

WORKSHOP REPORT

Enhanced Capacities of National Coral Reef Technical Members on Integrated Management of Coral Reef and Associated Ecosystem, Monitoring and Reporting of Ecosystem Health

April 2023



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Workshop summary and next steps

The Western Indian Ocean Coral Reef Task Force (CRTF) was created by the third meeting of the Conference of Parties of the Nairobi Convention for the Protection, Management, and Development of the Marine and Coastal Environment of the Western Indian Ocean (COP3) in 2001. Since then, the task force has been active in coral reef monitoring and reporting through the International Coral Reef Initiative (ICRI) and Global Coral Reef Monitoring Network (GCRMN) via the coral reef networks in the WIO.

Due to the COVID-19 pandemic the network has not been able to meet, so this workshop was held to revitalize and enhance capacities of the national coral reef task force members for the integrated management of coral reefs and associated ecosystems, monitoring, and reporting. Participants provided national, regional, and international updates related to coral reef monitoring and associated activities. After 3 days of active discussions on the elements of a regional action plan and terms of reference, the following key actions were highly recommended to:

- Strengthen coordination mechanisms.
- Improve fish methods and variables.
- Improve data management, sharing, reporting and communication.
- Promote coral reef restoration.
- Reactivate the GCRMN Socio-economic Monitoring (SocMon) Initiative in the WIO

The workshop outputs are summarized in this report and crafted into a Terms of Reference for a new Technical Working Group on Coral Reefs, to carry forward coral reef coordination in the WIO in coming years, and to support countries of the region in monitoring obligations for coral reefs under the Kunming-Montreal Global Biodiversity Framework agreed to at COP15 of the Convention on Biological Diversity in December 2022.

Background

The Western Indian Ocean (WIO) region comprises almost 6% (about 15,180 km²) of the total global area of coral reefs, and the region is a globally important hotspot for coral reef biodiversity. The WIO includes sovereign states along the eastern and southern African mainland (Somalia, Kenya, Tanzania, Mozambique, South Africa), island states (Mauritius, Madagascar, Comoros, Seychelles), as well as overseas territories (Reunion – France). The human population has grown considerably during the last century, with the states named now supporting approximately 220 million people, of which some 69 million live within 100 km of the coastline.

Coral reef ecosystems underpin the economies of the countries in the region, particularly through the fisheries and tourism sectors, and provide livelihood opportunities and income for local communities estimated at US\$ 8.4 billion annually. WIO coral reefs are estimated to have an asset value of US\$ 18.1 billion.

The coral reefs of the Western Indian Ocean have been found to be vulnerable to collapse within decades. Rising sea temperatures due to climate change, and overfishing, are the dominant threats to coral reefs of the Western Indian Ocean. The WIO region suffered the most from the global coral reef bleaching event in 1997- 1998, in which 30-50% of corals were estimated to have died. It was also affected by the third global coral bleaching event in 2016.

Retaining the integrity and resilience of coral reef ecosystems is a critical part of the solution for achieving Sustainable Development Goal 14 under the 2030 Agenda for Sustainable Development and applicable targets of the [Global Biodiversity Framework](#). Actions to protect coral reefs in the region will include alleviating fishing pressure through the co-management of small-scale fisheries, and the establishment of no-take areas for fishery replenishment. Embedding climate mitigation and adaptation as national priorities within development and planning frameworks will be a priority, including specific actions such as reducing stressors to coastal and marine systems and people linked to coral reefs. Another priority will be to increase support (funding and capacity building) for reef monitoring, towards restoration, conservation, and effective management of at least 30% of coastal and marine ecosystems.

The regional coral reef networks in the Western Indian Ocean have been active since 1999, coordinating and reporting on coral reef monitoring activities through the Coral Reef Task Force (CRTF) of the Nairobi Convention, and the Global Coral Reef Monitoring Network, with support from multiple sources. Most recently the networks have produced a regional status report (2017), reported the 3rd coral bleaching event (2018), and contributed to the global status report (2020), supporting regional engagement in the International Coral Reef Initiative.

