▪ Dr. Eric Okuku, Kenya Marine and Fisheries Research Institute

The regional priorities that were identified under this outcome were **marine litter and microplastics, oil spills and chemical pollution**, and **eutrophication**. Identified scientific and knowledge gaps included the ecosystem and human health impacts of pollutants; understanding of the life cycle of pollutants from source to sink; improved tools to understand the quantities and distribution of pollutants in the ocean, including the use of innovative tools to track pollutants; research and tools related to clean-up approaches including ecologically benign oil spill

dispersants; research on DNA contaminants; research on pathways of pollutants between coastal areas and the deep ocean; and research on the potential recycling of collected pollutants (e.g. oil and plastics). Regional assessments of marine litter and microplastics in the ocean were recommended, as were the development of standardized methods for assessment of marine pollutants, initiatives to promote circular economy approaches to marine litter, and citizen science to contribute to pollutant monitoring.

Capacity development needs in relation to this outcome included improved capacity for the development and implementation of regional pollution action plans; the development and use of innovative technologies for mitigation, recycling or pollution removal; and for data management and sharing. It was recommended that early career ocean professionals should be the target of capacity development efforts. Additional priorities that were discussed included the need for acquisition of infrastructure and equipment for ocean clean-up efforts, including for oil spills, and upgrading of regional research centres and laboratories. Finally, the need for harmonization of legislation and regulation for marine pollution was identified as a regional priority.

The following ideas on future initiatives that could become early actions under the Decade were considered:

- Improve the institutional capacity of Research Centres and laboratories in Africa to strengthen research on marine pollution
- Promote the clean ocean concept into school's curriculum in Africa and raise awareness on marine pollution resulting from shipping activities and land base activities
- Develop capacity for research and innovation to promote a circular economy
- Promote clean-up campaigns of ocean and waterbodies involving youth and private sector
- Develop capacity for integrated of coastal and deep-sea research to better understand the impact of human activities on coastal and marine ecosystems
- Promote regional marine spatial planning in Africa

***Working Group 2: A healthy and resilient ocean where marine ecosystems are mapped and protected.***

Convenor                   ▪ Dr. David Obura (CORDIO East Africa)

Rapporteurs :           ▪ Dr. George Rushingisa, Tanzania Fisheries Research Institute

- Ms Hellen Kizenga, Institute of Marine Science, University of Dar es Salaam, Tanzania

The regional priorities that were identified under this outcome were: **understanding and using knowledge** about what constitutes a healthy and resilient marine environment; **understanding and managing the linkages** between ecosystem services and the people that are highly dependent on them; and developing the breadth of **relevant and adaptive governance approaches** that are needed to ensure healthy and resilient ecosystems. It was concluded that there is a need for an improved understanding of ecosystem health including functions and services, and the development of relevant indicators to measure and monitor ecosystem health. To contribute to this goal, there is a need for research on species diversity and taxonomy, roles in ecosystem resilience, and biodiversity patterns, including modelling. Environmental parameters should be integrated into observed biodiversity patterns to elucidate why those patterns shift and to better inform policies directed at mitigating negative impacts. Expanded programmes on mapping and monitoring critical and vulnerable ecosystems, and baseline studies on marine and coastal ecosystems (including physical, chemical and biological environmental parameters) in a changing environment are also necessary, including research on critical ecosystem vulnerabilities to climate change. There is a need for increased knowledge to demonstrate the benefits of a resilient ocean including in relation to marine disasters. Such knowledge should build on

programmes to quantify and monitor stock/resource abundance and benefits derived from them, and improved information on value of ecosystem services and the dependency of people/economies. There is also a need to better understand and map community influence and dependence on marine ecosystems, especially in relation to vulnerable communities. Increased use of citizen science was identified as one means of generating the needed data to address these priority questions.

In terms of governance, there is a need for policies that recognize the importance of healthy marine ecosystems to improve commitment in achieving a healthy and resilient ocean. To achieve this, there is a need to expand knowledge about and use of different governance options for management, including territorial use rights and co-management, and of traditional knowledge and practices. Research into the influences on compliance with policy and the development of innovative tools to promote good compliance and alignment are required, as is research that identifies how to facilitate better alignment of governance mechanisms within and among countries. There is also a need to better understand the impacts of conflict (internal/trans-boundary) and weak governance on resource use and ecosystem health.

In terms of capacity development needs in relation to this outcome, it was concluded that the WIO region lacks a comprehensive ocean science programme that is developed and implemented through national agencies/partners. There is a need to build capacity and regional/trans-boundary science and policy cooperation, for example for marine spatial planning that is currently highly reliant on external advice and expertise, and for science to policy uptake amongst decision makers. There is a need to establish common methodologies and protocols for monitoring and research, to facilitate cooperation, sharing and management. Opportunities to expand the use of marine technology sharing platforms linking technology resources with varied users should be explored. There is a need to invest in biodiversity science (e.g. taxonomy and systematics research and predictive population dynamics) and to better combine science and local knowledge. The role of social sciences in understanding ecosystem service use and dynamics is central and should be a focus of capacity building and training. Specific needs for capacity development exist in area-based management, including the use of tools to climate proof marine protected areas (MPAs) and locally managed marine areas (LMMAs). Capacity in addressing marine and coastal disputes is also required. Finally, capacity development to increase the coping and adaptive capacities of communities dependent on marine ecosystem services is essential throughout the region.

The following ideas on future initiatives that could become early actions under the Decade were considered:

- To solidify the African agenda in ocean science for development, an “Africa maritime university” could be established as an alliance of existing institutions and programmes, linked to relevant UN bodies (e.g. UNESCO-IOC, World Maritime University, etc.) and as a platform under the Decade? This could build on the initial partnership of programmes/initiatives identified in the preamble?
- Financing for the Decade’s activities in Africa will be critical for success, generated from partnerships as well as novel financing. A special financing vehicle could be established to assure consistency and build a longer legacy from the decade.

***Working Group 3: A predictable ocean where society has the capacity to understand current and future ocean conditions.***

- Co-convenors:
- Dr Juliet Hermes, South African Environmental Observation Network - SAEON, South Africa
  - Dr Sidney Thurston, National Oceanic and Atmospheric Administration - NOAA, USA (and Indian Ocean Observing System)

Rapporteurs:     ■     Dr Riaan Cedras, University of the Western Cape, South Africa

The regional priorities that were identified in relation to this outcome included **data and observations, research and modelling**, and **governance**. There were a large number of gaps identified in relation to data and observations including data accessibility (often related to 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. Data collection and management challenges include limited capacity to collect data, lack of ship time, and lack of methodologies to integrate local and indigenous knowledge. Data policies related to data sharing and use of data repositories to centralize data are required. There is a need to improve the use of data to parameterise and validate models on local to regional scales (including environmental, ecosystem, species and habitat models). It was recommended that model validation campaigns are carried out with *in situ* observational scientists working together with modellers to improve accuracy and precision of model outputs. The lack of baseline data was seen as a major challenge for the region. Specific data needs include river output (including sedimentation), cyclone prediction to inform early warning systems, consistent Harmful Algal Bloom (HAB) monitoring data and data related to ABNJ/BBNJ; for this latter issue it is recommended to look at international programs such as IndOOS and PIRATA, but also many other cruises such as IIOE2 and Nansen work beyond EEZ as examples. In relation to research and modelling requirements, identified priorities include understanding mechanisms to identify required baseline monitoring, increased downscaling of global models, improved modelling from coastal shelf to ABNJ, improved access to coupled ocean/atmosphere models, improved model projections of species, habitats and ecosystems as well as an improved capacity to deal with model complexity. The key research and modelling priorities identified for the region are listed below.

- |   |   |
|---|---|
| ■ Biological modelling                                | ■ Transboundary research/studies  |
| ■ Monsoon   | ■ Climate scenarios   |
| ■ Madden-Julian Oscillation (MJO)                     | ■ Coastal areas climatologies   |
| ■ Indian Ocean Dipole (IOD)                           | ■ Limited Area Models (LAMs)  |
| ■ El Niño and Benguela Niño                           | ■ Ecological Models (species, habitats and ecosystems)                                  |
| ■ North Atlantic Oscillation                          | ■ Key ecosystems of the region  |
| ■ Intertropical Convergence Zone (ITCZ)               | ■ Upwelling regions   |
| ■ Subtropical IOD                                     | ■ Ecosystem shifts, timescales and impacts on the subsistence fishers vs industry       |
| ■ Seychelles Chagos Thermocline Ridge                 | ■ Integrated biodiversity monitoring (including Genetic connectivity/biodiversity loss) |
| ■ Subseasonal to Seasonal Weather Forecasting (S2S)   |   |
| ■ Studies relating to carbon budget and acidification |   |

In terms of capacity development needs in relation to this outcome, there is a need for a full inventory of existing infrastructure and facilities, and deployment of tools to facilitate sharing resources and equipment (e.g. research vessels or high-performance computing capacity). Computer power/data processing time is limited as are programming skills/capacity. There is a need for state-of-the art equipment including new hardware and sensors. Capacity development is required for the development and use of models including finer resolution models/Limited Area Models (LAMs) and downscaling models. Regional capacity development institutions are needed

to provide education, training and capacity building that is adapted to the regional context; for example, downscaling models or advanced research on regional climatologies. There is a need to build network capacity and competency within the region, develop regional platforms and programs, and promote knowledge sharing including sharing of studies, models, publications and research. The development of national and regional ocean research institutes and university campuses is an urgent priority to generate regional knowledge and provide a career path for regional scientists.

A final area of discussion related to the need to transmit data and research in a form that can be used by end-users including governments and policy makers. This requires the construction of an institutional framework to bridge science and policy and facilitate uptake of data and models by decision makers. The need for clear messaging and communication of reliable data to decision makers was identified as important, as was improved communication between policy makers, IOC national focal points and scientists.

The following ideas on future initiatives that could become early actions under the Decade were considered:

Data and observations	<ul style="list-style-type: none"> <li>▪ The entire African shelf region is routinely monitored (EOVs and EBVs) and data is near real time and accessible and the bathymetry is mapped at high resolution. This is complemented by autonomous monitoring (including pH through BGC Argo) being enhanced around Africa</li> <li>▪ There is a consistent provision of ocean data products and services (e.g. ocean apps) for the benefit of society (5-year dream!)</li> <li>▪ Establishment of a regional calibration and instrument centre in which we could develop local instruments (enhancing local industry). This could be a hub for access to ships as well</li> <li>▪ Standardised, interoperable and integrated monitoring programme for biodiversity and related environmental parameters.</li> </ul>
Modelling	<ul style="list-style-type: none"> <li>▪ Each state should have a high-resolution ocean model covering coast to shelf area for operational oceanography</li> <li>▪ Establishment of a network of African operational oceanographers and hydrographers (ocean scientists) and better networking between North and South Indian Ocean</li> <li>▪ Establishment of standardized capacities for predictive species occurrence monitoring and population/ecosystem dynamics modelling</li> </ul>
Governance	<ul style="list-style-type: none"> <li>▪ Establishment of a pan African ocean sciences institute and an African marine science research program (continue and expand on from IIOE2, but also make it more African-owned)</li> <li>▪ Ocean job creation (both technical and scientific) is enhanced significantly</li> <li>▪ Under each ocean decade theme there is a minimum of 10 African experts working in the field and that these people continue developing capacity over the next 15 years</li> <li>▪ A complete and accessible inventory of institutes, jobs, ships, models and capacity in the region</li> <li>▪ Strengthen existing regional programs – GMES, GOOSAFRICA, IOCAFRICA</li> </ul>



#### ***Working Group 4: A safe ocean where people are protected from ocean hazards.***

- Co-convenors
- Dr. Gilbert Siko, Department of Science and Technology, South Africa
  - Dr. James Kairo, Kenya Marine and Fisheries Research Institute, Kenya
- Rapporteur:
- Mr. Mthuthuzeli Gulekana, Department of Environmental Affairs, South Africa

The regional priorities identified in relation to this outcome were **improved ocean management systems, measures to reduce physical alteration and destruction of habitat**, and **improved maritime security**. Key science and knowledge gaps include: the need for modelling of extreme events and their impacts for coastal zone management; the establishment of baseline assessments for biological, chemical and geophysical parameters to inform ocean management; research on the effects of natural barriers to mitigate natural extreme events, including the use of indigenous knowledge; research on coastal vulnerability and community perceptions of risk together with mapping and identification of highly vulnerable areas; and improved understanding of influences driving illegal maritime activities that affect security.

