



Towards a Western Indian Ocean regional ocean acidification action plan



Workshop report

28th – 29th October 2019

Maru Maru Hotel, Gizenga St, Zanzibar, Tanzania

When quoted this report should be referred to as:

Laffoley, D., Baxter, J.M., Hassoun, A.E.R., Spalding, M., Osborn, D., Oliver, J., & Andrew, T.G. 2020. Towards a western Indian Ocean regional ocean acidification action plan. Workshop report. Switzerland, IUCN. 29pp.

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1. Introduction and background, funding, and support

The Nairobi Convention in collaboration with the IUCN-chaired Ocean Acidification international Reference User Group (OAIrUG) and the Western Indian Ocean Marine Science Association (WIOMSA) organized the Indian Ocean Regional Ocean Acidification workshop in Zanzibar, Tanzania on 28th and 29th October, 2019. The workshop was organized with the financial support of the Prince Albert II Foundation, the UN International Atomic Energy Agency (IAEA), the Nairobi Convention and WIOMSA through its MASMA Programme.

This workshop built on the outcomes of the ‘WIOMSA Ocean Acidification workshop – developing regional capacity for ocean observations in support of SDG target 14.3’ held in Dar es Salaam, Tanzania in October 2017 and the Decision CP.9/9 (2) on Ocean Acidification of the Ninth Conference of Parties to the Nairobi Convention that took place in Mombasa, Kenya in August 2018.

The main objectives of the workshop (Annex 1) were to: take stock of current regional knowledge and actions on ocean acidification and identify priorities to be included in a draft regional action plan for consideration by the parties to the Nairobi Convention for the western Indian Ocean (WIO) region that will provide guidance on how to respond to this challenge. Development of the action plan will benefit from the recent regional action plan developed for Latin America and the Caribbean and the White Paper for the WIO region.

The workshop was attended by about 40 regional invitees comprising government representatives, end users, and resource managers, and informed by a small number of key ocean acidification scientists who could provide an overview of current global scientific knowledge on ocean acidification, and also comment on current and planned activities in the region (Annex 2).

The main output from the event is this Workshop Report, and a series of priority actions to be included in a draft Action Plan for the region for consideration by the Nairobi Convention.

2. Regional context

The Western Indian Ocean (WIO) extends from the continental margins of eastern Africa in the west to the banks of the Mascarene Plateau in the east (30° to 80° E) and is situated between the latitudes 120° N and 30° S. The region encompasses a large array of marine and coastal settings including small island states and large countries with extensive coastlines and tropical and subtropical climates. It comprises the continental coastal states of Somalia, Kenya, Tanzania, Mozambique and South Africa, and the island states of Mauritius, Comoros, Reunion (France), Seychelles, and Madagascar. However, Madagascar encompasses both island and mainland characteristics.

The WIO region is an area of considerable ecological and human diversity with highly productive coastal habitats and a rich biodiversity. The region is characterised by high marine biodiversity, but the biomass of individual species is generally low, with marine productivity depending more on nutrient input from rivers along the coasts of eastern Africa and Madagascar than on upwelling systems. The WIO is considered a distinct subdivision of the tropic Indo-West Pacific, the world’s largest marine biogeographic province. The total number of species in the WIO region is not precisely known, but the estimated range is between 11,000 and 20,000 or more, bearing in mind that invertebrate fauna in most deep-sea environments are poorly known. The Indo-West Pacific region has the greatest diversity of fishes of all the eight ocean biogeographic regions. Embedded in this is the West Indian Ocean with some 2,200

species, about 14% of the global total of marine fishes. The fish species found in the WIO can be grouped into 270 families, representing some 83% of all the fish families known. This richness is due to the large variety of habitats and oceanographic conditions of the region.

The region contains a range of sub-regions, where the Northern Mozambique Channel represents a core for high tropical marine biodiversity and the Mascarene Islands have among the highest levels of marine endemism globally. Unique aspects of the Mascarene plateau include the largest seagrass beds in the world, species endemism, and significant aggregations of marine mammals and seabirds. Zones of unique productivity are associated with the Somali and Agulhas currents in the north and south, and the Mascarene plateau and banks in the centre.

Compared to most other regions of the global ocean, the WIO region is relatively less impacted by human activities. However, this is changing as economies of countries of the WIO region continue to grow with activities such as industrial fishing, shipping, oil and gas exploitation, agriculture and urbanization showing an upward growth trend. Many ocean-dependent communities in the region are facing increasing economic hardship from degradation of their resource base, due largely to growing pressures of development from infrastructure, extractive industries and population. The effects and impacts of global climate change exacerbate other sources of disturbance.

As with other parts of the ocean, climate impacts in the WIO due to increasing air and sea surface temperature increases, precipitation changes, increasing frequency and severity of extreme weather events, and sea-level rise are compounded by concerns about ocean acidification due to elevated levels of atmospheric carbon dioxide.

While there is large body of knowledge in the region on climate impacts such as coral bleaching due to increasing sea surface temperature, precipitation changes and sea-level rise, the same cannot be said about ocean acidification. Ocean acidification has the potential to affect food security and carbon storage through negative impacts on calcifying organisms such as coral reefs, shellfish and plankton. Ocean acidification may also impact various economic sectors (e.g. fisheries, aquaculture, tourism) and coastal communities, and may also have indirect effects on much broader segments of the economy and population at large.

Because of scarcity of data collected in the region on ocean acidification, its potential impacts and the rate of acidification are poorly understood. However, a comparison of studies undertaken 40 years apart (1963 and 2004) in the Mozambique Channel showed an increase of 60 μatm of pCO_2 on average, which is significant. In recent years the number of studies on ocean acidification has started to increase.

Even with the limited data on ocean acidification, some actions have been taken at a regional level. Both the Regional State of the Coast Report and the Climate Change Strategy for the Nairobi Convention have identified ocean acidification as one of the potential threats that the region will need to face. Based on this recognition, together with the outcome of the 'WIOMSA Ocean Acidification workshop – developing regional capacity for ocean observations in support of SDG target 14.3' held in Dar es Salaam, Tanzania in October 2017, the Ninth Conference of Parties to the Nairobi Convention held in Mombasa, Kenya in August 2018, identified ocean acidification as a priority (Decision CP.9/1.). The Contracting Parties were urged to start addressing the impacts of ocean acidification through, among other actions,

capacity development, scientific cooperation, regional monitoring and adaptation activities (Decision CP.9/9.).