Objectives

With a renewed focus on scientific support to policy through the [Science-Policy Platform of the Nairobi Convention](#) and the adoption of the Kunming-Montreal Global Biodiversity Framework in December 2022, a new phase of activities is being initiated with support from the Nairobi Convention. The hosting aim of this workshop was to revitalize and enhance the capacities of national Coral Reef Task Force technical members for the integrated management of coral reefs and associated ecosystems, monitoring and reporting on ecosystem health.

The specific objectives of the workshop were to:

- Establish a new workplan, including priorities for monitoring and use of data, and continued engagement in the Global Coral Reef Monitoring Network.
- Reconfirm coral reef monitoring tasks within the CRTF by confirming technical membership by country and roles, and coordination mechanisms.
- Strengthen data sharing and repository mechanisms for the regional Coral Reef Monitoring Network.
- Recognize the headline indicators and monitoring framework adopted for the Kunming-Montreal Global Biodiversity Framework, to identify mechanisms for supporting national coral reef management and reporting under the framework of the Nairobi Convention, Global Coral Reef Monitoring Network, Convention on Biological Diversity, and Sustainable Development Goals.

The workshop

The workshop was organized by CORDIO East Africa in collaboration with AIDE NGO, the Environment Ministry of Comoros, and the Nairobi Convention. It was held at the Retaj Moroni hotel in Comoros on March 1-3, 2023. The workshop was structured for those who could attend in person, allowing also for virtual participation for those who were unable to attend in person. It consisted of a combination of working sessions, open discussions, and presentations. The workshop's agenda and schedule can be found in Annex A (Table 1).

There were 40 attendees in total, either for the entire workshop or for selected sessions. Participants were nominated and selected from existing members of the Coral Reef Task Force (CRTF) and active national contributors to the WIO regional coral reef monitoring, as well as related coral reef networks and reporting procedures. Participants came not only from different organizations but also from nine different countries: Kenya, Tanzania, Mozambique, South Africa, Madagascar, Seychelles, Comoros, Mauritius, and Reunion. Refer to Annex B (Table 2) for a list of attendees.

Workshop plenary sessions

Introductory sessions

The workshop was officially inaugurated by the Comoros Minister of Environment, His excellency Houmadi Msaidie, who was joined by the Secretary of the Nairobi Convention Secretariat, Mr. Dixon Waruinge, as well as Mr. Said Ahamada (AIDE) and David Obura (CORDIO East Africa). The honorable minister was happy to host the event in Comoros Island where experts discussed collaborative efforts to protect WIO coral reefs, which many local populations depend on. The Nairobi Convention was also pleased to support this event where the regional network could be revitalized, new members' capacities could be strengthened, and unmet needs in the network could be revealed.

Country updates

Comoros

Monitoring is being conducted on three islands: Grande-Comore, Moheli, Anjouan. The technical team for the survey is implemented by various organizations from government institutions, universities, and non-governmental organizations (NGOs) at the local and island levels. Following the MoU signed in 2005 by AIDE NGO and the Environment Department, a charter was also signed in 2018 by the active entities to establish the National Coral Reef Network. In addition to monitoring, they also provide training, raise awareness through education, and manage some reefs. Monitoring and data collection has however been inconsistent across the islands over the past years. The next steps are to update the national charter to include new members, receive additional training in data analysis, develop working sessions for a national report, complete the national report's validation process, and disseminate the national report.

Kenya

Coral reef monitoring reported here began in the late 1980s with sporadic surveys in selected locations and expanded to more regular and long-term surveys in the 2000s. In the last decade, there has been a collaborative effort in monitoring from various government and non-governmental organizations, with Kenya Marine and Fisheries Research Institute (KMFRI), Kenya Wildlife Service (KWS) and CORDIO East Africa as the key institutions. Currently, there is a national coral reef assessment process that brings together different partners and key stakeholders to understand the resilience of coral reefs and what management recommendations should be made. However, a clear long-term monitoring strategy is still lacking, as the majority of grants are short-term, and location based. Inadequate capacity is also considered a challenge.