Capacity development needs include training on methodologies for effective research in marine technology, capacity building on the development and deployment of early warning systems, diffusion of standardised methodologies for baseline assessments (e.g. in risk or vulnerability assessments), improved use of surveillance and intelligence technology in Ocean Maritime Domain Awareness, and effective access to and sharing of data. Finally, there is a recognised need to improve the transmission and use of data related to ocean safety by decision and policy makers.

The following were proposed as ideas that could be developed as early actions under the Decade:

- Establish an African institute to train on Maritime Domain Awareness within the AU
- Establish Ocean technology hubs for constant innovations towards realization of safe oceans
- Mapping conditions/trends of critical habitat & Restoration of degraded critical coastal/marine ecosystems
- Extension of the ODINAFRICA Project (([www.odinafrica.net](http://www.odinafrica.net)))
- Establishment of ocean technology hubs/labs/centres of excellence
- Marine Spatial Planning and ocean policy enforcement

#### ***Working Group 5: A sustainably harvested and productive ocean ensuring the provision of food supply and sustainable livelihoods***

- Co-convenors:
- Dr. Kwame Koranteng, Fisheries Commission Board, Ghana
  - Prof. James Njiru, Kenya Marine and Fisheries Research Institute, Kenya
- Rapporteurs:
- Dr Georges Degbe, Institut de Recherches Halieutiques et Océanologiques du Bénin
  - Dr Edward Senkondo, Tanzania Fisheries Research Institute, Tanzania

The regional priorities identified in relation to this outcome included **unsustainable exploitation of resources, climate variability and change** and effects on marine ecosystems, **ineffective governance**, and **anthropogenic impacts on marine ecosystems**. In relation to the unsustainable exploitation of resources, key knowledge gaps include reliable fish catch and effort data collection, regular stock assessments, improved understanding of fishing techniques and technologies needed for sustainable exploitation of marine resources, innovative strategies for alternative livelihoods, mapping of marine and coastal ecosystem (e.g. for MPAs), and information on the nature and extent of IUU fishing both in the EEZ and the high-seas and ABNJ. Key capacity development and technology needs include capacity to carry out stock and catch assessment surveys, development of fishery stock assessment platforms, capacity to harness traditional knowledge and practices and to promote alternative livelihoods options, and training and technology on marine spatial planning.

In relation to climate variability and change, key knowledge gaps include information on the health and vulnerability of habitats, including changes over time; knowledge of adaptive capacity of local communities to effects of climate change; and research into effective climate change mitigation measures. The key capacity development need relates to skills for climate risk modelling to inform the development and operation of early warning systems.

In relation to governance, key knowledge gaps relate to limited maritime security studies including the impacts of piracy, studies on environmental and social impacts of IUU, zonal attachment/migratory studies of shared fish stocks, knowledge of the most effective tools for management planning and ecosystem based management, and tools for integration of indigenous and local knowledge into management processes. Key capacity development and technology needs include vessel monitoring systems and tracking; access to clean energy sources for fishing vessels particularly for artisanal fisheries; capacity for implementation of MSP at policy and technical levels; capacity to develop and deploy regional Fisheries Observer Programs; improved access to patrol vessels; and capacity to develop and adopt management approaches based on territorial user rights for fisheries (TURF).

In relation to anthropogenic impacts on marine ecosystems, knowledge gaps include identification and description of the anthropogenic impacts on marine and coastal ecosystems (e.g. from mineral exploitation, construction of container terminals and harbours), assessment of anthropogenic impacts on fisheries resources, and improvement of scientific knowledge on marine ecosystem functioning, including deep-sea ecosystems. Key capacity development needs include skills in anthropogenic impact assessments related to marine resources, technology and infrastructure for monitoring of marine and coastal ecosystems, and capacity for research on marine plastics and other marine debris including seaweed.

The following possible future initiatives were proposed:

Key issues	Future projects
1) Unsustainable exploitation of resources	<ul style="list-style-type: none"> <li>• Support for fisheries and oceanographic research vessels to carry out regional fish stock assessment surveys</li> <li>• Aquaculture and mariculture projects</li> <li>• Assessment of marine ecosystem services</li> </ul>
2) Ecosystem/ Biodiversity/ Climate change considerations	<ul style="list-style-type: none"> <li>• Regional climate change adaptation projects</li> <li>• Regional biodiversity and ecosystem management projects</li> <li>• Establishing and supporting networks of marine protected area</li> </ul>

3) MCS, IUU and Management, Conflict on resources use, Governance	<ul style="list-style-type: none"> <li>• Eco regional approach to marine spatial planning development project.</li> <li>• Transboundary conservation areas (peace parks)</li> <li>• Regional approach to ocean governance training (capacity and infrastructural development, VMS and tracking, etc.)</li> <li>• Regional MCS Projects</li> </ul>
4) Maritime Boundary delimitation	<ul style="list-style-type: none"> <li>• Develop and support projects on capacity building on negotiations for maritime boundary delimitation</li> <li>• Establish networks with scientists and arbitrating bodies for boundary delimitation such as ITLOS, ICJ e.tc</li> </ul>
5) Support for capacity building and effective participation in conferences on UN Decade of Oceans	<ul style="list-style-type: none"> <li>• Establishment and support of national bureaus on UN Decade of Oceans to support national projects - through lobbying and funding mobilization</li> <li>• Establish Trust fund for UN Decade of Oceans to support capacity building and effective participation for African countries in UN Decade of Oceans initiatives</li> </ul>

***Working Group 6: A transparent and accessible ocean with open access to data, information and technologies.***

- Co-convenors
- Narnia Bohler-Muller, Human Sciences Research Council, South Africa
  - Harrison Ong'anda, Kenya Marine and Fisheries Research Institute, Kenya
- Rapporteur:
- James Mbugua- CORDIO-East Africa

The regional priorities identified in relation to this outcome include the need for an improved **focus on user driven data**; challenges in **data sharing** related to a lack of common platforms, or incompatible metadata and data formats; lack of **standardized policies** in relation to open access data; technical **capacity and resource limitations**; and **lack of trust** between organisations to share data. Key science or knowledge needs include methods for standardized data collection, curation, storage and dissemination. An inventory of existing repositories and platforms should be carried out along with analyses of existing metadata formats/language and fitness of use. There is a need for efforts in data rescue, salvage and digitization to fully optimize the use of existing datasets. Standardised rules for Clearing House Mechanisms and policy alignment on data sharing and open access policies is required. Further technological development for increased data sharing and increased accessibility is also required.

Countries should address the lack of long-term continuous time series of data required for studies such as on climate change or ecosystem degradation. National Oceanographic Data and Information Centres should be established or strengthened to manage the data.

Capacity development priorities include increased skills in data management, collection, curation, analysis and digitization. Increased awareness is required to data publishing platforms and tools including knowledge on data centres and repositories. Documentation of standard methodologies and best practices would contribute to capacity development. Capacity development for technical staff is required including skills in data gap analysis. Investment in open source software and peer-to-peer exchanges for skills transfer were recommended as priority considerations.

The following were proposed as possible early actions under the Decade:

- Need to design curricular and research programmes on ocean policy agenda in order to analyse rationale/objectives, identify gaps/priorities, align teaching/research/outreach activities capable to impact on policy
- An African node of Ocean Data Information System should be considered
- Create a system where stakeholders can provide, discover and use different products and services
- Create a platform for dialogue on issues such as Open Access

## 7. REPORT OF PANEL DISCUSSIONS ON CROSS-CUTTING ISSUES.

### ***Panel 2: Innovative models to mobilise resources and create partnerships***

*Keynote Dr. Angelique Paponneau, Seychelles' Conservation and Climate Adaptation Trust*

*Panelists Dr. Paul Mboya Tuda, Leibniz Centre for Tropical Marine Research (ZMT)*

*Dr. Julius Francis, Western Indian Ocean Marine Science Association*

*Mr. Ibukun Adewumi, World Ocean Council*

*Moderator Ms. Alison Clausen, IOC Secretariat*

**Objective:** To present innovative resource mobilization mechanisms and partnerships operating in the region and incite discussion on their potential for replication or scaling up to support Decade outcomes.

The implementation of programmes in ocean sciences in the region is frequently hampered by limitation of resources. Many governments have to balance the provision of funding for ocean science and research against competing needs from equally deserving sectors such as health, food and education. Innovative resource mobilization mechanisms and partnerships are therefore important for funding ocean science and research. Two examples of funding mechanisms were presented to set the stage for the discussions:

- The Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) has benefited from a debt swap and a Blue Bond. The government of Seychelles, with support from The Nature Conservancy (TNC) negotiated a restructuring of its debt obligation with the Paris Club of creditors on more favorable terms in exchange for increased investment in ocean conservation. SeyCCAT received USD 21.6m from The Nature Conservancy, comprising of a USD 5m grant and USD 15.2m in loan capital. SeyCCAT lends USD 20.2m to the Government of Seychelles in order to purchase USD 21.6m of sovereign debt from its creditors at a USD 1.4m discount to face value. SeyCCAT has set up a Blue Grants Fund and a Blue Endowment Fund to manage these resources. SeyCCAT also manages part of the USD 15m Blue Bond that was launched in 2019 between the Seychelles Government and World Bank, to finance the fisheries recovery of the Mahe plateau.
- The activities of the German Federal Ministry for Economic Cooperation and Development (BMZ) are guided by the “BMZ Ten-Point Plan of Action for Marine Conservation and Sustainable Development” covering the thematic fields of: Conservation of marine biodiversity, Sustainable fisheries, Marine pollution and Climate change adaptation. One of the initiatives established by BMZ is the “MeerWissen - German-African Partners for Ocean Knowledge”, which was launched to strengthen marine research and build bridges between marine research and decision-making processes in Africa and thereby contribute to a better and more effective conservation and management of our ocean. The centrepiece of the MeerWissen initiative is a funding programme for partnership projects of African and German marine research institutions.

These projects are developed together and reflect actual needs in the region to ensure results are usable for decision-makers. Selected projects are supported for 2 years with 240.000€ each. MeerWissen works closely with existing institutions and networks that work at the science-policy interface. In the case of the Western Indian Ocean there is a close collaboration with WIOMSA, to ensure that MeerWissen products and results are fed into regional processes and to work together in enhancing the science-to-policy dialogue.

Ocean research in the region is mainly undertaken by government research institutions, universities, NGO's and consultancy firms. National funding sources include governments, national research councils and foundations. Foreign sources include development cooperation agencies (Sida, IDRC, DFID, NORAD, JICA ....), multilateral organizations (GEF, World Bank, ..), foundations/trusts, private sector and high-net-worth individuals. Some countries in the region have already adopted carbon trading as a source of funding.

Ocean research in the region should be strengthened through stronger integration of sciences, greater investment in ocean observing systems and improved science-policy interface. New partnerships should be developed, supported by a new ocean-climate finance, and improved ocean literacy and education to modify social norms and behaviour.

Financial partners looking to support ocean and marine research in Africa should consider the investing in:

- long term, multi-country initiatives
- solution-based initiatives, aiming at improving public and private decision-making/deliver economic benefits
- national/regional granting councils to increase their capabilities to plan science better, disburse research funds fairly and equitably and monitoring the value and impact of scientific research
- research chairs and centres of excellence to create sustainable research performing units
- doctoral programmes and training to build and expand the future generation of scientists and academics
- training of technical staff
- Young scientists as a powerful resource for change and sustainable development.