3. The Action plan priorities for the Western Indian Ocean region

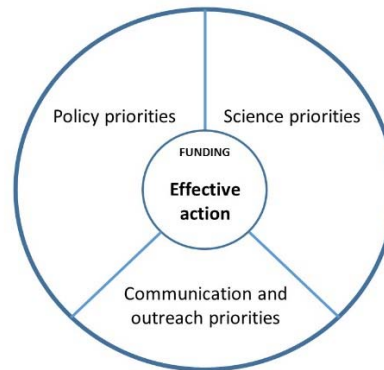


Figure 1. Key components of the regional Action Plan on ocean acidification for the Western Indian Ocean.

3.1 Closing the gaps on ocean acidification funding in the Western Indian Ocean.

The problem of raising funding is a fundamental issue for the region as they depend on individual countries and their research priorities and whether they are in place, and for example, whether there is a national body to give guidelines for science and research. This varies hugely across the WIO region, with some countries such as South Africa having already established a research priority for ocean acidification which facilitates funding requests, whilst for others, such as the Comoros, research priorities have been set but an Action Plan is needed to present for funding through national channels. For most countries of the region there is currently little government funding, and no baseline information even for economically important species. In such situations ongoing WIOMSA collaboration and support is very important.

As such, solving the problems of funding is about resources and capacity more broadly for the region. At a global and multilateral scale, it may be possible, for example, to pitch for blue economy projects in the future as a regional community. Other funding sources such as the Green Climate Fund (GCF) require substantial resources to get to the point of proposal submission, while co-financing requirements for Global Environment Facility (GEF) applications can be an obstacle as it is challenging for nations to find the matching resources, especially cash. Enhanced collaboration between countries will be key as well as some basic mapping of capacity and capabilities that already exist in the region, and then mapping out how these can come together effectively to generate regional proposals for funding.

Participants at the workshop considered that as WIOMSA fosters a multinational approach, it is very well placed to coordinate funding approaches through existing mechanisms that would

help strengthen coordination, cooperation and a stepwise scaling-up in resources. This approach is needed as funding will not make a difference on its own if structures and capacities are not in place. In countries with lower capacity, a regional approach is more effective than a national one and there is a strong need to identify funding sources, including from the private sector. National research councils are currently the main funding source, but major disparities exist between countries in the region. It is evident that ocean acidification is, to many, still regarded as part of the climate change research issue and therefore not considered a priority. So, the topic needs to be looked at more broadly (in other thematic contexts) but, where possible, also as a stand-alone theme for funding.

The workshop identified three gaps that need to be filled by appropriate priority actions to develop and grow funding opportunities. These are:

- Enhanced regional collaboration and coordination, and mapping of capacity and capabilities that already exist, to generate a firm basis from which to develop regional proposals for funding.
- Developing a step-wise regional strategy to scaling-up funding, facilitated by WIOMSA, as developing capacity and coordination that might go hand-in-hand with increasing funding.
- Work to mobilize increased resources from different sources, especially but not exclusively multi-lateral (e.g. the Global Environment Facility) and regional, towards building capacity in order to monitor ocean acidification and the advancement of strong science-policy-society communications and interactions.

3.2 Science gaps and associated priorities for action

The diversity of the region makes science and coordination difficult. This includes diversity in terms of economic development and population. The example of Seychelles was given, where it has a small population but is healthy economically, whereas Tanzania's population is large but economic development is not as advanced. This diversity discourages collaborative science which is exacerbated by a lack of trained capacity in the region – even if the money becomes available, there is currently few experts capable of doing the work. Supporting and enhancing basic coordination and awareness across the region is key, as researchers in the region need to know where to look for funding, and greater clarity should accordingly be developed as to which institutions are, could, and should be doing ocean acidification research. In addressing this problem, it will be important to be pragmatic and understand the limitations of the respective institutions.

Maintaining high tech equipment is expensive. It is not enough to simply supply research equipment to study ocean acidification, but plans must be in place to maintain the equipment over time and support the underlying capacity needs. The costs associated with research vessels are extremely high and beyond the capacity of most countries in the region. It will also be important to develop and strengthen quality control and reliable data in the region. Assistance may also be needed in providing certified reference materials to ensure data quality control. A key step is therefore to promote an increase in regional collaboration to

study and address ocean acidification. This collaboration will need to be multifaceted as it needs to focus on not just natural sciences, but also the economic and social sciences. In developing such an approach, it will be important to ascertain which economic sectors and/or industry players are likely to experience a significant impact due to ocean acidification.

Support to assist scientists to publish their research in peer-reviewed journals should be considered. This may involve helping with revising papers, language translation, or the preparation of 'special issues'. In all the above, it will be important to plan for the development of some centres of excellence and identify highly respected leaders/champions from the region, willing to promote and advance ocean acidification science.

The workshop identified six interrelated gaps that need to be filled by appropriate priority actions to develop and grow the science base. These are:

i. Networking and capacity development

Priorities

- Undertake a baseline literature review, to establish what is known about ocean acidification in the region. The white paper is a good start and an ongoing process that could support this.
- Develop the regional network on OA to strengthen opportunities for cooperation and collaboration. An immediate benefit would be sharing information generated by others. This action is fundamental for capacity building intended to create a core group in the region to help each other, to generate funding proposals, and publish together: six countries currently collaborate but it is important to bring more countries on board especially for monitoring.
- Strengthen partnerships between chemists and biologists working on ocean acidification in the region.
- Develop capacity for open sea work.
- Work to remove obstacles to encourage talented students to undertake research – only Kenya (via CORDIO) and South Africa have reached a level where modelling can occur coherently.
- Develop a science exchange programme between key facilities in countries across the region.
- Develop a protocol on publishing scientific results so this occurs in a timely manner – this will help scientists to get an idea about activities happening in terms of ocean acidification in their country (what has been done).

ii. Regional standardization and training

Priorities

- Strengthen inter-country collaboration to deliver a common approach, methods and research focus, especially monitoring and data standards to enable regional comparisons.