Tanzania

Coral reef monitoring in Tanzania is divided into five major zones: Zone 1 (Tanga), Zone 2 (Dar es Salaam), Zone 3 (Pemba and Unguja), Zone 4 (Mafia and Songosongo), and Zone 5 (Mafia and Songosongo) (Lindi and Mtwara). The monitoring is done using WIO GCRMN monitoring protocols. Tanzania's Marine Park

and Reserve Unit (MPRU) is the primary monitoring agency on the mainland, but other institutions, including universities and private institutions, have their own monitoring efforts on both the islands and the mainland. Capacity and resource requirements, such as data analysis and reporting expertise, and monitoring equipment, are among the major challenges that limit monitoring effort.

Mozambique

The Ministerial Decree of the Coral Reef National Strategy for Conservation and Management and the Ministerial Decree of the Coral Reef National Action Plan for North Mozambique (Nampula) provide a mandate for coral reef monitoring in Mozambique. These efforts include training technical staff on coral reef monitoring and other issues, as well as improving monitoring programs at different sites with the support of a regional team such as CORDIO. Additional initiatives under consideration include increasing monitoring capacity, purchasing monitoring gear, setting up a national database that could link to regional efforts, developing a monitoring plan, and drafting an implementation guide for the Coral Reef Strategy and Action Plan.

South Africa

Coral reefs cover about 40 km² in South Africa and extend along a 120-kilometer stretch of coastline. They are distributed in three main reef complexes: the Northern Complex, the Central Complex, and the Southern Complex. Annual monitoring has been carried out at a single site within four fixed transects marked with pins since 1993 by the Oceanographic Research Institute (ORI). The transects are photographed, and corals manually digitized before percentage cover, recruitment and mortality are quantified. Temperature at hourly intervals is also being monitored. Capacity and funding constraints are major challenges to monitoring. Future plans include expanding the monitoring to other sites, using more efficient methods, and monitoring other parameters like ocean acidification.

Madagascar

The Madagascar Coral Reef Network (MCRN) is the officially approved body for coordinating coral reef activities in Madagascar. The coordinating body includes the National Coordinator, Technical Secretary, substitute Technical Secretary, and a Technical Cell. Members of the network come from the government (Ministry of Environment and Fisheries), non-governmental organizations (NGOs), communities, and the private sector, among others. The network conducts remote sensing, coral transplantation, reef restoration, and community-based ecological monitoring. The network plans to set up a system for collecting data, a system for sharing, storing, and analyzing data, a system for reporting to policymakers and other users, and a system for writing policy briefs based on scientific publications. The challenges include data collection, analysis, and reporting capabilities, as well as funding constraints.

Mauritius

Mauritius is a Small Island Developing State (SIDS) with 150 km² of coral reef. The Marine Science Division (MSD) monitors and manages coastal marine ecosystems and resources for long-term conservation. The

Ministry has monitored coral reefs since 1992. The program is required to monitor the reefs' health over time. It has set up twenty-six monitoring sites around the island, covering the forereef, backreef, and inshore reef zones. In its ninth meeting on March 4, 2022, the Cabinet officially established the National Coral Reef Network (CRN). The CRN is coordinated and chaired by the Ministry of Blue Economy, Marine Resources, Fisheries, and Shipping and is comprised of over twenty members from various Ministries, National Coastal Guard, universities, fishermen and coastal communities, and other institutions. The CRN works with local stakeholders to improve and harmonize coral reef policies and institutional frameworks to support the nation's conservation goals.