The establishment of university-based ocean innovation incubator hubs, supported by the private sector, can serve as a conduit to transform research results to action via technological development that is adapted to regional and local contexts and led by African researchers.

### ***Panel 3: Capacity development and transfer of marine technology***

*Keynote Dr. Jacqueline Uku, Western Indian Ocean Marine Science Association*

*Panelists Prof. Joseph Rasowo, Technical University of Mombasa, Kenya*

*Dr. Margaret Kyewalyanga, Institute of Marine Science, University of Dar es Salaam, Tanzania*

*Mr. Jaco Stemmet, FUGRO, South Africa*

*Mr. Mthuthuzeli Gulekana, Department of Environmental Affairs, South Africa*

*Moderator Dr. Tim Andrew, Nairobi Convention Secretariat, UN Environment Programme*



**Objective:** To build on the discussions in the working groups and incite discussion on the key capacity building needs that will allow Africa to participate fully in the Decade.

The focus of the discussions was on the key capacity building needs that will allow Africa to participate fully in the Decade, and in particular how to ensure that future capacity development actions in Africa result in sustainable and real benefits for ocean science and for African scientists.

The Western Indian Ocean Marine Science Association (WIOMSA) shared their experiences in Capacity Development for marine sciences. WIOMSA was established as a regional professional, non-profit, membership organization, in 1993, with a view toward sustaining the use and conservation of its marine resources. WIOMSA works through its programmes to provide tools/mechanisms to assist scientists to cope and adapt to changing circumstances and to enable them to play a leading role in policy and decision-making processes. WIOMSA plays a key role in linking the knowledge that emerges from research to the management and governance issues that affect marine and coastal ecosystems in the region.

WIOMSA has implemented a range of capacity development initiatives including the Marine and Coastal Science for Management (MASMA) programme to provide funding and technical support for coastal and marine research, training and communications, and the Marine Research Grants (MARG) to provide opportunities for emerging research scientists and students to undertake research activities or participate in workshops and conference. The WIOMSA Symposium is the largest regional scientific event and brings together marine scientists, resource managers, policymakers and the business community to discuss issues of regional importance. WIOMSA has also established the Women in Marine Science Network (WIMS) and the WIO Early Career Scientists Network (WIO-ECSN). Communication and dissemination of information is another area of focus for WIOMSA, which regularly publishes the Western Indian Ocean Journal of Marine Science and the WIOMSA Magazine. In the period 2015-2018 a total of 387 peer-reviewed publications were produced by the MARG and MASMA grantees and 5 leading topics are coral reefs, fisheries, conservation, genetics and climate change.

The following priority areas were identified during the discussions:

- Importance of national funding to ocean research and capacity development to ensure that these are sustained and address national priorities, reaping long term benefits for the countries. This funding should also be sourced from private sector.
- Establishment of a visiting scholar/exchange programme to enable countries at different levels of development and different skill sets to share expertise and experiences. Development of scholarship and mentorship programmes, targeting Early Career Scientists.
- Improving the quality and quantity of research outputs. Scientists and institutions should think beyond producing publications to transforming lives through innovation and robust application of our science. They should be able to demonstrate that the research results have been applied and impacted on the society.
- Assessment of the current status of capacity in the region required. This will involve mapping of institutions (including facilities such as vessels, laboratories, observation platforms and other equipment), and inventory of experts (specialization, qualification, gender and age).
- Identification of the major clients of capacity development and how their requirements can be addressed.
- The importance of keeping scientists doing good science was stressed with the recommendation to support senior scientists that move to administrative work to continue to maintain their labs and to train and mentor young scientists

- Platform should be developed to facilitate the sharing of infrastructure and optimizing their use.
- Dissemination and use of locally developed technology and tools.
- Establishment of state-of-the-art regional research facilities. Research and academic institutions need to have robust strategies that can be supported by regional and international organizations.
- There is need to focus on the young and emerging scientists through robust mentorship programmes.
- WIOMSA's experience demonstrates that there is need to mobilize the scientific community through capacity building, partnerships and research support and link this to policy and should be replicated across Africa.

#### ***Panel 4: Communications and ocean literacy***

*Keynote: Dr David Obura, CORDIO East Africa*

*Panellists Mr. Wanjohi Kabukuru, The Indian Ocean Observatory*

*Ms. Moina Spooner, The Conservation Africa*

*Ms. Leila Ben Hassen, Blue Jay Communication Ltd*

*Moderator Dr. Nina Wambiji, Kenya Marine and Fisheries Research Institute, Kenya*

**Objective:** To incite discussion on the most appropriate forms of communicating about the Decade and ways of improving ocean literacy in Africa.

Improved ocean literacy and better communication will be important to get the support of the population and the leaders in addressing ocean related issues. The focus should be on bridging the science to policy and the science to public gaps.

Though the countries of the region have invested significantly in ocean sciences, the first edition of the Global Ocean Science Report (2015) demonstrated that there are relatively, much fewer ocean science publications coming from Africa compared to other regions. We need to empower scientists with skills and tools to enable them to analyse and interpret the large amounts of data sets available in the region, so that the information generated can be published and inform management and the harnessing of the ocean and coastal environment and resources for development.

The synthesis of information available from various sources to provide policy options is another area that needs to be addressed. This should in particular focus on priority issues such as fisheries, water quality, climate change, habitat destruction and extreme events.

Communication to the public should especially focus on the youth as more than 60% of the continent's population is below 30 years old. Information should be provided to enable them to understand the ocean and its processes, the wonders of the ocean and the challenges it faces, and ocean related opportunities (including for jobs and employment). The communications should use the language they understand and on the platforms that they access/frequent such as twitter, Instagram, Facebook etc.

The African Day of Oceans and Seas (25 July) and the Decade of African Oceans and Seas (2015-2025) declared by the African Union should be used effectively to communicate the issues and concerns of the region.

## 8. COLLABORATION WITH IOCINDIO

The Regional Planning Workshop for the Northern/Central Indian Ocean countries as well as ROPME Sea Area towards the UN Decade of Ocean Science for Sustainable Development (2021-2030) was hosted by the National Institute of Ocean Technology (NIOT), at the NIOT Campus, Chennai, India from 8-10 January 2020.

The conference working groups came up with the following recommendations:

### WG I: CLEAN OCEANS

- Collecting litter before it enters the marine system, and recycling of plastic waste.
- Awareness on usefulness of change in the public perceptions towards plastic use.
- Developing and implementing a proper plan for disposal of the marine litter collected during the beach clean-up operations.

### WG II: HEALTHY AND RESILIENT OCEAN

- To identify the boundary between healthy and unhealthy ecosystems and the drivers affecting the ecosystem's health and environment including invasive species and biofouling and the restoration steps needed to improve the health and resilience of oceans.
- Involve local communities in resource conservation, use of local knowledge for protection and conservation of resources and promoting ecosystem value services.

### WG III: A PREDICTED OCEAN

- Establish a data hub for mid-eastern region under IOCINDIO platform.
- An ocean prediction science team to be formed and a regional forum established to address all the issues related to a predicted ocean.

### WG IV: SAFE OCEANS

- Mitigation or elimination of risk by developing proper models for risk assessment for operations at sea and a comprehensive coastal vulnerability assessment.
- Efforts are needed to minimize or eliminate false alarms about a possible extreme event.

### WG V – A SUSTAINABLY HARVESTED AND PRODUCTIVE OCEAN

- The major recommendation was to develop a working concept that brings together the modes and means to enhance economic benefits and coastal livelihoods by sustainably harnessing the marine resources through capture fisheries and through responsible mariculture. Further, the goals are also to provide guidelines to be able to address specific ocean management challenges and advance goals for economic development and conservation.

### WG VI. A TRANSPARENT AND ACCESSIBLE OCEAN

- The major recommendations were that data and information goals should be user-driven and the ocean science community needs an accessible data system/portal to deliver data and info and they should be coupled with an internationally developed and recognized data policy.

The following potential areas of collaboration between IOCAFRICA and IOCINDIO were identified:

- (i) Training on data collection, analysis, and interpretation (including capacity building in programs and software to analyse different oceanographic data and other related issues
- (ii) Creation of a platform for data sharing, adaptation of technologies, facilities and infrastructure with Africa
- (iii) Joint oceanographic cruises
- (iv) Coastal vulnerability studies

## 9. CONCLUSIONS AND KEY MESSAGES

The workshop emphasized the need to strengthen and build upon existing mechanisms and frameworks, and align with the African Unions initiatives. This includes the Agenda 2063, which recognized the Blue Economy as a major contributor to continental transformation and growth, and the 2050 African Integrated Marine Strategic Plan of Action (2050AIMS), which provides a roadmap for increased wealth creation from Africa's oceans and seas by developing a sustainable thriving blue economy.

Capacity development was identified as a priority, in particular the improvement of infrastructure and facilities for research, provision of training for scientific and technical staff, as well as translation of science to policy. Other issues highlighted include the role of youth and job creation, marine spatial planning, climate change impacts on the coastal zones, land-sea interactions and pollution, and innovative financing models for the ocean economy.

The following are some of the key messages from the workshop:

- (i) Solutions need to originate from Africa, building on existing projects and programs, mechanisms, frameworks and strategies and aligning with African Union initiatives. The various African Commissions and Conventions already in place need to be harnessed to ensure smooth coordination and uptake of Decade-related activities, especially at a regional level.
- (ii) Blue economy is a major priority for the region – but how can we better define what it means for governments, communities and scientists? What are the major data and knowledge needs for a true blue economy? How can we move past the concept and get to the practical application of blue economy?
- (iii) Youth are the future, hence the need for sustained and continued investment in the next generation. Youth need to be encouraged to want to engage in ocean science. Jobs need to be created and practical obstacles need to be overcome.
- (iv) There are examples of innovative financing models that exist or that could be developed. We need to engage with a range of different actors – traditional donors, private sector, banks and others – to make these innovative financing models a reality. We need to send a unified message to donors about the type of support we need, and especially for the different regions of Africa.
- (v) There is capacity in the region but it is unevenly spread between countries and between types of institutions and actors. Capacity development should be structured and inclusive and there needs to be monitoring and follow-up. Opportunities for south to south capacity development should be explored. Accreditation of qualifications will facilitate mobility.
- (vi) Poor governance and policy are constraints to effective management of marine resources. The 'science' of governance and policy has been neglected. To ensure that the science is used for action, the science-to-policy-to-practice nexus needs to be fostered through strengthening existing science to policy mechanisms (e.g. Science to Policy Platform of the Nairobi Convention).
- (vii) Ocean literacy and communications should be a priority and targeted strategies will be needed for different groups. We need to encourage all people to care about the ocean.
- (viii) Data is a sensitive issue. "Fly in fly out" research is not acceptable and better systems for curating and managing African data in Africa need to be developed while still maintaining connectivity to the global data landscape.
- (ix) Modelling was identified as an important tool for prediction and forecasting of the behaviour of ecosystems, in support of management and policy decisions.

The recommendations of this workshop will be incorporated into the Implementation Plan for the Decade which will be presented to the UN General Assembly towards the end of 2020.