- Identify priority taxa to enable similar species and groups to be investigated in different experiments and observations across the WIO. The use of common groups and taxa should not hinder research interests but is clearly advantageous in building the regional perspective on impacts and effects of ocean acidification. Selection of species would need to take account of:
 - their economic and ecological significance and importance;
 - their role as keystone / sentinel ecosystems and species;
 - expanding from characteristic species currently used in experiments to species important at other trophic levels in ecosystem components, e.g. phytoplankton;
 - consideration of the inclusion of groups or taxa whose presence can decrease or help ameliorate ocean acidification impacts and effects, e.g. blue carbon, carbonate accreting organisms.
- Develop best practices for the region with a focus on biological experimentation (best practices appropriately adapted to the region).
- Strengthen consistent data validation approaches through GOA-ON training.
- Develop quality control (QA/QC)/inter-comparisons assays between labs, not only regionally but also internationally.
- Expand the current regional focus of research from key benthic species (i.e. corals, seagrasses, etc.) to exploring the effects on pelagic species as well (e.g. copepods, pteropods). This should include developing regional training on how to study pelagic species.
- Develop regional investments in training the next generation to expand regional capacity in OA, rather than relying on the few existing experts.

iii. Equipment and facilities

Priorities

- Improved methods of accessing and sharing data across WIO countries including support for regional assessments.
- Improved accessibility of regional and national oceanographic scientific data. Grow capacity building and tools (i.e. GOA-ON in a box) to undertake experimental studies and basic carbonate chemistry (capacity building is needed, mainly for precision and accuracy of measurements).
- Develop capacity and experience in developing and deploying basic impact assessment tools.
- Gain access to tools to simulate pH.

iv. Ocean acidification literacy

Priorities

- Develop greater awareness and understanding at governmental level about the threats and consequences of ocean acidification in order to support new programmes and priorities.

- Introduce specific training on ocean acidification-related topics as it is somewhat hidden in broader chemistry and marine science themes. Ocean acidification needs to be packaged as a module; ocean acidification literacy needs to be integrated at undergraduate level and introduced as part of educational programmes at local level.

v. Integration with sectors

Priorities

- Work with economically important users, biodiversity authorities, national institutes, universities and governmental agencies. For example:
 - enhance cooperation with government departments, agencies, ocean users and industry to develop partnerships and increase the scale of sustained observations e.g. the Southwest Indian Ocean Fisheries Commission and FAO projects.
 - create initiatives at the national level to integrate Marine Protected Areas (MPAs) monitoring and surveillance and natural parks into the GOA-ON ocean acidification network to provide reference sites that put in context changes in the broader coastal and open ocean environment.

vi. Development and utilization of the regional and global ocean acidification observing networks

Priorities:

- Expand participation in OA-Africa hub affiliated to GOA-ON (see section 4 below) to develop the monitoring network - such that all countries with a coast have scientists participating in the programmes. Regional scientists can benefit from the Ocean Acidification Information Exchange (OAIE ; www.oainfoexchange.org/) online platform to communicate with each other and with the broader OA community and regional hubs to learn from their experiences and stay updated about the latest OA news in the region and elsewhere. The OAIE is an online platform for professionals (scientists, policymakers, public) involved with or interested in the topics of ocean and coastal acidification (OCA).
- Develop and make better use of collected and network data to understand natural variability and the offshore to inshore conditions across the region.
- Integration of data collection efforts with broader society including industry and citizen science.

3.3 Communications and outreach gaps and associated priorities for action

Communication and outreach are the fundamental linkages between scientific knowledge, policy and action. Even with excellent science, little impact will be realised without effective communication.

Reaching the hearts and minds of people is a route through which the political arena and private sector can be activated to invest in science and their futures. Repositioning the arguments around ocean acidification to set them in the context of the private sector and

entrepreneurs will be critical in achieving greater and deeper engagement from those sectors. Building a solution-based agenda into which they can invest in a positive way will be a key part of the communication agenda moving forwards. Alongside this, using communications to build stronger alliances with sympathetic, like-minded sectors, such as the mangrove and broader blue carbon communities, will facilitate greater grass-roots support and faster implementation of some of the underlying science needs.

New communication routes should be explored to achieve greater impact and effect, including music, tradition, story-telling and the use of on-line games. On-line social media should be explored as a key route to connecting ocean acidification concerns with vulnerable coastal communities.

Investing in effective communication is to invest for action. Every effort should be made to build on existing capabilities and opportunities such as training and education initiatives e.g. 'acid ocean'¹. Understanding the audience and tailoring the message is critical. The challenge is to prioritize the audience that needs to be targeted, which can range from young children to teachers, the public, politicians, fishermen and industry.

The workshop identified four communications-related gaps that need to be filled by appropriate priority actions. These are:

i. Nature and focus of the messaging

Priorities:

- Understand the audience that you are communicating with - level of education, age, etc.
- Use language that the specific audience can relate to i.e. English, French, Portuguese, French, Swahili, Xhosa, Afrikaans, Zulu, Malagasy, Seychelles Creole, Mauritian Creole, Shangani.
- Translation of scientific information to policy language including highlighting the benefits in terms of economic value.
- Take advantage of opportunities such as World Ocean Day to demonstrate ocean acidification impacts, e.g. arranging boat rides and showing effects of ocean acidification and coral bleaching.
- Ensure that at National Government level the climate change strategy aligns with the regional climate change strategy (i.e. Nairobi Convention).
- Decisions of the Conference of the Parties of the Nairobi Convention feed into policy and capture the input from as broad an expertise as possible.
- Engage with key journalists to ensure accurate messages are conveyed as widely as possible.

¹ See an introduction at <https://www.youtube.com/watch?v=yQuTjRh18-8>

ii. Regularising science / policy exchanges

Priorities:

- Communication between scientists and policy makers to ensure:
 - Scientists are speaking with one voice.
 - It is understood that there are currently insufficient human resources to address challenges posed by OA.
 - The need is recognized to establish a science hub to promote a more coordinated approach to linking with government.
 - Development of a synthesis paper for the WIO region by the hub to promote coordination among scientists in the region and to attract funds to the region.
 - Invitation of representatives from policy-making bodies to participate in scientific meetings – this could be through the Nairobi Convention Science-Policy Platform and replicating such platforms at national level.
 - Policy briefs are developed by well-trained scientists.
 - The economic impact of ocean acidification is clearly articulated.
 - Demonstration of support in reporting on SDG 14.3.

iii. Ocean acidification literacy and accessibility

Priorities:

- Communication with the public - simplification of results and dissemination to the public to explain concerns about ocean acidification in language that they can understand. Making information accessible to the different groups of stakeholders.
- Provide training for journalists on environmental issues to promote dissemination of information – ocean literacy for journalists.
- Develop an easy-to-understand definition of the term ocean acidification to help as many people as possible to understand the implications.
- Use Social Media e.g. Twitter, Facebook, Animations to showcase the work and issues involved.
- Greater input is required from all countries to the ocean acidification white paper which is currently in draft form.

iv. Ocean acidification communication champions

Priorities:

- Enlist public figures such as singers, politicians, religious leaders, community leaders, sports personalities as champions of ocean acidification awareness raising efforts.