Seychelles

The Government of Seychelles through the Seychelles Marine Spatial Plan (SMSP) has designated 30% of Seychelles EEZ as Marine Protected Area of which 15% are high biodiversity protection areas (Zones 1) and 15% are medium biodiversity protection and sustainable use areas (Zone 2) both of which coral reefs are protected. In addition, Seychelles has established a National Policy and Strategic Action Plan for the Conservation and Management of Coral Reefs, with implementation expecting to start in 2023. The action plan aims to establish an effective, transparent, and equitable governance structure for coral and coral reef protection, minimize local and national anthropogenic stressors, standardize coral reef monitoring and reporting, mainstream coral reef financing, and raise public and stakeholder awareness. In addition, the country is in the process of developing a proposal for funding from the Global Fund for Coral Reefs (GFCR) to establish long-term financing for the management of coral reefs through coral-positive initiatives, such as support for the coordination of a national coral reef network and Steering Committee for the implementation of the national coral reef policy.

Reunion

Monitoring programs have been set up in four different coral reef ecosystems on the west and southwest coasts of the island of Reunion: Saint-Gille, Saint-Leu, Etang Sale, and Saint-Pierre. The monitoring results indicate a distinct shift in algae/coral and coral species. Monitoring of coral reefs has been ongoing for about 25 years, and this monitoring has been relatively stable since 2005/2007. Finance for coral reef monitoring was also made more stable by a fixed annual allocation of Euros 50,000. The university and private company Entropie serve as a focal point and provide the country with consistent methodological and data validation. Reunion has also instituted a yearly national status report.

Other Presentations

Updates from ICRI

The International Coral Reef Initiative (ICRI, <https://icriforum.org/>) is a global partnership of nations and organizations working to protect coral reefs and related ecosystems worldwide. The Secretariat rotates among member countries and is currently led by the United States (through the US Department of State and National Oceanic and Atmospheric Administration (NOAA)). ICRI's 2021–2024 plan of action is

promoting coral reef resilience, reducing local threats, advancing science and technology, and growing the coral reef community.

Updates from GCRMN global

The Global Coral Reef Monitoring Network (GCRMN) is an operational network of the ICRI (<https://gcrmn.net/>). The GCRMN is a global network of coral reef scientists, managers, and organizations. It reports on global coral reef status and trends. It improves understanding of coral reef status and trends at global and regional levels, provides science-based recommendations in support of raising awareness, management, and policy development, facilitates greater use of coral reef data and builds human and technical capacity to collect, analyse and report biophysical and socio-economic data on coral reefs. It generates global and regional monitoring reports and manuals. It is currently developing its workplan that will establish a data taskforce, update manuals and protocols, integrate ecological and socio-economic monitoring, including reef fish indicators and explore the possibility of GCRMN to support monitoring under the Kunming-Montreal Global Biodiversity Framework.

A global database for the GCRMN

The GCRMN is developing a centralized and collaborative platform for integrating benthic coral reef monitoring data, dubbed “gcrmn_db_benthos”. The GCRMN reporting process begins in the field with the collection of individual datasets. The datasets are then integrated and analyzed to generate visualizations for reporting. The data integration step is the process of combining, merging, or joining different datasets to make a single data object. Integrating data is important for accurate estimates. However, data integration is time-consuming, lacks transparency because the code for data integration is not publicly available, and has historically been conducted by a small team without collaboration. To address this, the gcrmn_db_benthos is a new system hosted on Github that will house R-language code repositories for the integration of different datasets. The repository will be accessible to the public and will facilitate collaborative analysis. The code will follow five main steps: data standardization, data grouping, taxonomic recategorization, spatial attribution, and quality checks. GCRMN's steering committee approved the approach, which will be tested in the 2023 Pacific report.