## ANNEX I WORKING GROUP REPORTS

### ▪ WORKING GROUP 1: A CLEAN OCEAN

Key regional issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology needs that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solutions in the region and to allow full participation in the preparation and implementation phase of the Decade.
Marine litter and microplastics	<ul style="list-style-type: none"> <li>• More in depth research on impacts/ risks on ecosystem and human health</li> <li>• Tracking of marine litter from source to the sink               <ul style="list-style-type: none"> <li>• Study of the life cycle of marine litter</li> <li>• Complete series of data and information on sources and quantities in the ocean</li> <li>• Promotion of marine litter circular economy</li> <li>• Regional assessments and monitoring of marine litter and microplastics in the ocean</li> <li>• Promote citizen science</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Build capacity to develop and implement regional action plans</li> <li>• Build capacity and transfer knowledge on data and Information management and sharing</li> <li>• Support acquisition of innovative infrastructure and equipment for ocean clean up in Africa</li> <li>• Put in place and upgrade regional laboratory facilities and centers in Africa</li> <li>• Enhance capacity and shared technologies (recycling, alternative products etc) in Africa</li> <li>• Enhance human capacity in Africa and support young scientists               <ul style="list-style-type: none"> <li>• Harmonisation of legislations and regulations of marine pollution</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Promote Partnership between scientific institutions and industry.</li> <li>• Promote cooperation between regional scientific association, NGOs (e.g. WIOMSA and SCOR)</li> <li>• Capitalize on existing partnerships with regional economic communities and regional organisations (e.g.; SADC, COMESA, IGAD, ECOWAS, COI etc...</li> <li>• Capitalize on existing partnerships with UN agencies</li> <li>• Promote collaboration with international and regional conventions e.g. Nairobi Convention, Paris convention and IMO conventions</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of national policies</li> <li>• Introduce penalties for plastic waste</li> <li>• Work with producers/packaging companies</li> <li>• Promote ocean literacy in Africa</li> </ul>
Oil spills/ chemicals	<ul style="list-style-type: none"> <li>• Data and knowledge management</li> </ul>	<ul style="list-style-type: none"> <li>• Database for research on oil spill mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Insurance against oil spill accidents</li> </ul>



	<ul style="list-style-type: none"> <li>• Regional assessments and Monitoring</li> <li>• In depth research on impacts on ecosystem and human health</li> <li>• Safety procedures to prevent and combat oil spills</li> <li>• Promote research on recycling of recouped spilt oil</li> <li>• Develop innovative tools for tracking of marine pollutants (e.g. Satellite)</li> <li>• Promote DNA research on contaminants</li> <li>• Standardization of methods for assessment of marine pollutants</li> <li>• Encourage research on environmentally friendly oil spill dispersants</li> <li>• Promote science policies interactions</li> </ul>	<ul style="list-style-type: none"> <li>• Acquisition of oil spill equipment</li> <li>• Enhance mitigation measures in oil spill in Africa</li> <li>• Harmonisation of legislations and regulations on oil spills</li> <li>• Enhance capacity on shared technologies in Africa</li> <li>• Enhance human capacity in Africa</li> </ul>		<ul style="list-style-type: none"> <li>• enforcement of governance system for oil waste management</li> <li>• Promote green ports, eco-friendly infrastructures and industry</li> <li>•</li> </ul>
Eutrophication	<ul style="list-style-type: none"> <li>• Apply intra disciplinary ocean research to make integration between coastal and deep sea environment</li> <li>• Data and knowledge management</li> <li>• Regional assessments and Monitoring</li> <li>• In depth research on impacts on ecosystem</li> <li>• Standardization of methods for assessment of marine pollutants</li> <li>• Promote science policies interactions</li> </ul>	<ul style="list-style-type: none"> <li>• Database equipment</li> <li>• Mitigation mechanisms</li> <li>• Harmonisation of legislations and regulations on marine pollutants</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Clear policies on waste disposal</li> <li>• enforcement of land use plan</li> </ul>

▪ **WORKING GROUP 2: 'A HEALTHY & RESILIENT OCEAN'**

Key Regional Issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology needs that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solutions in the region and to allow full participation in the preparation and implementation phase of the Decade.
<b>1) Understanding and using knowledge about what constitutes a healthy and resilient marine ecosystem</b> <i>(Mapping and continuous monitoring of marine ecosystems in a changing environment)</i>	<p>Expand use of citizen and user-oriented (e.g. tourism operators, fishers) data collection</p> <p>Research on critical ecosystem vulnerabilities to climate change.</p> <p>Expanded programmes on mapping and monitoring critical &amp; vulnerable ecosystems, and baseline studies on marine and coastal ecosystems (on physical, chemical and biological environmental parameters) in a changing environment.</p> <p>Need for clear understanding of healthy marine ecosystems, functions and services, and development of relevant indicators</p> <p>Research on species diversity and taxonomy, roles in ecosystem resilience, and biodiversity patterns, including modelling.</p>	<p>The WIO region lacks a comprehensive open ocean science programme, developed and implemented through national agencies/partners – e.g. through new deep seafloor mapping technologies, etc.</p> <p>Establish common methodologies and protocols for monitoring and research, to facilitate cooperation, sharing and management.</p> <p>Improved capacity in marine area management needed (MPA, LMMA, etc.).</p> <p>Expanded use of marine technology sharing platforms (e.g. SAIAB) linking technology resources with varied users, including capacity building, data sharing, etc.</p> <p>Investment on biodiversity science and researchers (taxonomy, systematics, etc.)</p>	<p>Regional programmes and exchanges are already strong, but need more balanced participation of non-governmental participants for sustainability, training, etc.</p> <p>Should build on, project-based research and monitoring to develop programs institutionalized for sustainability.</p> <p>Build marine ecosystem health/management into regional climate change approaches (see governance)</p>	<p>Importance of monitoring and management related to land-based impacts to limit pollution and other threats undermining marine ecosystem health and resilience (Outcome 1 – Clean Ocean).</p> <p>For supporting open ocean research agenda, could link to Africa caucus in BBNJ negotiations, to identify science-policy needs.</p>

Key issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology need that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solution in the region and to allow full participation in the preparation and implantation phase of the decade
<b>2) Understanding and managing the linkages between ecosystem services and people that are highly dependent on them</b>	<p>Production of evidence demonstrating benefits of resilient ocean (as opposed to one with compromised health), incl. in relation to marine disasters</p> <p>Programmes to quantify &amp; monitor stock/resource abundance and benefits derived from them</p> <p>Need for studies and mapping of community influence, dependence and alternative livelihoods of vulnerable communities that are highly dependent on marine ecosystems.</p> <p>Improved information on value of ecosystem services and dependency of people/economies.</p>	<p>Capacity building to increase the coping/adaptive capacities in communities dependent on marine ecosystem services.</p> <p>Combine science and local knowledge, and inclusivity of stakeholders, to improve management of the marine ecosystems and services (LMMAs, TURFs, etc.).</p> <p>The role of social sciences in understanding ecosystem service use and dynamics is central, and requires focus for capacity building and training.</p>	<p>Sub-regional fisheries commissions, they need to be harmonized and strengthened, with a focus around resilient oceans.</p> <p>Partnership with cities/private sector to be built up to manage use of resources and impacts, including on setting targets to minimize impacts</p> <p>Build on existing projects, tools/outputs – e.g. Senegal MPA/fisheries project (FAO CCLME) that produced indicators and tools –</p>	<p>Importance of direct links to management of resource use and production aspects (Outcome 5 – sustainable use))</p> <p>Use the SDG framework to look at the importance of SDG 14 on implementation of the others.</p> <p>Build alternative livelihoods and opportunities for societal sustainability, in case of insecure ecosystem services.</p>

<p><b>3) Developing the breadth of governance approaches relevant and needed to ensure healthy and resilient marine systems</b></p>	<p>Need for policies that recognize the importance of healthy marine ecosystems to improve commitment in achieving health and resilient ocean</p> <p>Expand knowledge about and use of different governance options for management, including territorial use rights and co-management, and of traditional knowledge and practices.</p> <p>Support research and development of innovative tools to promote good compliance – e.g. incentives, taxes, fiscal tools, etc. – and alignment among count</p> <p>Support research that identifies how to facilitate alignment of governance mechanisms – within and among countries.</p> <p>Understanding the impacts of conflict (internal/trans-boundary) or weak governance on resource use and ecosystem health dimensions.</p>	<p>Invest in climate proofing of MPAs (and other management tools), including information generation and capacity building in governance sectors.</p> <p>Strengthen core capacities for managing for resilience and sustainability – enforcement, etc.</p> <p>Strengthen science and policy programmes at national levels</p> <p>Build capacity and regional/trans-boundary science and policy cooperation, to develop MSP along common paths among countries. This can include identifying and meeting common information needs. Is there an African path for MSP, rather than just following external advice?</p> <p>Build capacity in addressing marine and coastal disputes (dispute resolution)</p>	<p>Strengthen partnerships around synergies in ecosystem resilience – e.g. co-management at local levels, blue carbon for finance, etc. Harmonize approaches.</p> <p>Existing conventions and legal instruments should be strengthened – including signing, ratifying, aligning legalities national regulations, partnership agreements, etc.</p> <p>Build on Blue Economy movements so that healthy/resilient ecosystems are a core thread for improved governance</p> <p>Build regional partnerships around extended continental shelf applications to strengthen joint management (examples – Seychelles/Mauritius, Nigeria/São Tomé Príncipe ...)</p> <p>Strengthen participation in regional fishery agreements/policies to protect (large) marine ecosystem resilience.</p> <p>Building on the ocean health index and ocean health hubs, and their application in national and other contexts for informing ocean resources and ecosystem management.</p>	<p>Invest in mainstreaming of marine ecosystems in global partnerships around carbon/climate change, the development agenda, etc.</p> <p>Identify needs for improved ecosystem management regulations and law enforcement, in particular to MPAs.</p> <p>Strengthen/harmonize existing management regimes and application in different contexts, and their interactions (Ramsar, MPA, World Heritage, biosphere reserves, etc.)</p> <p>Invest in ABNJ/BBNJ discussions to close gaps in science and policy applied by regional/African countries.</p> <p>Harmonize policies across scales – local/sub-national/national/regional</p>
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▪ **WORKING GROUP 3 – A PREDICTABLE OCEAN**

Key Regional Issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology needs that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solutions in the region & to allow full participation in the preparation & implementation phase of the Decade.
<b>1 Data &amp; Observations</b> <ul style="list-style-type: none"> <li>- Accessibility of data</li> <li>- Quality of data (plus metadata)</li> <li>- Nature of data (physical, biological, chemical etc...)</li> <li>- Ownership of data</li> <li>- Data collection and management</li> <li>- Capacity to collect data</li> <li>- Integration of data sources</li> <li>- Data policy</li> <li>- Data sharing/Data repository</li> <li>- Data sustainability</li> <li>- Data collection initiatives</li> <li>- Best Practices and methodologies</li> <li>- Access to an understanding of earth observation data</li> <li>- Access to industry data</li> </ul>	<ul style="list-style-type: none"> <li>- Observing parameters</li> <li>- Ship Time</li> <li>- Indigenous information</li> <li>- Trained personnel</li> <li>- Software/programs</li> <li>- Centralization of data</li> <li>- Structure responsible for coordinating data acquisition</li> <li>- Data for model validation – need model validation campaigns with <i>in situ</i> observationists working together with modelers</li> <li>- <b>Baseline monitoring</b></li> <li>- River output (including sediment)</li> <li>- Cyclone prediction and early warning</li> <li>- Consistent HAB monitoring</li> <li>- ABNJ/BBNJ – look at international programs such as IndOOS and PIRATA, but also many other cruises such as IIOE2 and Nansen work beyond EEZ. Ensure this data is taken up, regional scientists are involved (look at Nansen as a success story).</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Inventory of existing infrastructures and facilities</li> <li>- Tools and capacity building</li> <li>- Computer power/Data processing time</li> <li>- Programming skills/capacity</li> <li>- State of the art equipment</li> <li>- New hardware and sensors</li> <li>- Finer resolution models/Limited Area Models (LAMs)</li> <li>- Downscaling</li> <li>- Studies relating to carbon budget and acidification</li> <li>- Does every coastal country need its own ship? Synchronize cruises, regional pool of vessels</li> <li>- Knowledge exchange between oil and gas companies varies between countries and is very much government driven. We need to share best practices between the regions, so if one government (e.g. Angola has a very successful data and vessel sharing policy this could be shared with all the region)</li> <li>- Capacitating institutions</li> </ul>	<ul style="list-style-type: none"> <li>- Linkages with Decade of African Oceans and Seas, African Union Commission</li> <li>- Better integration of existing platforms</li> <li>- African Centers of high performance computing</li> <li>- Indian Ocean Observing System (INDOOS)</li> <li>- JCOMM</li> <li>- IOC: IODE, GLOSS, IGOOS, GOOS OBPS</li> <li>- GOOS-AFRICA, GMES &amp; AFRICA, LMEs, Regional Conventions,</li> <li>- UNEP, WMO,</li> <li>- FAO and the Nansen programme</li> <li>- Big Data companies</li> <li>- National Statistics Offices</li> <li>- Indigenous knowledge partners</li> <li>- international association of oil and gas production</li> <li>- UNESCO Chairs, UNESCO Category 2 Centers in Africa</li> <li>- Expand the IOC Ocean Teacher Global Academy initiatives</li> <li>- Partnerships around data for environmental assessments where in country capacity may be limited</li> <li>- Sharing data practices across the region. Nansen policy as a good example, try to implement something similar with all foreign research vessels</li> <li>- Communication with met services</li> </ul>	<ul style="list-style-type: none"> <li>- Citizen science programs</li> <li>- MOUs</li> <li>- Marine diversity</li> <li>- Government support</li> <li>- Culture for sharing data</li> <li>- Share equipment, methodologies, knowledge for baseline monitoring to make it standardized (eg Nairobi Convention and IOC/GOOS OBPS eg for understanding ocean acidification)</li> <li>- Look at existing partnerships and data (eg FAO Nansen) and integrate this data into Africa, ensure it is being taken up and utilized</li> </ul>