- Create effective forums for linking scientists with the policy/decision makers.
- Develop more effective communication structures and better follow-up of actions.
- Create adequate resources to communicate effectively and engage the community.
- Target schools to educate the students who are the future and of the importance that they understand the concepts at an early age – include ocean acidification in school curriculum.
- Develop material for children e.g. books and competitions for children to showcase their understanding of ocean acidification. At regional level, develop writing and drawing competitions for children and reward winners e.g. at WIOMSA symposium.

3.4 Policy gaps and associated priorities for action

Throughout the WIO region, there is an urgent need to achieve greater progress through more effective integration of the science and knowledge on ocean acidification with policy measures and action to achieve the sustainable use of ocean resources. The 2030 SDG Agenda, and in particular the target 14.3, seeks to ‘Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels’ providing the political framework to improve ocean acidification observation and scientific cooperation. There are a variety of ways through which this can be achieved.

The workshop identified six gaps that need to be filled by appropriate priority actions. These are:

Policy relevance and recognition

Priorities:

- Ensure ocean acidification is tied to country reporting on SDG 14.3 and thus ocean acidification can be related to the SDGs, e.g. food security affected by ocean acidification.
- Relate ocean acidification to marine resources that are of importance nationally and regionally.

Policy commitments

Priorities:

- Ensure that ocean acidification issues are adequately captured in policy frameworks. Where policy may exist, action is limited - what should be done (implementation) on ocean acidification is not clear. Scientists should provide guidance on implementation.
- Creating a standalone policy on ocean acidification is difficult to achieve, therefore there is a need to link and integrate it to policy on Climate Change, Blue Economy, and

Marine Spatial Planning. Ocean acidification is a variable in climate change and the Blue Economy.

- Complete the ocean acidification white paper so that it can be of utility in the region and also provide a basis for further engagement.
- Strengthen the focal point mechanism for various SDG indicators in the countries of the region – in some instances, the focal points to report to are not known.
- Develop national data management policies.
- Revise policies in some countries that may make it difficult to share data.
- Enlarge MPAs & full protection zones in MSPs to protect some areas against ocean acidification and other stressors.

Policy linkages

Priorities:

- Relate ocean acidification to marine resources that are of importance nationally and regionally.
- Harmonize policy and reporting lines between national ministries and departments for a more coordinated approach in reporting on ocean acidification.
- Emphasise connectivity of the systems and habitats, including land-sea interactions, ensuring that OA is recognised as a regional problem requiring regional policy formation.

Awareness and literacy

Priorities:

- Agree a simple definition of ocean acidification at national and regional levels to ensure a common understanding of the need for policy on ocean acidification in the region.
- Translate scientific information into policy language. Policymakers should be able to see the benefit in terms of economic value.
- Improve policy on data accessibility and sharing - National Bureau of Statistics could be useful for data sharing. Oblige scientists to submit their data to national data centres.

Public / private partnerships

Priorities:

- Develop a Public-Private Sector Partnership Memorandum of Understanding to support ocean acidification activities at national and regional levels.

Training and capacity building

Priorities:

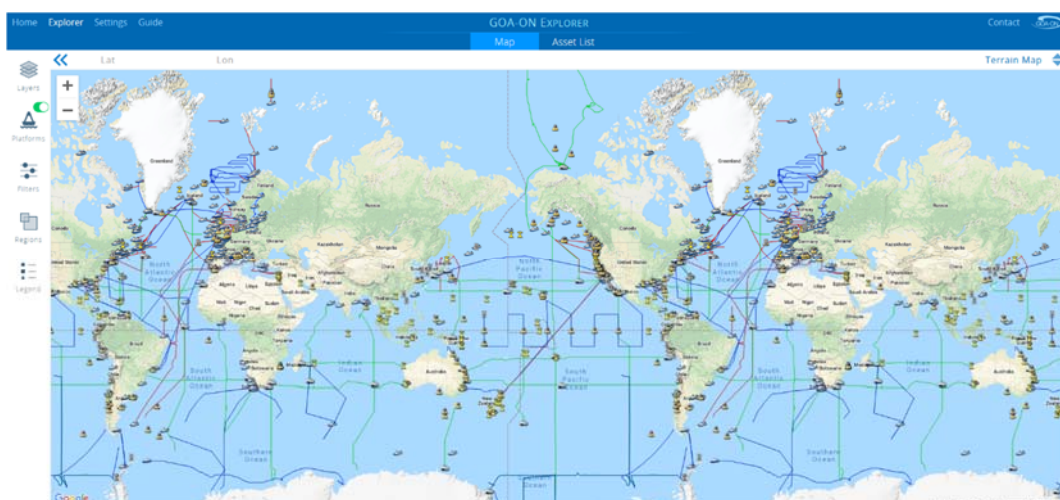
- Establish a WIO Ocean Science hub to support OA initiatives, and map who is doing what in the networks – funds will need to be sourced to support a regional meeting for hub establishment.
- Require schools and universities to integrate ocean acidification into curricula.
- Include pH and carbonate chemistry to the list of variables that should be measured by governments as part of their current environmental monitoring policies.

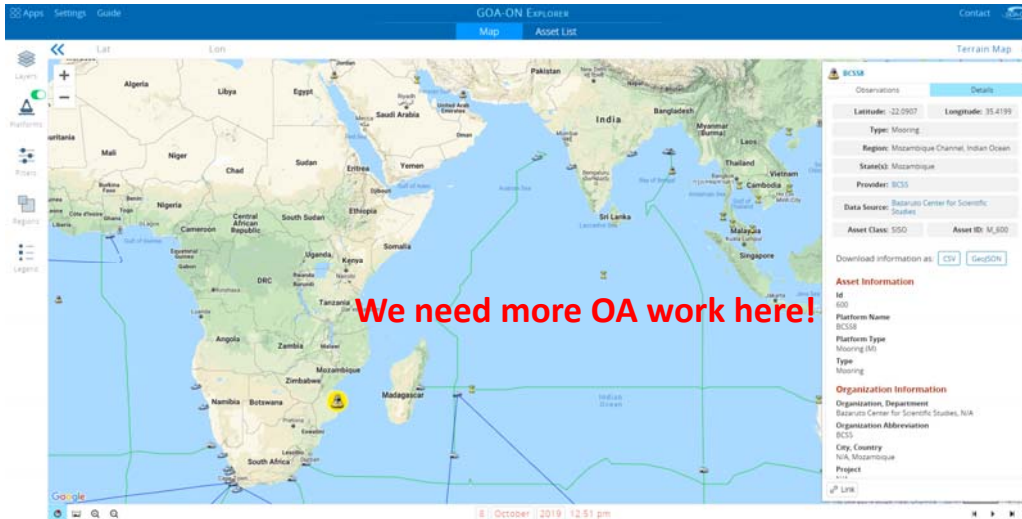
4. Strengthening the OA Africa Global Ocean Acidification Observing Network (GOA-ON) networking and getting involved

✓ Why is it important to join GOA-ON?