The Kunming-Montreal Global Biodiversity Framework

The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted by the Parties to the Convention on Biological Diversity on 19 December 2023 in Montreal, Canada. Its ambition is to deliver on the 2050 vision of the convention “living in harmony with nature” through four goals for 2050 and 23 interim targets for achievement by 2030. Critical targets important for coral reefs including effectively protecting 30% of all ecosystems (including marine), placing 100% of marine areas under biodiversity-inclusive spatial planning, supporting restoration (the actual target needs to be determined nationally) and promoting sustainable use across 100% of reef areas outside of protected areas, through fisheries, tourism, and other economic sectors. The monitoring framework of the GBF cites coral, algae and fish variables as complementary indicators supporting the calculation of headline indicators, in particular ‘ecosystem extent’ and the ‘Red List of Ecosystems’ for coral reefs. The GCRMN reporting supported by

the new Technical Working Group and calculation of the Red List of Ecosystems for the WIO in 2021 will directly support countries in reporting for the GBF, and this will form a focus for this workshop and future workplan for the TWG in coming years.

Regional update

A brief regional update was provided by CORDIO, highlighting the publication of the regional GCRMN and bleaching reports in 2017 and 2018, and contributions to the global status of reefs report by the GCRMN in 2021. During Covid an online course on data management and analysis was supported by the WIOMSA-MASMA programme, and the course materials are available for further online delivery, to be developed through this project. Priorities for the coming year were presented in relation to the objectives of this workshop to deliver a new workplan for coral reefs in the Nairobi Convention region under the auspices of a new structure, a Technical Working Group for Coral Reefs. This is based on recent developments of the TWG for Marine Spatial Planning and to update activities and approaches from the last 20 years of work.

Working group sessions

Working sessions were held on days 2 and 3 where groups were formed to discuss selected subjects. These subjects were compiled from suggestions on the first day of the workshop, to be included in the ToR of the Technical Working Group. The list of topics was as follows, and the first five were prioritized and discussed. See annex C for working group participants.

- Coordination mechanisms
- Fish methods and variables
- Data management, sharing, reporting and communication
- Coral reef restoration
- Capacity and Resource needs
- Socio-economic Monitoring (SocMon)
- Coral bleaching
- Coral reef monitoring methods

Coordination of the TWG

1. Participation in the technical working group
 - Roles of members of the working group:
 - participate actively in the work, coordination, and communications of the group.
 - act as a communication/liaison between the TWG and relevant national entities, in particular the Nairobi Convention Focal Point, and/or their organizations and interested groups.
 - be active in national activities related to the TWG.

- Members of the working group need to have technical expertise and a role in an identified area.
 - Each country should have a national representative, identified through existing country processes, such as the National Coral Reef Monitoring Networks.
 - Organizational/non-national participants can be members of the TWG on approval by existing members and by invitation from them and the Secretariat.
 - The TWG is to be led by a Chair, with a vice Chair identified in case of their absence. These positions to be elected by the members from among themselves, and with approval by the Nairobi Convention Secretariat
 - These positions should be reviewed/confirmed on a yearly basis, with a maximum tenure of 5 consecutive years. The same person can be re-elected in the future.
 - Number of members: a maximum of 15, of which 1 representative is from each of the 10 member countries to the Nairobi Convention, plus up to 5 additional members, who may be from organizations or other bodies based within the WIO. Additional non-voting members may be co-opted or invited for meetings for specific tasks related to the workplan and activities of the TWG.
2. Mandate:
- To identify and agree on the Terms of Reference for the group and report to Nairobi Convention (frequency to be determined).
 - To encourage, promote and facilitate implementation of work identified under the Terms of Reference in the countries of the Western Indian Ocean.
3. Accountability
- Accountable to Nairobi Convention processes, and to the national mandates established for the national members of the TWG.
 - Provides regional coordination for the Western Indian Ocean for the Global Coral Reef Monitoring Network. The TWG reports on behalf of the region to the GCRMN for GCRMN meetings (representative to be designated by the TWG) and for regional and global reporting on the health of coral reefs.
 - Support countries in national reporting of coral reef indicators and status to the Global Biodiversity Framework (GBF)
4. Meeting frequency
- Two meetings annually, of which one should be in person, to the extent that this is possible.
 - Meetings should be arranged in consultation with the Nairobi Convention Secretariat, to maximize synergies with ongoing projects.
 - Online meetings and email communication will be used to deliver on the tasks identified in TWG's workplan.
5. Funding
- The TWG and its members are not responsible for fundraising for the activities identified by the TOR, but should assist relevant bodies (the Secretariat, countries, organizations, communities) in sourcing funding.