<b>2 Research/Modeling</b>	<ul style="list-style-type: none"> <li>- Downscaling of global models</li> <li>- Coastal through shelf through ABNJ, depends on computing facilities and resolution</li> <li>- Coupled ocean/atmosphere</li> <li>- Data assimilation</li> <li>- Biological modelling</li> <li>- Monsoon</li> <li>- Madden-Julian Oscillation (MJO)</li> <li>- Indian Ocean Dipole (IOD)</li> <li>- El Niño and Benguela Niño</li> <li>- North Atlantic Oscillation</li> <li>- ITCZ</li> <li>- Subtropical IOD</li> <li>- Seychelles Chagos Thermocline Ridge</li> <li>- Subseasonal to Seasonal Weather Forecasting (S2S)</li> <li>- Transboundary research/studies</li> <li>- Climate scenarios</li> <li>- Regional Climate Centres</li> <li>- Ocean/Atmosphere interaction studies</li> <li>- Coastal areas climatologies</li> <li>- Limited Area Models (LAMs)</li> <li>- Dealing with model complexity</li> <li>- Ecological Models</li> <li>- HABs studies</li> <li>- Key ecosystems of the region</li> <li>- Upwelling regions</li> <li>- Ecosystem shifts, timescales and impacts on the subsistence fishers vs industry</li> <li>- Understanding mechanisms to identify what baseline monitoring is needed</li> </ul>	<ul style="list-style-type: none"> <li>- Education, Training and capacity building</li> <li>- Follow ups of methods</li> <li>- Training on models</li> <li>- Advanced research on climatologies specific to a region (Example Monsoons)</li> <li>- Metrics</li> <li>- Indices to measure progress</li> <li>- Computer power/Data processing time</li> <li>- Finer resolution models/Limited Area Models</li> <li>- Translating earth system data and models to management</li> <li>- local capacity and regional experts to translate and downscale global models</li> <li>- Share high performance computing across the region, eg that available in South Africa, Tunisia, Cote d'Ivoire etc.</li> </ul>	<ul style="list-style-type: none"> <li>- NOAA</li> <li>- ECMWF</li> <li>- EUMETSAT</li> <li>- Deltares</li> <li>- Copernicus</li> <li>- Mercator</li> <li>- Centres like Meteo France, JMA, IMD, BOM, CMA, SAWS etc...</li> <li>- UCT and UWC (South Africa)</li> </ul>	<ul style="list-style-type: none"> <li>- Regional Universities</li> <li>- Regional Exchanges programs</li> <li>- Regional Blocks</li> <li>- Team Building/Team of experts in various fields</li> <li>- Early warning systems and information sharing</li> </ul>
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<b>3 Governance</b>	<ul style="list-style-type: none"> <li>- Communication</li> <li>- Awareness</li> <li>- Ocean interest</li> <li>- Key governance documents (in institutions of African Union strategic plan etc.) do not capture our thoughts, consultations are not widely sought and partnerships are not utilized. IOC need to ensure strategic plans assist us in achieving these recognized goals</li> <li>- How can we link science to sustainable development and ensure that regional inequalities are addressed – how can predictability address food security.</li> </ul>	<ul style="list-style-type: none"> <li>- Communication to high levels</li> <li>- Build institutional framework to bridge science and policy</li> <li>- Clear messaging to authorities</li> <li>- Clear presentations through charts, video, figures</li> <li>- Presentation of statistics and facts</li> <li>- Build mechanisms to present studies/publications/research</li> <li>- Network capacity and competency within the region, develop regional platforms/programs and promote knowledge sharing</li> <li>- Recognize the African diaspora scientists and science communities– when an African publishes at a foreign institute the publication should still be recognized as coming from an African author.</li> <li>- Improve communications between policy maker's/IOC representatives and scientists.</li> <li>- We need to create sustained ocean institutes and university campus within the region as people are upskilled elsewhere but there are no jobs for them afterwards in their home countries.</li> </ul>	<ul style="list-style-type: none"> <li>- Regional collaboration</li> <li>- Blue Chapter</li> <li>- Blue Economy</li> <li>- Regional initiatives like WIOMSA, Nairobi Convention, UNEP etc...</li> <li>- AU initiatives</li> <li>- SADC, COMESA etc...</li> <li>- BlueMed convention</li> <li>- Indian Ocean Commission (IOC)</li> <li>- Engage national governments in the ocean decade (eg national WG), create tangible actions and raise national commitments</li> <li>- Link the African union decade and the UN decade</li> </ul>	<ul style="list-style-type: none"> <li>- Decade for the Ocean</li> <li>- Scientific conferences</li> <li>- Joint conferences (Political and scientific)</li> <li>- State level meetings</li> <li>- Paris Agreement</li> <li>- Ratification of Protocols/Agreements</li> <li>- Commemoration events (World Ocean Day, Africa Day of the Oceans)</li> <li>- Intergovernmental Oceanographic Commission (IOC of UNESCO)</li> <li>- Promotion of the UN Decade</li> <li>- Set of national offices for the UN Decade</li> <li>- African decade for the ocean and sea</li> <li>- African Union Commission vision for the oceans</li> <li>- Look at previous LME programs (BCLME, ASCLME and GLME) they were very successful in enhancing regional capacity and observations, what did they do right, what are their legacies. They have shifted into more action plans, but there is still a need to continue on the observations</li> </ul>
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▪ **WORKING GROUP 4: A SAFE OCEAN WHERE PEOPLE ARE PROTECTED FROM OCEAN HAZARDS**

Key Regional Issues	Key science or knowledge needs	Key capacity development or transfer of marine technology needs	Main partnership and resource mobilisation needs	Other tangible actions for improving solutions in the region and engagement in the Decade
1. Inadequate ocean management system	Develop modelling of extreme events and their impacts for coastal zone management  Establish baseline assessments for bio/chem geophysical parameters to inform ocean management	Training on methodology of effective research in marine technology  Capacity building on Early Warning system  Improve dialogue between modellers and policymakers and elected people  Standard methodology/ approach for baseline assessment	E- guard Djibouti Code of conduct HAB Group Economic Commission of Central Africa IPCC UNDP GOOS-AFRICA WIOMSA ICG/NEAM Group African Union IAEA Tsunami warning Centres	Establish an online community of maritime experts in Africa  Enhancing the maritime security unit within the African Union  Undertake research on whole water column profiling
2. Physical alteration & destruction of habitat	Research on the effects of natural barriers (habitats e.g. sand dunes, mangroves, etc) to mitigate natural extreme events using indigenous knowledge  Conduct coastal and social (perceptions) vulnerability assessments	Surveillance and intelligence technology in MDA Methodology on effective research in marine technology Effective data dissemination Sensitization on Ocean Maritime Domain Awareness Political awareness on the impact of people when safety and security	Yaoundé Code of Conduct) Maritime Piracy Regional coordination Centre (Cameroon) Jeddah Amendment (Djibouti Code of Conduct – DCOC) Security Architecture UNDP African Union	Sharing of research expeditions Network on tide gauges around Africa Peer to peer learning between African countries Integrate some of the technical expertise into university curriculum
3 Inadequate Maritime security	Mapping & identification of high risk vulnerable areas  Rationale of marine illegal activities (Social aspects)			

▪ **WORKING GROUP 5: A SUSTAINABLY HARVESTED AND PRODUCTIVE OCEAN ENSURING THE PROVISION OF FOOD SUPPLY AND SUSTAINABLE LIVELIHOODS**

Key Regional Issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology needs that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solutions in the region and to allow full participation in the preparation and implementation phase of the Decade.
1. Unsustainable exploitation of resources	<ul style="list-style-type: none"> <li>Reliable fish catch and effort data collection</li> <li>Regular stock assessment</li> <li>Understand fishing techniques and technologies needed for proper exploitation of marine resources</li> <li>Innovative strategies for alternative livelihoods.\</li> <li>Mapping of marine and coastal ecosystem (e.g. for MPAs)</li> <li>The nature and extent of IUU fishing both in the EEZ and high and ABNJ</li> </ul>	<ul style="list-style-type: none"> <li>Capacity to carry out stock and catch assessment surveys</li> <li>Fishery stock assessment platforms</li> <li>Capacity to link science to policy and management. (Science to Policy dialogue)</li> <li>Access to affordable technologies at both national and international levels</li> <li>Harnessing traditional knowledge and practices</li> <li>Capacity building in alternative livelihoods options</li> <li>Training and technology on marine spatial planning</li> </ul>	<ul style="list-style-type: none"> <li>FAO, UNEP, WAS, UNDP, WIOMSA, SCOR, IOCS, UNESCO, SWIOceph, CBD, COMHAFAT/ ATLAFCO</li> <li>NGOs with relevant programmes such as WIMAFRICA, IUCN, WWF</li> <li>International Seabed Authority.</li> <li>Other International agencies e.g. the Indian Ocean Tuna Commission</li> <li>Between governments, ministries, departments, MPAs and local communities</li> </ul>	<ul style="list-style-type: none"> <li>Engagement with regional platforms for integrated and standardized methods of assessment and management of ecosystems and the associated resources</li> <li>Adoption and enforcement of existing legal frameworks as well as formulating relevant policies to prevent illegal exploitation of marine resources</li> <li>Awareness creation on sustainable utilisation of marine resources among resource users</li> <li>Establishment of MPAs</li> <li>Promote alternative livelihoods</li> </ul>
2. Climate variability and change and effects on marine ecosystem	<ul style="list-style-type: none"> <li>Health of habitats and vulnerability assessments, (coral reefs, seagrass beds, mangroves) &amp; changes over time</li> <li>Ecosystems valuation</li> <li>Lack of awareness among locals</li> <li>Lack of regeneration plan</li> <li>Climate change vulnerability assessment for different ecosystems.</li> <li>Adaptive capacity of local communities to effects of climate change</li> <li>Climate change mitigation</li> </ul>	<ul style="list-style-type: none"> <li>Training of experts and resource users</li> <li>Climate risk modeling</li> <li>Early Warning System (EWS) for slow onset events (Sea level rise, Ocean acidification, Sea surface temperature)</li> </ul>	<ul style="list-style-type: none"> <li>Expand the South West Indian Ocean Climate Change Portal for information sharing</li> <li>GCRMN</li> <li>IPCC</li> <li>GLOSS</li> <li>Nairobi and Abidjan Conventions</li> </ul>	<ul style="list-style-type: none"> <li>Harmonization of legislation among countries (e.g. consideration of transboundary MPAs)</li> <li>Strengthen the Regional Sea Programs</li> </ul>