GOA-ON is a collaborative international partnership composed of 730 scientists from 100 countries in 2020 (<http://www.goa-on.org/>). The network's vision is to share ocean acidification expertise, data, and information, to ultimately provide the world with: 1) a scientifically valid status of ocean acidification in open-ocean, coastal, and estuarine environments, 2) an understanding of its drivers and impacts on marine ecosystems, and 3) forecasts on local scales around the world.

Joining the GOA-ON community would give you the opportunity to be informed and updated about the latest scientific publications, events, announcements and resources related to ocean acidification via our international network, and through our regular newsletters and website updates. In addition, you will have the opportunity to join the Pier 2 Peer mentorship programme and access to small Pier 2 Peer research grants to foster collaborations across national boundaries (<http://www.goa-on.org/pier2peer/pier2peer.php>). GOA-ON also provides resources for United Nations Sustainable Development goal 14.3.1.





✓ **Why is it crucial for Western Indian Ocean countries to join OA-Africa?**

Ocean Acidification Africa (OA-Africa) is a network established to coordinate and promote ocean acidification awareness and research in Africa. This network is a regional hub of the GOA-ON and is composed of more than 100 members including scientists, graduate students, technicians, and managers working or interested in ocean acidification observations across the African continent.

OA-Africa aims to:

- Ensure Africa is resilient and knowledgeable of potential threats and mitigation/adaptation strategies available to combat ocean acidification.
- Develop a network of scientists working together to provide: (1) information to stakeholders and policymakers, (2) provide guidance and direction, (3) coordinate activities related to ocean acidification research and monitoring, (4) identify broad support for increased ocean acidification research and monitoring, and (5) promote the advancement of science.
- Facilitate collaboration between scientists, stakeholders, and policymakers to build understanding of social, biological, and physical impacts and implications of ocean acidification.

✓ **How to join OA-Africa?**

In order to join the hub, it is recommended to become a member of the GOA-ON community through the GOA-ON website: <http://www.goa-on.org/members/join.php>

Then you can contact one of OA-Africa's co-chairs via e-mail, introducing yourself, your scientific background, study area, institution and country:

Nayrah Shaltout (Egypt): nshaltout@gmail.com

Roshan Ramasseur (Mauritius): ramessur@uom.ac.mu

Sheck Sherif (Liberia): sheck.sherif@gmail.com

For any other information about GOA-ON, please consider checking our website and/or contacting our secretariat:

Michael Acquafredda (michael.acquafredda@noaa.gov)

Katherina Schoo (k.schoo@unesco.org)

5. Funding gaps against priorities

In the following three tables we have attempted to summarize potential funding gaps for science, policy, and communications priorities identified in this report. As part of this, we looked at multilateral, regional, national and other funding sources. Then for each priority we looked at history and alignment to give the seeker of funds some idea of probability on a scale of 5 to 1, where a 5 is likely, and a 1 is an unlikely funder. We also left an “Internal Funding” column to remind each project proponent that some priorities may lend themselves to internal or pre-existing funding.

Matrix on Funding and Science Priorities	Funding										Internal (i.e. does not require additional or outside funding)	
	Multilateral Funding					Regional Funding		National Governments	Sub-National Governments	Private Sources		Philanthropy
	World Bank	Green Climate Fund	Global Environment Facility	USAID, SIDA, and other Foreign Direct Assistance Funding	WIOMSA	Africa Development Bank						
Literature Review	4	3	3	3	3	2	3	3	4	4		
Baseline on Ocean Acidification (1)	2	5	4	5	3	2	3	2	5	5		
Needs Survey (2)	2	4	3	4	3	2	2	3	4	4		
Survey of who is doing what? (3)	2	4	3	4	3	2	2	3	4	4		
Capacity Building (4)	3	5	4	5	3	2	3	3	3	3		
GOA-ON in a Box kit distribution	3	4	4	4	3	2	2	2	3	3		
Advanced Training	3	4	3	4	3	2	2	2	3	3		
Establish institutions/ Degree Programs and Provide Students and Teachers Support (5)	3	3	3	3	3	3	2	2	4	4		
Data (6)	2	5	4	5	3	2	3	2	5	5		
Mobilize Existing Capacity and Opportunities (7)	3	3	4	3	3	2	4	3	4	4		

Footnotes:

- (1) Baseline studies should include offshore and nearshore data
- (2) Survey needs include threatened flora and fauna, threatened habitats and Bio-region changes, primary production effects/key food chain organisms, finding links between science and industry needs, and national priorities. Biological studies on economically, ecologically, and culturally valuable species.
- (3) It is necessary to understand who can champion ocean acidification (chemistry and biology), what equipment is needed, if external research vessels are needed, challenges for institutions, collaboration opportunities, and existing networks.
- (4) Training should consider standard methods, best practices, software, language. Creation of regional training and equipment hubs.
- (5) Programs should support long-term monitoring, quality control, causes studies, impact studies, and modeling studies. Pier-to-Pier Fellowships.
- (6) Data needs include collection, sharing, analysis, and publication.
- (7) Ocean acidification research and literature should be integrated into other large projects, as well as provide synergy effects with other cumulative stressors. This should include adaptation and mitigation (in industry).

The scale would be as follows:

- 5 = they have funded Ocean Acidification (OA) work in this category before.
- 4 = it aligns very well with their stated strategy and OA or at least ocean and carbon are listed in their strategy.
- 3 = they have funded this type of work but it's unclear if they have a focus on OA.
- 2 = there is some general thematic alignment but there is no explicit mention of OA/ocean climate or there is no explicit mention of this type of work.
- 1 = limited/no alignment, very unlikely to be a funder for this activity.

Matrix on Funding and Communication Priorities	Funding											
	Multilateral Funding					Regional Funding		National Governments	Sub-National Governments	Private Sources	Philanthropy	Internal (i.e. no outside funding)
	World Bank	Green Climate Fund	Global Environment Facility	USAID, SIDA and other Foreign Direct Assistance Funding	WDMISA	Africa Development Bank						
Communications	Message Development (1)	3	3	3	3	4	2	3	3	5	5	
	Research to identify Messengers (2)	2	2	2	2	2	1	2	2	4	4	
	Research to identify the Audience	2	3	2	2	2	1	2	2	4	4	
	Research to identify the Effective Means	2	3	2	3	3	2	3	3	5	5	
	Communications Production	3	2	3	2	3	1	3	3	5	5	

Footnotes:

(1) Message development should include the nature of our message; our ask; and ways to combine with other climate issues.