6. Coral reef monitoring

- Continuing with the focus of the last 20 years, a core function of the TWG is coordination and support of coral reef monitoring within countries of the WIO, and for data aggregation for management and policy purposes. Priority areas of activity were identified below, filling gaps identified from 2017 regional and 2021 global GCRMN reports.

Technical aspects

Fish methods and variables

The establishment of a fish sub-group within the TWG was identified as a priority need, to identify standard protocols for WIO fish monitoring and the need for capacity development and support.

The GCRMN Technical Note 2018 states “fish abundance and diversity has been the least reliable, most variable and least commonly recorded variable of the three primary GCRMN variables ... due largely to the need for greater expertise in observers”. The GCRMN manual identifies 23 families for monitoring, while operationally in the WIO, the reportable data have been from 15 families, but from only 4 to 5 countries.

Fish monitoring task force/sub-group. The group agree that a fish working group is needed under the TWG to assure the standards established do get implemented. The modality proposed is that members for a fish sub-group under the TWG be identified, ideally with one person from each country plus additional technical resource persons. Operationally, the group may be recognized but informal, mandated for this purpose under the TWG and reporting in line with TWG coordination and reporting requirements.

Transect size and number

- 50 x 5 m transects are the most widely used from the GBR, Australia, to most WIO countries and in the Pacific. They are easy for training observers.
- Replication – number of transects per site: 5 is the optimal minimum (3 is insufficient)
- NB Circular point counts are an acceptable method, but are not recommended largely for consistency in training manuals

Taxonomic level for monitoring - Family

The GCRMN Technical Note (GCRMN 2018) proposes a range of families, but the list is updated here for the WIO based on recent findings (see Annex D). The recommendations are as follows:

- *Minimum set of 6 families/sub-families*

Includes 4 key indicator/sensitive families (marked with*):

- *Chaetodontidae (butterfly fishes)
- *Scarinae (parrot fishes)

- *Acanthuridae (surgeon fishes)
 - Lutjanidae (snappers)
 - Carangidae (trevally)
 - *Epinephelinae (groupers)
- *Additional families to add if capacity available:*
Either key fishery species in many East African countries, or easy to identify diversity indicators.
 - Pomacanthidae (angel fishes)
 - Haemulidae (sweetlips)
 - Balistidae (trigger fishes)
 - Siganidae (rabbit fishes)
 - *Families excluded from those recommended in GCRMN 2018 are:*
Due to being difficult to identify, often small and cryptic, and hard to count simultaneously while counting other families.
 - Lethrinidae (emperors)
 - Labridae (wrasse)
 - Mullidae (goat fishes)
 - Pomacentridae (damsel fishes)
 - The total is thus 10 families.
 - Additional families may be added, but any total fish density or biomass presentation needs to state clearly what families are included. There is a significant problem with “total” being used where it’s not clear which families are included.
 - In some cases, key species are desirable to add. The only species identified during the group discussion was the Napoleon wrasse, *Cheilinus undulatus* (Labridae).

Primary variables

- The desirable goal is to express reef fish monitoring data as a biomass metric (kg/ha) for each family. However, if fish size is not estimated (see below) biomass cannot be calculated therefore a density metric (no. of individuals/ha) is used.
- If species are identified and fish size is estimated the following metrics can be used:
 - Fish biomass. This is a valuable and sensitive variable.
 - Species diversity based on 10 families

Data management, security and sharing is a primary need, including establishing the potential for auto reporting (see section ‘Data management’).