3. Ineffective governance	<ul style="list-style-type: none"> <li>• Maritime security studies</li> <li>• Studies on environmental and social impacts of IUU</li> <li>• Fisheries Certification</li> <li>• Zonal Attachment/ migratory studies of shared fish stocks</li> <li>• MCS</li> <li>• Management Planning</li> <li>• Piracy</li> <li>• Policy and Legislation</li> <li>• Ecosystem Based Management</li> <li>• Integration of indigenous knowledge into management processes</li> </ul>	<ul style="list-style-type: none"> <li>• Vessel monitoring systems and tracking</li> <li>• Clean energy sources for VMS particularly for artisanal fisheries</li> <li>• Capacity for implementation of MSP at policy and technical levels.</li> <li>• Citizen Science and Community management</li> <li>• Regional Fisheries Observer Programs</li> <li>• Patrol Vessels</li> <li>• Territorial Use Rights in Fisheries (TURFs)</li> <li>• Maritime Boundary Issues</li> </ul>	<ul style="list-style-type: none"> <li>• FAO Regional Fisheries Management Organizations (RFMOs) (e.g. CECAF, SWIOFC, ICCAT, SRFC, IOTC) and programmes (e.g. EAF-Nansen Programme)</li> <li>• NGOs (e.g. WWF, IUCN)</li> <li>• UNESCO, IOC, UN-DOALOS, FAO,</li> <li>• UNEP Regional Seas programs</li> <li>• International Centres for Data, Remote sensing and Oceanographic</li> </ul>	<ul style="list-style-type: none"> <li>• MSP at ecoregional scales</li> <li>• Promote transboundary marine resource management</li> <li>• Promote regional VMS and tracking systems</li> <li>• Regional approach to capacity and infrastructural development.</li> <li>• High Level Engagement in the Region (Ministerial Conference on UN Decade of Oceans</li> <li>• Local stakeholder workshops</li> <li>• Media engagement for awareness raising</li> </ul>
4) Anthropogenic impacts on marine ecosystem	<ul style="list-style-type: none"> <li>• Identification and description of the anthropogenic impacts on marine and coastal ecosystems (e.g. from mineral exploitation, construction of container terminals and harbours)</li> <li>• Assessment of anthropogenic impacts on fisheries resources</li> <li>• Improvement of scientific knowledge on marine ecosystem functioning, including deep sea ecosystem</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building on anthropogenic impact assessments related to marine resources</li> <li>• Infrastructure for monitoring of marine and coastal ecosystems</li> <li>• Research on marine plastics and other marine debris including seaweed</li> </ul>	<ul style="list-style-type: none"> <li>- BLUE BELT Initiative</li> <li>- LME Programmes in Africa</li> <li>- UNEP regional seas programmes (Nairobi and Abidjan Conventions)</li> <li>- RAFISMER Network</li> <li>- PRCM</li> <li>- UEMOA initiatives</li> <li>- COMHAFAT/ ATLAFCO</li> <li>- FAO</li> <li>- IOC/UNESCO</li> </ul>	<ul style="list-style-type: none"> <li>• Enforcement of the regional cooperation</li> <li>• Open Sciences to access to the regional oceanographic data</li> </ul>

▪ **WORKING GROUP 6: A TRANSPARENT AND ACCESSIBLE OCEAN WITH OPEN ACCESS TO DATA, INFORMATION AND TECHNOLOGIES.**

Key issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology need that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solution in the region and to allow full participation in the preparation and implantation phase of the decade
Require a focus on user driven data	Standardised training in data collection curation, storage and dissemination in order to facilitate data sharing and ease of use.	Capacity development in data management	-IOC Africa and IOCINDIO- collaborate on data and information sharing Other potential partners (not a closed list) IIOE2 JCOM GEBCO-for ocean mapping IORA	<ul style="list-style-type: none"> <li>▪ Awareness raising and knowledge sharing at national/regional and global level</li> <li>▪ Joint research publications using comparative data</li> <li>▪ Strengthen the science to policy interfaces – use data to influence policy</li> <li>▪ Translating science into practice for the common good</li> </ul>
Lack of common platform for data sharing; Incompatible metadata formats; Incompatible data (data existing in printed format/file type)	<ul style="list-style-type: none"> <li>▪ conduct a baseline study of what repositories/platforms already exist and then identify gaps and opportunities</li> <li>▪ Knowledge on existing metadata formats/language and fitness of use</li> <li>▪ Data rescue/ salvage/ digitisation of existing data</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sharing information on existing infrastructures</li> <li>▪ Training in data collection, analysis, curation and dissemination</li> <li>▪ Standardisation of methods</li> <li>▪ standardisation of metadata format</li> <li>▪ Data digitisation-<i>where data exists in printed format</i></li> </ul>	OBIS regional nodes, Nairobi Convention clearing house mechanism, -	<ul style="list-style-type: none"> <li>▪ An African node e.g. Ocean Data Portal) should be considered</li> <li>▪ Accessibility should be prioritised (language etc)</li> <li>▪ it will be useful having a common metadata standard-language for the region. The most commonly used for biodiversity data is Ecological, Monitoring Language EML format.</li> </ul>

Key issues	Key science or knowledge needs that are currently lacking for this issue	Key capacity development or transfer of marine technology need that are currently lacking in relation to this issue	Main partnerships that exist that could be created to support achievement of science and capacity development needs for this issue	Other tangible actions for improving information and solution in the region and to allow full participation in the preparation and implantation phase of the decade
Conflicting policies/law/guidelines within institutions/nations with regards to <b>Open Access</b>	<ul style="list-style-type: none"> <li>Clearing mechanism system rules, etc</li> <li>Policy alignment on data sharing agreements</li> <li>Regional assessment of existing data, information sources and existing technologies</li> <li>Funding for raw data collection</li> </ul>	<ul style="list-style-type: none"> <li>ocean literacy</li> <li>Awareness of data publishing platforms/tools</li> <li>Identify Institutions data centres and other repositories.</li> <li>Awareness on new and existing technologies</li> <li>Development of data management plans prior to project implementations</li> </ul>	<ul style="list-style-type: none"> <li>Nairobi Convention-clearing house mechanism</li> <li>A database of regional experts</li> <li>Regional bodies i.e. WIOMSA to fund for data collection through MARG programme</li> </ul>	<ul style="list-style-type: none"> <li>Ocean community: accountability, responsibility and law</li> <li>Data which is not collected cannot be shared-priority should thus be made to invest in biodiversity data collection</li> <li>Develop a model law/policy for the region (guidelines to assist with IP for example)</li> <li>Document lessons and best practices on data sharing</li> </ul>
Technical incapability and inadequate resources to hire and retain staff/buy equipment etc.	<ul style="list-style-type: none"> <li>Documented lessons on best practices/software's/technology</li> <li>clear guidelines on data sharing/access</li> <li>knowledge on existing technology /technical solution</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building of technical staff</li> <li>Expert gap analysis/ocean expert database</li> <li>Documentation of best practice</li> <li>Investment on open source software i.e. R that has huge user community</li> </ul>	<ul style="list-style-type: none"> <li>KMFRI-OTGA to promote marine literacy, data management and communication</li> </ul>	<ul style="list-style-type: none"> <li>Liaison with other centres of excellence/organisation where data management skills are much more developed</li> </ul>
Lack of trust between organisation/institution/governments		<ul style="list-style-type: none"> <li>Peer to peer exchange/communication and working in liaison</li> </ul>		<ul style="list-style-type: none"> <li>Public private partnership</li> <li>developing legally binding/transparent legal agreement /MOU</li> </ul>

## ANNEX II: WORKSHOP PROGRAMME

### Day 1: Monday 27 January 2020

09.00-10.00 WELCOME AND OPENING ADDRESSES

TEA/COFFEE BREAK

#### KEYNOTE ADDRESSES

*Co-Chaired by Suzan Kholeif and Gilbert Siko, Members Executive Planning Group for the UN Decade of Ocean Science for Sustainable Development*

10.00-11.00 Results and recommendations of the Global Sustainable Blue Economy Conference and their relevance to the Decade planning (*Prof. James Njiru, Director, Kenya Marine and Fisheries Research Institute*)

Introduction to the UN Decade of Ocean Science for Sustainable Development & overview of the preparation phase 2018 – 2020 (*Mika Odido, UNESCO/IOC Coordinator in Africa*)

11.00–11.15 Introduction to sli.do and use during workshop (*Ms Alison Clausen, Programme Specialist, UNESCO/IOC and Andrew Kegode M'Mbaiza, UNESCO Regional Office for Eastern Africa*)

#### 11.15–12.45 Panel 1: Setting a Regional Vision for the UN Decade of Ocean Science

*Moderated by Julius Francis, Western Indian Ocean Marine Science Association (WIOMSA)*

Objective: To present a broad vision of ocean science in the region, and incite discussion on why and how the Decade could advance ocean science in the region, particularly in line with key regional strategies such as AIMS 2050 and Agenda 2063.

Keynote: What is the vision for ocean science in Africa with specific reference to the priorities and objectives of Agenda 2063 and AIMS 2050? (*Dr Jared Bosire, UN Environment, United Nation Environment (Nairobi Convention secretariat)*)

Panelists: *Dr Karim Hilmi, Dr Reza Badal, Director General, Dr Angelique Paponneau; Dr Riaan Cedras,*

12.45 13.00 Methodology and organization of working groups (*Ms Alison Clausen, Programme Specialist, UNESCO/IOC*)

**13.00- 14.30 LUNCH BREAK: Side Event: Harnessing the Resources of International Ocean Science Organizations to develop Sustainable Ocean Science and Actions in the Indian Ocean:** Panelists: *Dr. Marie-Alexandrine Sicre (SCOR), Dr. Jacqueline Uku (WIOMSA), Dr. Juliana Prosperi (CIRAD), Dr. David Williamson (IRD), Pr. Agnes Wangui Muthumbi (University of Nairobi)*

#### 14.30-17.30 PARALLEL WORKING GROUP SESSIONS

WG 1: A clean ocean where sources of pollution are identified & removed

WG 2: A healthy and resilient ocean where marine ecosystems are mapped and protected.

WG 3: A predictable ocean where society has the capacity to understand current and future ocean conditions.

### Day 2: Tuesday 28 January 2020

09.00 09.30 Summary of Day 1 and programme for Day 2

#### 09.30 12.30 PARALLEL WORKING GROUP SESSIONS

- WG 4: A safe ocean where people are protected from ocean hazards.
- WG 5: A sustainably harvested and productive ocean ensuring the provision of food supply and sustainable livelihoods
- WG 6: A transparent and accessible ocean with open access to data, information and technologies.

#### 12.30 14.00 LUNCH BREAK: Side Event: Towards a common roadmap in biodiversity data handling and management

- *Conveners: Dr. Hauke Reuter and Dr. Hauke Kegler, Leibniz-Centre for Tropical Marine Research (ZMT); Dr. David Obura, CORDIO - East Africa and Mr. Theuri Mwangi, the Nairobi Convention*

## Day 2: Tuesday 28 January 2020 AFTERNOON

### 14.00 – 15.30 **Panel 2: Innovative models to mobilize resources and create partnerships**

*Moderator: Alison Clausen, IOC Secretariat*

**Objective:** To present innovative resource mobilization mechanisms and partnerships operating in the region and incite discussion on their potential for replication or scaling up to support Decade outcomes

**Keynote:** Given your experience in innovative blue financing with the SeyCCAT initiative, could you provide some thoughts on innovative blue financing models that are appearing globally that could be used to support ocean science in Africa? *Angelique Paponneau*

*Panelists: Paul Mboya Tuda, Julius Francis, Ibukun Adewumi*

### 15.30 – 16.00 **Coffee Break**

### 16.00 – 17.30 **REPORTING BACK FROM WORKING GROUPS**

Rapporteurs

## Day 3: Wednesday 29 January 2020

09.00 – 09.30 Summary of Day 2 and programme for Day 3

### 9.00 – 10.30 **PLENARY DISCUSSION ON WORKING GROUP OUTCOMES**

### 10.30 – 11.00 **TEA/COFFEE BREAK**

### 11.00 – 12.30 **Panel 3: Capacity development and transfer of marine technology**

*Moderator: Tim Andrew, Nairobi Convention Secretariat*

**Objective:** To build on the discussions in the working groups and incite discussion on the key capacity building needs that will allow Africa to participate fully in the Decade.