(2) Consider who is emotionally motivated to communicate and the types of messengers available.

The scale would be as follows:

- 5 = they have funded Ocean Acidification (OA) work in this category before.
- 4 = it aligns very well with their stated strategy and OA or at least ocean and carbon are listed in their strategy.
- 3 = they have funded this type of work but it's unclear if they have a focus on OA.
- 2 = there is some general thematic alignment but there is no explicit mention of OA/ocean climate or there is no explicit mention of this type of work.
- 1 = limited/no alignment, very unlikely to be a funder for this activity.

Matrix on Funding and Policy Priorities	Funding												
	Multilateral Funding					Regional Funding			National Governments	Sub-National Governments	Private Sources	Philanthropy	Internal (i.e. no outside funding)
	World Bank	Green Climate Fund	Global Environment Facility	USAID, SIDA, and other Foreign Direct Assistance Funding	WIOMSA	Africa Development Bank							
Policy Development Strategy (1)	4	3	4	5	5	3	3	3	3	5	5		
Policy Development Levels (2)	3	3	4	4	4	2	3	3	3	5	5		
Categories of Policy Development (3)	4	3	4	5	5	3	3	3	2	5	5		

Footnotes:

(1) Develop a Strategy/Platform to Facilitate Policy Development; Develop a Policy Brief on Ocean Acidification; Training and Capacity Building for Politicians/Decision-makers

(2) Regional and National Policy Development

(3) Support for Research; Adaptation; Mitigation; and Public Education. Or comprehensive (including research, adaptation, mitigation and education).

The scale would be as follows:

5 = they have funded Ocean Acidification (OA) work in this category before,

4 = it aligns very well with their stated strategy and OA or at least ocean and carbon are listed in their strategy,

3 = they have funded this type of work but it's unclear if they have a focus on OA,

2 = there is some general thematic alignment but there is no explicit mention of OA/ocean climate or there is no explicit mention of this type of work,

1 = limited/no alignment, very unlikely to be a funder for this activity.

6. Funding opportunities from the IAEA

The IAEA has a portfolio of projects related to ocean acidification with several mechanisms to engage: IAEA Technical Cooperation projects, and the IAEA Ocean Acidification International Coordination Centre.

The IAEA Technical Cooperation (TC) Programme

The technical cooperation programme is the IAEA's primary mechanism for transferring nuclear technology to Member States, helping them to address key development priorities in areas such as health and nutrition, food and agriculture, water and the environment, industrial applications, and nuclear knowledge development and management. The results based programme aims at achieving tangible socioeconomic impact by contributing directly in a cost-effective manner to the achievement of the major sustainable development priorities of each country, including relevant nationally identified targets under the Sustainable Development Goals (SDGs).

Information on how the TC programme works and how to participate: <https://www.iaea.org/services/technical-cooperation-programme>

An African TC project (RAF7014) on ocean acidification is coming to an end at the end of 2019. Submission of new proposals for regional projects for the next TC cycle (projects to begin in 2022) should be submitted before spring 2020 (the exact deadline will be communicated in January 2020).

The IAEA Ocean Acidification International Coordination Centre (OA-ICC)

The IAEA Ocean Acidification International Coordination Centre ([OA-ICC](#)) promotes international collaboration on ocean acidification. The OA-ICC organizes training courses in Member States and provides access to data and resources to advance ocean acidification research. The Centre promotes the development of data portals, standardized methodology and best practices. The OA-ICC works to raise awareness of the issue among various stakeholders and inform about the role that nuclear and isotopic techniques can play in assessing its impacts. To achieve these objectives, the OA-ICC works with many international partners and supports global and regional ocean acidification networks, including the [Global Ocean Acidification Observing Network](#).

The OA-ICC's activities can be divided into three categories: advancing OA science, capacity building, and outreach/communication:

Advancing ocean acidification science

The OA-ICC supported the creation of the Global Ocean Acidification Observing Network (GOA-ON), and has also supported the regional hubs of this global network, including OA-Africa. GOA-ON aims to increase ocean acidification observations in areas where data is currently scarce, including in the Western Indian Ocean. Other OA-ICC scientific activities include the organization of expert workshops on topics such as the management and access to global ocean acidification data, the development of best practices and the standardization

of methodology to increase inter-comparability of results. The OA-ICC also provides online open access resources such as the [OA-ICC news stream](#), a [bibliographic database](#) with nearly 6,000 references related to ocean acidification, and a [compilation of ocean acidification experimental data](#).

Capacity building

The OA-ICC, together with many international partners, organizes training courses on ocean acidification, tailored to participants' needs and using the latest methodology, best practices and available resources. Through these, scientists with backgrounds in biological, geological, and chemical oceanography are able to get a more holistic vision of the field. Courses include theoretical aspects, as well as practical, hands-on components relating to sampling, measurements, and experiment design. The importance of data archiving and sharing is also stressed. New capacity building activities are shared through the OA-ICC News Stream, and through GOA-ON. Interested scientists should consider becoming a member of the GOA-ON [here](#) in order to stay up to date on these activities.

Outreach and communication

The OA-ICC and partners actively work to raise awareness about ocean acidification at international fora such as the United Nations Framework Convention on Climate Change (UNFCCC) Conferences of the Parties (COP) and the Sustainable Development Goal (SDG) process. The OA-ICC is also involved in the [Community of Ocean Action on Ocean Acidification](#), where groups around the world have submitted over 260 Voluntary Commitments related to ocean acidification. OA-Africa recently submitted a Voluntary Commitment, found [here](#). Other interested groups working on ocean acidification should consider submitting a VC in order to gain visibility.

Any opportunities for ocean acidification trainings, support to attend conferences, and participation in research projects such as IAEA Coordinated Research Projects are communicated through the OA-ICC news stream and/or relevant regional hubs. Please [subscribe to the news stream](#) for regular information on these opportunities (from IAEA and partners).

7. Funding opportunities from The Ocean Foundation

Through its International Ocean Acidification Initiative, The Ocean Foundation has trained more than 200 scientists and policymakers, developed low-cost monitoring tools, designed a guidebook for legislation (<https://oceanfdn.org/oa-guidebook>), and helped establish 17 new monitoring programs.

The Ocean Foundation is working to establish a network of regional and national centers of excellence on ocean acidification monitoring, mitigation, and adaptation (including continued support for OA-Africa). The Ocean Foundation can support capacity development by replicating its cost-effective and efficient delivery of training and technical assistance, such as:

- Establish and strengthen monitoring capacity through the provision of technical training and monitoring equipment. The Ocean Foundation could help establish regional training hubs with regular workshops, assist nations and regions with monitoring plans, facilitate

the customization and delivery of low-cost equipment, and provide a platform for ongoing involvement.

- Provide legal drafting expertise for international, regional, national, and sub-national policies to address ocean acidification. The Ocean Foundation has prepared draft legislation on ocean-related policies and tailored the draft legislation with consideration to needs, contexts, and governance structures. On 8th January 2020, The Ocean Foundation will share a Guidebook on legislation to address ocean acidification.
- Establish a global partnership to test adaptation and mitigation strategies. Many of the most promising tools for adapting and mitigating ocean acidification remain largely untested; or, remain too expensive to implement at scale. The Ocean Foundation could coordinate a global partnership to test promising adaptation and mitigation methods. This partnership would look at the efficacy of different methods in a variety of geographies and ecosystem types.

As a result of being a trusted consultant, facilitator, researcher, and collaborator, we are proud to be able to provide the public thorough collection of key publications that have guided our work. The research page can be found at: <https://oceanfdn.org/ocean-acidification/>

How to seek funding:

All of our grantmaking is inherently donor-driven, therefore we do not maintain a generic open request for proposals, and instead we only solicit proposals for which we already have an interested donor in mind. While we do not accept unsolicited funding requests, if your organization would like to submit a one-page letter of inquiry, please write to our Grants Manager, Alyssa Hildt (ahildt@oceanfdn.org). If we have a funding source that is a good fit for your project, we will contact you with more information, and possibly solicit a full proposal at that time.

8. Voluntary contributions

TOF Voluntary Commitments

The Ocean Foundation sees an opportunity for commitments at the regional level to support capacity development, establish a network of national and regional centers of excellence on ocean acidification monitoring, mitigation, and adaptation. This could potentially be accomplished through a Memorandum of Understanding with WIOMSA and the Nairobi Convention. The goal is to facilitate collaboration to address ocean acidification and related issues within the Western Indian Ocean Region.

A Memorandum of Understanding may include the development and implementation of joint strategies and pilot projects. Such projects include the renewal and expansion of current ocean acidification monitoring capacity. The Ocean Foundation could gift “GOA-ON in a Box” kits to qualified institutions in partnership with capacity building or other advanced training. Once a method proves effective, the partnership could create practical, low-cost guidelines and systems for implementation. For example, the Pier-2-Peer programme, a scientific

mentorship program, can expand cooperation and facilitate knowledge exchange. The Ocean Foundation can supplement this program through scholarships and travel awards.

The Ocean Foundation has extensive experience providing regional policy training on ocean acidification. As a follow on to legal drafting, The Ocean Foundation can provide one-on-one coaching from the experts who have drafted and successfully passed ocean acidification legislation using our model or template law from best practices.

9. Next steps

- To identify OA scientists in each country of the region and start the first cooperation through an online survey that would help identifying “Who’s doing what?” in each country, the type of expertise of every scientist, the tools and methodologies used for OA monitoring, and the data collected so far by the OA community of the region.
- Based on the survey, a white paper could be written between scientists of the region, or the existing white paper strengthened. This paper should consider the capabilities of each country’s researchers/technicians/research centres in order to get regional (WIOMSA) and international (IAEA, IUCN, TOF, etc.) funds.
- Working on the sustainability of the funds in order to build a time-series OA monitoring network in the region, supported nationally as well by the involved countries.
- A common regional data centre to compile the data collected regionally through regional projects.
- Involvement of all the scientists as co-authors in the resulting reports and peer-reviewed articles to give the appropriate credits to all those involved in the OA work.
- Alongside these steps, preparation of an OA Action Plan for the WIO for consideration by the Conference of Parties to the Nairobi Convention at a future meeting.

Annex 1: Workshop agenda

AGENDA

Sunday 27th October

Arrivals day

Monday 28th October

- | | |
|-------------|---|
| 0830 | Arrivals and workshop participant registration |
| 0900 – 0915 | Welcome (David Osborn, IAEA and Dixon Waruinge, Nairobi Convention) |
| 0915 – 1030 | Round table introductions (who you are and where you come from) |
| 1030 – 1040 | Scene setting for the meeting (Dan Laffoley IUCN) |
| 1040 – 1111 | Refreshment break and group picture (20 minutes) |
| 1111 – 1130 | Background and latest science on ocean acidification (Jason Hall-Spencer) |
| 1130 – 1150 | Regional White Paper on Ocean Acidification (Julius Francis, WIOMSA) |
| 1150 – 1210 | The Latin American and Caribbean Ocean Acidification Action Plan (Francisco Arias, Invemar) |
| 1210 - 1230 | Building the GOA-ON approach (Abed El Rahman Hassoun, GOA-ON) |
| 1230 - 1300 | Questions and discussion |
| 1300 – 1400 | Buffet lunch |
| 1400 – 1415 | Instigating OA policy development (Mark Spalding, Ocean Foundation) |
| 1415 – 1430 | Explaining the working group process to develop the Action Plan priorities (Dan Laffoley/John Baxter, OAiRUG) |
- We will divide into four discussion groups each will have two animateurs from the meeting organising and delivery group and each workshop discussion group will elect someone to report back and maybe someone chair if they wish
- Group 1 Thomas Sberna/David Osborn
Group 2 Abed El Rahman Hassoun/Francisco Arias
Group 3 Julius Francis/James Oliver
Group 4 Jason Hall-Spencer/Tim Andrew
- Each group to record key priorities on PowerPoint under the main themes of the Action Plan – material from Colombia plan should help inform thinking on what priorities may be for each session
- | | |
|-------------|---|
| 1430 – 1630 | Working groups discussions on the regional ocean acidification action plan – session 1: Funding and science gaps and associated priorities for action |
| 1630 - 1730 | Reporting back from discussion groups (15 minutes each) |

1800 Close and return to hotel
1930 Welcome cocktail
2000 – 2200 RUG Dinner at hotel

Tuesday 29th October

0830 Arrivals at venue and coffee
0900 – 1100 Working groups discussions on the regional ocean acidification action plan – session 2: Communications and outreach gaps and associated priorities for action
1100 – 1130 Refreshment break
1130 – 1230 Working groups discussions on the regional ocean acidification action plan – session 3: Policy gaps and associated priorities for action
1230 – 1400 Buffet lunch
1400 – 1500 Report backs from the four discussion groups (15 minutes each) and reflections
1500 - 1730 Next steps and publication process of the regional action plan /meeting close
2000 – 2200 Free evening