**Keynote:** How can we ensure that future capacity development actions in Africa result in sustainable and real benefits for ocean science and for African scientists? *Dr Jacqueline Uku*

*Panelists: Prof Joseph Rasowo, Dr Margaret Kyewalyanga, Mr Jaco Stemmet, Mr Mthuthuzeli Gulekana*

### 12.30 – 14.00 **LUNCH BREAK**

### 14.00 – 15.30 **Panel 4: Ocean literacy and communications**

*Moderator: Nina Wambiji, KMFRI*

**Objective:** To incite discussion on the most appropriate forms of communicating about the Decade and ways of improving ocean literacy in Africa.

**Keynote:** How can we communicate better on ocean science and make it relevant for Africa today? *David Obura*

*Panelists: Mr Wanjohi Kabukuru, Ms Moina Spooner, Ms Leila Ben Hassen*

### 15.30 – 16.00 **TEA/COFFEE BREAK**

16.00 – 17.00 Plenary discussion on key messages from workshop

17.00 – 17.30 Summary of next steps in Decade preparation phase

Closing Remarks: *Prof Karim Hilmi, IOC Vice Chair Group V (Africa and Arab states)*



## ANNEX III SIDE EVENTS

### EVENT I



#### From Data to Decision: Towards a common roadmap in biodiversity data handling and management

**The Conveners:** Dr. Hauke Reuter and Dr. Hauke Kegler, Leibniz-Centre for Tropical Marine Research (ZMT); Dr. David Obura, CORDIO - East Africa and Mr. Theuri Mwangi, the Nairobi Convention

#### SUMMARY

Today many coastal ecosystems are at a crossroad. The pace of change is increasing, as is the rate at which we lose species in the terrestrial and marine realm. On the other hand, the amount of data relevant to the conservation and sustainable use of those ecosystems is increasing. Two main issues arise from these developments: a) the need to store, analyse, visualise and integrate those large datasets and b) to create a culture in which data is readily shared with all stakeholders and understandable for decision makers. This report is a contribution to the Regional workshop for the IOC/UNESCO UN Decade of Ocean Science for Sustainable Development in Nairobi from January 27th – 29th. During that workshop the Leibniz Center for Tropical Marine Research (ZMT), CORDIO East Africa and the Nairobi Convention held a special event on biodiversity data handling and management. We conducted this workshop to receive expert opinion on topics relevant to biodiversity data management.

The main issues in biodiversity data management, integration and sharing are that were identified were a) a lack of defined and standardised parameters which describe a species occurrence and ideal habitats and environmental conditions, b) a heterogeneous legal framework with no clear definitions on

#### Key points:

- ✓ many coastal ecosystems are at a crossroad and decisive steps are necessary for a sustainable use of those ecosystems and its resources
- ✓ The amount of available data is steadily increasing, and new technologies to collect information are developed
- ✓ There is a lack of defined and standardised parameters which describe a species occurrence and ideal habitats and environmental conditions
- ✓ Legal framework are still very heterogeneous with no common and clear definitions on how generate, cite or share biodiversity data
- ✓ The suggested steps to improve the situation of biodiversity data handling might be easy to implement on a technical level, but will need a strong concerted political effort

how generate, cite or share biodiversity data as well as no incentives to make data openly available and lastly c) a culture among scientists, practitioners and politicians which is not very susceptible to the concept of open data sharing. In a separate round concrete examples were given on how to improve the current situation.

Those suggestions included 1.) the definition of shared key biodiversity parameters and essential environmental variables, 2.) a standardization of monitoring efforts itself across regions, 3.) to implement policies that

encourage both horizontal and vertical transfer of relevant data and 4.) the establishment of strategic alliances and tap existing resources.

## THE CONTEXT

This report is a contribution to the Regional workshop for the IOC/UNESCO UN Decade of Ocean Science for Sustainable Development in Nairobi from January 27th – 29th. During that workshop the Leibniz Center for Tropical Marine Research (ZMT), CORDIO East Africa and the Nairobi Convention held a special event on biodiversity data handling and management. The feedback from this event, an interactive workshop, led to this report.

Many coastal ecosystems worldwide are at a crossroad now. The pace of environmental change is increasing, as is the rate at which we lose species in the terrestrial and marine realm. On the other hand, the amount of data relevant to the conservation and sustainable use of those ecosystems is increasing. New technologies such as drones, underwater sensors and cameras, as well as citizen science efforts, deliver us a stream of data in near real-time. Two main issues arise from

these developments: a) the need to store, analyse, visualise and integrate those large datasets and b) to create a culture in which data is readily shared with all stakeholders and understandable for decision makers.

During the workshop the following 4 questions were asked to get a broad feedback from a diverse group of participants:

1. ***What are the data needs for practitioners, policy makers and scientists?***
2. ***What is the relationship between local / regional / global institutions working on biodiversity data?***
3. ***What are enabling/hindering factors when it comes to data sharing?***
4. ***Which activities are needed / desired to promote an improved handling and sharing of data?***

## WORKSHOP RESULTS

We received great and inclusive feedback from the participants on the 4 main questions asked during the workshop. Those will be summarized in the following section, before we will provide a more generalized summary and way forward:

### **What are the data needs for practitioners, policy makers and scientists?**

We split the responses by status groups for clarity. **Policy makers** placed a strong emphasis on the economic valuation of marine resources. Underlying data should enable them not only to estimate the inherent value of certain ecosystems, such as coral reefs, seagrasses or mangrove forests but

also assist in evaluate future blue carbon initiatives. One of the key aspects concerning data needs for practitioners was that data should be easily accessible and digestible, also in terms of data visualisation. Some of the needs were shared by **practitioners**, who emphasized standardized long-term data on key performance indicators relevant to the status of marine resources, e.g. population trends. Additionally, the data should be easily understandable for management purposes. Scientists on the other hand were interested in primary data on species and their habitats. This data should be accessible through a user-friendly data repository, while issues should be routed through a clearing house

mechanism, such as offered by the UNEP Nairobi Convention. Participants also mentioned topics and issues, which they identified as relevant to **society**. To include raw and metadata was mentioned several times, as well as the necessity to create long-term standardized data for comparative studies. Those datasets should be as large and inclusive as possible, and openly shared. It was also mentioned several times that this data should have an impact on society, strengthen policies on marine conservation and sustainable resource use and increase ocean literacy.

### **What is the relationship between local / regional / global institutions working on biodiversity data?**

Standardization was an issue that was mentioned several times among participants when it comes to the data which is collected and the indicators the data feed into. Without standardized data collection there would be no way for smaller local databases to feed into global ones, and the data would not be comparable or interoperable. This is an even more central issue as the relationships between institutions and databases, both horizontally and vertically, were often characterized as “disconnected” or not well functioning. Moreover, the roles local and global databases fulfil are different but inherently interconnected. Local databases and institutions working with biodiversity identified as key players when it comes to creating spatially and temporally high resolution data, while global databases are often seen as aggregators that make sense of the larger picture and enable policy makers to compare different regions and look for similarities or differences, e.g. why certain measures are successful in some areas but fail in others. Interoperability and an open access to the data across all levels was a second big point. The available data should be easy to identify and access from various sources, and not hidden in small databases that are not readily available through web portals etc.. This could be solved through shared APIs (application programming

interfaces), so that the different database could forward search queries and access each other's data, which have the additional benefit of creating redundancies and backups for the datasets.

### **What are enabling/hindering factors when it comes to data sharing?**

Obviously we are required to make faster and better informed decisions in conservation as the pace of environmental change is unprecedented and biodiversity loss occurs at a dramatic rate. The amount of data needed and being generated is increasing and often heterogeneous, and the data itself needs to be interoperable and comparable on larger scales to be of use. This puts a big strain on individual institution and calls for transformative changes in the way we generate, analyse, use and share data. Many of the goals and interests are apparently shared, therefore key enabling factors in that regard were an increased collaboration among institutions and the formation of strategies partnerships while working on similar issues. There are new emerging technologies for big data analysis as well as data sharing, e.g. from insurance and software companies, which could be harnessed and modified to make sense of the bulk of biodiversity data. This would enable policy makers to identify patterns of change and integrate biodiversity data with key environmental parameters to be better able to predict shifts in ecosystem status or species occurrence. Institutional funding will need to be increased to meet that demand in both technology as well as skilled personnel. While some great efforts in creating legal and binding frameworks to share data more openly are already promoted on a regional level through institutions such as IOC/UNESCO, The Nairobi Convention or COI-IOC, a strengthening of open access in legal frameworks and setting common standards on data management would simplify an open exchange of information. On the other hand, there are several **hindering factors and barriers** when it comes to data sharing. Data and metadata are often

collected, analysed and stored in various formats and according to different standards, which makes it inherently complicated to compare datasets from different sources. This goes along with often conflicting interests when the data is generated by research. Research data is your only capital when the goal is a career in academia, which frequently leads to a focus on publications and a delay in data sharing until the publications are accepted or published. Often data collected through research project is also not always adequate to answer policy-relevant questions. Additionally collecting, analysing and storing large datasets can also be an expensive endeavour, so those who covered the initial costs of producing that data might not always be willing to immediately disclose the results. On top of institutional barriers there are sometimes legal frameworks that slow down or outright prevent an open sharing of data.

### **Which activities are needed / desired to promote an improved handling and sharing of data?**

One of the main goals of the workshop was also to collect expert opinion on which concrete steps can be taken to improve biodiversity data handling, management and sharing. Among the recommendations, two main stories merged 1.) **The need for an inventory** on information, institutions and policies already dealing with biodiversity data handling and management. A first step can be a map or database of existing institutions and infrastructure in the region, including the type of data that is collected or stored and the policies, which are in place. This database could serve as a one stop solution for users and policy makers to quickly get an overview of existing data and institutions dealing with biodiversity data. In an additional step, the database could ultimately be transformed in a platform for expert to also exchange on best practice cases or develop common data handling, integration and sharing protocols and politics. This goes along with the identification of necessary data handling and analytical skills. The last efforts would directly

into 2.) **The development of suitable data handling and sharing protocols and policies.** This includes the harmonization of data and metadata standards as well as best practices for the integration and analysis of biodiversity data. Data portals should also develop common protocols and interfaces to exchange data and streamline accessibility and interoperability of data. There are a range of initiatives already working on those topics, such as the FAIR (Findable, Accessible, Interoperable and Reusable) data principles and the CODATA research alliance. On a personal level incentives for sharing data should be developed, as well as strategies to create a culture more favorable to sharing biodiversity data. Specific policies can also regulate how sharing data can be linked to funding's of research grants or activities, or work on preventing data piracy and research being conducted by foreign collaboration partners without sharing the gathered data. A supplementary point that was often repeated is 3.) That we need to work on **developing the necessary technical capacity and personal skills** to deal with the new challenges deriving from technological opportunities and analytical demands to predict future scenarios from species to ecosystem level. This can include regional alliances to share the load on infrastructure as well as standardized training courses on biodiversity data handling.