Wednesday 30th October

Departure day

Annex 2: Workshop participants

Indian Ocean Regional Workshop on Ocean Acidification, October 28-29, 2019, Zanzibar, Tanzania					
	Name	Country	Position/role	Organisation	Function
1	Dixon WARUINGE	Kenya	Head	Secretariat of the Nairobi Convention at UNEP	Co-host
2	Julius FRANCIS	Tanzania	Executive Secretary	WIOMSA	Co-host
3	Dan LAFFOLEY	UK	Marine Vice Chair, IUCN WCPA	IUCN	Facilitator
4	John BAXTER	UK	Chief Editor, Aquatic Conservation	IUCN	Facilitator
5	Jason HALL-SPENCER	UK	Professor of Marine Biology	Plymouth University	Facilitator
6	David OSBORN	Monaco/ France	Director, Environment Laboratories	International Atomic Energy Agency (IAEA)	Facilitator
7	James OLIVER	Switzerland	Senior Programme Officer	IUCN Global Marine & Polar Programme	Facilitator
8	Thomas SBERNA	Kenya	Regional technical coordinator	IUCN Regional Office for East & Southern Africa	Facilitator
9	Dr. Timothy ANDREW	Kenya	Policy and Governance Officer	Nairobi Convention	Organizer
10	Ms. Marlyn OMONDI	Kenya	Project Officer	Nairobi Convention	Organizer
11	Mathias IGULU	Tanzania	MASMA Manager	WIOMSA	Organizer
12	Abed El Rahman HASSOUN	Lebanon	Researcher	GOAON / National Council for Scientific Research in Lebanon	Invited speaker
13	Mark J SPALDING	USA	President	Ocean Foundation	Invited speaker
14	Mohamed MROIVILI	Comoros	Fisheries researcher	Ministry of Fisheries and Agriculture	Participant
15	Ms. Nassima Mmadi ISSA	Comoros	Officer	Centre Nationale de Controle at Surveillance de la Peche	Participant
16	Nayrah SHALTOUT	Egypt	Associate Professor	National Institute of Oceanography and Fisheries, Alexandria	Participant
17	Eric Ochieng OKUKU	Kenya	Senior Research Scientist	Kenya Marine and Fisheries Research Institute	Participant
18	Caroline MULINYA	Kenya	Lecturer	Masinde Muliro University of Science and Technology	Participant
19	Mercy Emojong AMAI	Kenya	Coastal Marine Officer	National Environment Management Authority	Participant
20	Josphine Mutiso WANZA	Kenya	Research scientist	Kenya Wildlife Service	Participant
21	Mr. Stephen KATUA	Kenya	Deputy Director, Coastal, Marine and Freshwaters	National Environmental Management Authority	Participant
22	Landison Andrianina RANDIMBISON	Madagascar	Park Director	Nosy Tanikely, Nosy Be, Madagascar National Parks	Participant
23	Mamy Nirina RAJAONARIVELO	Madagascar	Director and National Ocean Acidification project manager	National Center of Oceanographic Research (CNRO)	Participant
24	Bemahafaly RANDRIAMANANTSOA	Madagascar	Governance Coordinator, Marine Conservation Program	Wildlife Conservation Society	Participant

25	Dr. Paubert Tsimanaoraty MAHATANTE	Madagascar	Lecturer - Institute Halieutiques et des Sciences Marines- University of Toliara	University of Toliara	Participant
26	Kishore BOODHOO	Mauritius	Teacher	Chemistry dept University of Mauritius	Participant
27	Mrs. Anishta AUDIT-MANNA	Mauritius		Mauritius Oceanography Institute	Participant
28	Daniela de ABREU	Mozambique	Researcher and an Assistant lecturer	Eduardo Mondlane University	Participant
29	Sidónia Muhorro GUEZE	Mozambique	Environmental technician	Ministry of Land, Environment and Rural Development	Participant
30	Francisco ZIVANE	Mozambique	Researcher	National Institute of Fisheries Research	Participant
31	Jérôme HARLAY	Seychelles	Senior Lecturer & Researcher	Blue Economy Research Institute	Participant
32	Stefan R. KNIGHTS	Seychelles	Legal Draftsperson	Department of Legal Affairs	Participant
33	Ms. Sophie MOREL	Seychelles	Conservation Officer, Biodiversity Conservation Section	Ministry of Environment, Energy and Climate Change	Participant
34	Sean Nixon PORTER	South Africa	Scientist	Oceanographic Research Institute (Durban)	Participant
35	Riaan CEDRAS	South Africa	Regional scientist	University of the Western Cape	Participant
36	Dr. Warren JOUBERT	South Africa	Chief Marine Scientist	South African Weather Services (SAWS)	Participant
37	Abdul-aziz Alawy MUSSA	Tanzania	Fisheries and Marine Conservation Officer	Ministry of Agriculture, Natural resources livestock and Fisheries, Zanzibar	Participant
38	George RUSHINGISHA	Tanzania	Research Officer	Tanzania Fisheries Research Institute	Participant
39	Olivia John KALOKORA	Tanzania	Assistant Lecturer	Dar es Salaam University College of Education	Participant
40	Gloria Kavia YONA	Tanzania	Senior Fisheries Research Officer	Tanzania Fisheries Research Institute	Participant
41	Ismael KIMIREI	Tanzania	PI-OA	Tanzania Fisheries Research Institute	Participant

Annex 3: Membership of the four working groups

Group 1

David OSBORN
Thomas SBERNA
Sophie MOREL
Kishore BOODHOO
Olivia John KALOKORA
Sidonia MUHORRO GUEZE
George RUSHINGISHA
Josephine MUTISO
Caroline MULINYA
Nayrah SHALTOUT

Group 2

Abed El Rahman HASSOUN
Marlyn OMONDI
Eric O. OKUKU
Francisco ZIVANE
Ismael KIMIREI
Stefan KNIGHTS
Stephen KATUA
Anishta AUDIT-MANNA
Riaan CEDRAS
Landison A. RANDIMBISON

Group 3

Julius FRANCIS
James OLIVER
Nassima MMADI ISSA
Mohamed MROIVILI
Mark J SPALDING
Daniela de ABREU
Gloria YONA
Mamy RAJAONARIVELO
Jerome HARLAY
Warren JOUBERT

Group 4

Dixon WARUINGE
Tim ANDREW
Jason HALL-SPENCER
Mathias IGULU
Sean PORTER
Abdulaziz A MUSSA
Paubert MAHATANTE
Mercy Emogong AMAI
Bemahafaly RANDOIAMANANTSOA