### **The road ahead**

The field of biodiversity conservation and management is rapidly developing. New technologies and tools are at hand to increase our understanding of why species or ecosystems thrive under certain conditions and do not do well under others. Available computing power enables scientists and policy makers to get enhanced analytics and insight of the ever-increasing volume of data. Specialized professions and training are being developed to prepare biologists for the new bioinformatics analyses. Since reliable, high-resolution quality biodiversity and environmental data readily available and understandable are one of the cornerstones

of educated conservation and sustainable use of marine ecosystems and resources. What is currently missing is a common roadmap to connect the available dots and create a larger and more refined picture of the state of ecosystems, habitats and species worldwide. In our view the following (ambitious) key aspects need to be addressed to transform the way we conserve and sustainably manage marine ecosystems and resources. 1.) **Define shared key biodiversity parameters and essential environmental variables** to be included in standardized long-term monitoring efforts. Based on the feedback from key stakeholders (question 1) a set of parameters can be developed to be included in future monitoring efforts. Those harmonized efforts will assist in comparing different regions and create a large global and interoperable dataset. On top of that agreed set of variables additional parameters could be included for different regions based on specific needs in those areas. 2.) **Standardize monitoring efforts itself across regions.** Harmonized biodiversity monitoring will facilitate integration into larger datasets and interoperability of data. It will also assist with the exchange of best practice or mitigation strategies if those are measured against the same parameters. 3.) **Implement policies that encourage both horizontal and vertical transfer of relevant data.** Tearing down barriers, which hinder or prevent the sharing of data will likely be the most difficult task. On the other hand does it contain large potential to be of profound impact to biodiversity conservation and resource

management. Fostering a culture of open exchange of data, backed by supporting policies and incentives to data producers can decrease the timespan between sets of data being collected and shared with a wider audience. If data piracy and “parachute science” are discouraged, or capacity and data exchanges become mandatory, new strategic cooperation’s will be established. 4.) **Form strategic alliances and tap existing resources.** Too often scientists and policy makers work on similar topics while not being aware of other efforts in the same field. An exchange on the individual data needs as early as possible can open new avenues in science to policy interactions. Data being generated by scientist could be geared or adapted to the needs of policy makers from the very beginning. Therefore, we encourage shared conferences and inclusion of policymaking needs already in the development of projects with relevance to conservation or sustainable management of marine resources. Initiatives on FAIR and open data exchange, best practices or data management already exist; those are great resources, which can easily be tapped. We assume that many institutions working on marine conservation and marine resource management will have similar goals and have an inherent interest in a sustainable management of their coastal species, habitats or ecosystems. Therefore, by harmonizing and standardizing their individual activities we can create synergies to make biodiversity data collection, analysis, management and uptake in policymaking initiatives more streamlined and affordable

## ABOUT THIS REPORT

This report is a contribution to the Regional workshop for the IOC/UNESCO UN Decade of Ocean Science for Sustainable Development in Nairobi from January 27<sup>th</sup> – 29<sup>th</sup>. During that workshop the Leibniz Center for Tropical Marine Research (ZMT), CORDIO East Africa and the Nairobi Convention held a special event on biodiversity data handling and management. The feedback from this event, an interactive workshop, led to this report.

## DISCLAIMER

This report does not necessarily reflect the views of the ZMT or its partners.

## IMPRINT

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## EVENT II

### **Harnessing the Resources of International Ocean Science Organizations to develop Sustainable Ocean Science and Actions in the Indian Ocean**

**Organizing Partners:** Scientific Committee on Oceanic Research (SCOR), Western Indian Ocean Marine Science Association (WIOMSA), Institut de Recherche pour le développement (IRD)/ Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), University of Nairobi, Kenya.

**Description:** The purpose of this side event was: (i) to inform on international programs in the Indian Ocean and capacity-development opportunities, and (ii) to identify mechanisms to link local and global communities. We view this side event as an opportunity to stimulate discussion to create synergies among stakeholders to co-design actions for sustainable development during the UN Decade.

Presentations were made on the following topics, followed by discussion among participants:

- Scientific Committee on Oceanic Research (SCOR)
- 26 years of WIOMSA: Celebrating Scientific Excellence in the Western Indian Ocean Region
- Mikoko Project: Conservation and resilience of Kenya's mangrove forests
- Marine Microplastic Research in Kenya

The speakers were: Dr. Marie-Alexandrine Sicre (SCOR), Dr. Jacqueline Uku (WIOMSA), Dr. David Williamson (IRD), Dr. Juliana Prosperi (CIRAD), Prof. Agnes Wangui Muthumbi (University of Nairobi).

#### ***Outputs from the side event***

The main outputs from the side event was the sharing of information with participants of ongoing initiatives being undertaken at the global to local levels in Africa. A comparison of SCOR (over 60 years in existence) and WIOMSA (26 years in existence) was elaborated and the opportunities for both organizations to learn from each other.

At the global level the key role of SCOR is to help the international ocean science community to develop large-scale international research projects to address fundamental scientific questions or issues of immediate societal concern. SCOR serves as a project incubator for the international ocean science community. SCOR Working Groups provide mechanisms for the international ocean science community, though, the identification of specific areas of ocean science for which joint consideration can be undertaken over a three- to four-year period which would advance those areas, by agreement to standards and common methodology. The SCOR WGs include 10 Full Members and meet 3 times over 3-4 years. They typically produce a peer-reviewed paper or special issues to promote key areas of ocean science. There are also programmes that help develop the capacity for ocean science in developing regions of the world through a SCOR Visiting Scholars programme. Integration of emerging scientists is a key action area for SCOR

At the regional level, the presentation of WIOMSA provided highlights of its regional programmes as well as challenges. Challenges the Western Indian Ocean region is facing in terms of the ocean sciences could be broadly categorized into two major categories: first, the generation of new knowledge and building new capacity and second, optimal use of the existing capacity and

data and knowledge to address problems facing the region. There is need to mobilize the scientific community through capacity building, partnerships and research support and link this to policy. This needs to be replicated across Africa. The need to use different mechanisms to build capacity for ocean science and ideas come from close monitoring and evaluation of our progress. The need for partnerships for organizations like WIOMSA was highlighted through the science to policy framework developed in partnership with the Nairobi Convention. Analysis of the lead experts of WIOMSA projects showed majority are male with very few youth taking leadership and we need to work harder to change this trend. There is also unequal distribution of capacity. The countries of the region are of different sizes in terms of population, physical area as well political and economic development. There is need for special consideration for the island states so that they can participate.

Highlights of the Mikoko project in Lamu were provided by the IRD and CIRAD team. The 2 year Mikoko Project, has the objective to restore and conserve mangrove forests to improve socioeconomic well-being and ensure environmental sustainability especially in the context of climate change. The research base of the project provides an example of investments at the local scale which support local issues. In Mikoko project the status of the Lamu mangroves, their value and utilization potentials will be explored and this knowledge will be used for the management of mangroves in this important area of the Kenyan Coast.

Further focus on research at University level was discussed and how capacities of ocean scientists can be built for the future.



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## ANNEX V LIST OF ACRONYMS

2050AIMS	2050 Africa Integrated Maritime Strategy
ABNJ	Areas Beyond National Jurisdiction
AU	African Union
AUC	African Union Commission
BBNJ	Biodiversity Beyond National Jurisdiction
BMZ	Federal Ministry of Economic Cooperation and Development (Germany)
CCLME	Canary Current Large Marine Ecosystem
CD	capacity development
CERECOMA	Centre Spécialisé de Recherche sur les Ecosystèmes Marins
CHM	Clearing House Mechanism
COMRED	Coastal and Marine Resources Development
COMESA	Common Market for Eastern and Southern Africa
CORDIO- East Africa	Coastal Oceans Research and Development – Indian Ocean (CORDIO) East Africa
CRO	Centre de Recherches Oceanologiques
CRODT	Centre de Recherches Océanographiques de Dakar-Thiaroye
DEA	South African Department of Environmental Affairs
DFiD	Department for International Development
DPM	Direction des Pêches Maritimes
EBVs	Essential Biodiversity Variables
ECOWAS	Economic Community of West African States
EEZ	Exclusive Economic Zone
EOVs	Essential Ocean Variables
EPG	Executive Planning Group
FAO	Food and Agriculture Organization of the United Nations
GEBCO	General Bathymetric Chart of the Oceans
GEF	Global Environment Facility
GLOSS	Global Sea Level Observing System
GMES and Africa	Global Monitoring for Environment and Security Africa
GOOS	Global Ocean Observing System
GOOS-Africa	The Global Ocean Observing System for Africa
GOSR	Global Ocean Science Report
HAB	Harmful Algae Blooms
IAEA	International Atomic Energy Agency
ICAM	Integrated Coastal Area Management Programme
ICJ	International Court of Justice
IDRC	International Development Research Centre
IGAD	Intergovernmental Authority on Development
IHO	International Hydrographic Organization
IIOE-2	Second International Indian Ocean Expedition
IMO	International Maritime Organization
IMS	Institute of Marine Science
IndOOS	Indian Ocean Observing System
IOGOOS	The Indian Ocean Global Ocean Observing System Regional Alliance
IOC	Indian Ocean Commission
IOC	Intergovernmental Oceanographic Commission
IOCAFRICA	IOC Sub-Commission for Africa and the Adjacent Island States
IOD	Indian Ocean Dipole
IODE	International Oceanographic Data and Information Exchange
IPCC	Intergovernmental Panel on Climate Change

IRHOB	Institut de Recherches Halieutiques et Océanologiques du Bénin
IRSEN	Institut de Recherche en Sciences Exactes et Naturelles
ITLOS	International Tribunal for the Law of the Sea
IUU Fishing	Illegal, Unreported and Unregulated Fishing
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM in situ Observations Programme Support Centre
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenya University of Agriculture and Technology
KCGS	Kenya Coast Guard Service
KEFRI	Kenya Forestry Research Institute
KPA	Kenya Ports Authority
KMFRI	Kenya Marine and Fisheries Research Institute
KNSL	Kenya National Shipping Line
KU	Kenya University
KWS	Kenya Wildlife Service
LAMs	Limited Area Models
LME	Large Marine Ecosystems
LMMA	Locally Managed Marine Area
MARG	Marine Research Grants
MASMA	Marine and Coastal Science for Management
MEERWISSEN	African German Partners for Ocean Knowledge
MCS	Monitoring, Control and Surveillance
MoU	Memorandum of Understanding
MJO	Madden-Julian Oscillation
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NEAM	the North-Eastern Atlantic, the Mediterranean and Connected Seas
NGO	non-governmental organization
NIOF	National Institute of Oceanography and Fisheries
NIOT	National Institute of Ocean Technology
NOAA	National Oceanic and Atmospheric Administration
NODCs	National Oceanographic Data Centres
NORAD	Norwegian Agency for Development Cooperation
OBIS	Ocean Biogeographic Information System
OBPS	Ocean Best Practice System
ODINAFRICA	Ocean Data and Information Network for Africa
OTGA	Ocean Teacher Global Academy
PIRATA	The Prediction and Research Moored Array in the Atlantic
RV	Research Vessel
SADC	Southern Africa Development Community
SAEON	South African Environmental Observation Network
SAIAB	South African Institute for Aquatic Biodiversity
SAPPHIRE	Strategic Action Programme: Policy Harmonisation and Institutional Reforms.
SCOR	Scientific Committee on Oceanic Research
SeyCCAT	Seychelles' Conservation and Climate Adaptation Trust
SEI	Stockholm Environment Institute
SDG	Sustainable Development Goal
TAFIRI	Tanzania Fisheries Research Institute
TNC	The Nature Conservancy
TUM	Technical University of Mombasa

TURF	Territorial User Rights for Fisheries
UCT	University of Cape Town, South Africa
UDSM	University of Dar es Salaam
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGA	United Nations General Assembly
UON	University of Nairobi
UWC	University of Western Cape, South Africa
VMS	Vessel Monitoring Systems
WCRP	World Climate Research Programme
WIMAFRICA	African Women in Maritime
WIMS	Women in Marine Science Network
WIO	Western Indian Ocean
WIO-ECSN	Western Indian Ocean Early Career Scientists Network
WIOMSA	Western Indian Ocean Marine Science Association
WIO-SAP	Strategic Action Programme for the protection of the Western Indian Ocean from land-based sources and activities
WMO	World Meteorological Organization
WOC	WOC: World Ocean Council
WOMESA	Women in Maritime Eastern and Southern Africa
ZMT	Leibniz Centre for Tropical Marine Research