Additional items were listed but were not discussed. These may be addressed by the fish working group once these Terms of Reference are approved:

- Refining and deciding on analyses – aggregate indicators or species. This depends on management and other questions. Establishing comparability across countries is desirable.
- Engagement by sub-group members in wider global collaborations (e.g., the project CoNCENSUS) may be desirable - to improve standards, expand the use of their data, etc.
- Incorporating a ranger/ecoguard/community level of monitoring:
 - This is envisaged in the GCRMN Technical Note but has not been actioned.
 - Entry level monitoring that is more relevant to community members or rangers is important to add and could/should be recognised by GCRMN. Typically, these surveys monitor species that are easy to identify and count. Examples come from the Marine Park in Reunion and LMMAs in Kenya, Tanzania, and Mozambique.

Data management, sharing, reporting and communication

Data management and Sharing

- *Current repository:* CORDIO possesses a repository for all partner-contributed data. These data were utilized in the production of the GCRMN 2017 and 2020 reports, as well as the Red List of Ecosystems assessment in 2021.
- *Data Sharing Agreement:* There is a signed agreement between CORDIO and the data contributors that gave CORDIO permission to use the data in the production of the GCRMN 2020 report and the RLE work. No other uses were permitted, and CORDIO will need to seek another agreement to share or further use the data.
- *Global and regional repository:* The idea of creating a global repository was supported, but it was also suggested that the regional repository and database be kept separate from the global repository.
- *Data input for contributors:* Streamlining the data entry process in order to provide contributors with an easy and standardized approach to data entry. This could involve checking to see if the current database, like MERMAID, is compatible with the data from contributors.
- *Open data sharing system:* The Nairobi Convention suggested the establishment of a mechanism that will allow for open access to data in the region through a centralized database.
- *Technical coordinator for the WIO data:* Maintain a data technical coordinator to store, manage, clean, and process data provided by data contributors.

Reporting

- *Reporting:* The regional coral reef status report for the WIO should be maintained as the primary output from the TWG, as well as providing technical and data management support for countries to produce national outputs,
 - With the adoption of the Red List of Ecosystems as headline indicator in the Kunming-Montreal Global Biodiversity Framework (KM-GBF), production of the RLE at national levels should be a priority. National requirements and capacities will need to be identified.

- *Updating data for reporting:* Data within the regional repository should be maintained in an updated form to secure data and facilitate reporting. It should be determined whether or not there are spatial and temporal gaps at the monitoring sites, which are areas that either need to be revisited or are no longer monitored, possibly because they have become an algal reef.
- *Reporting Coordination:* coordination for reporting processes is an important function to be maintained. Given its role in doing this over the last ten years, CORDIO was supported in continuing its leadership role in providing coordination for the TWG.
- Reporting timelines for national and regional outputs should be identified based on national, regional and global processes. Tentatively, the following schedule was discussed/proposed:
 - Preliminary national RLE results for Kenya, Tanzania and Mozambique are included in CORDIO's NORAD grant that funded the regional RLE in 2019-2021. Preliminary results may be available at the end of June 2023 for consideration by the countries.
 - Reporting of these preliminary results may be prepared for the Nairobi Convention Science to Policy Platform scheduled for August 2023.
 - Targeting COP12 in early-mid 2024, national results for the above 3 countries may be complete, and preliminary results for the additional Nairobi Convention Parties prepared, to showcase how the TWG may support countries in reporting on the KM-GBF.

Communication

- Science to policy platforms and process: presenting policy brief, facts sheets in addition to reports and publications
- Using GCRMN regional websites: Update the WIO regional page on the GCRMN web-page (<https://gcrmn.net/western-indian-ocean/>) with the latest information on coral reef activities coordinated by the WIO.
- Establish the strategic support/justification for monitoring in relation to the value and applications of the data in various processes.
- WIO Coral Reef Symposium: Consider establishing a regional coral reef symposium where coral reef scientists can communicate their work.

Capacity and Resource needs

Capacity needs

- *Data analysis:* Conduct a second data training course (repeating the online course run by CORDIO with MASMA funding in 2021).
 - Scope the possibility of holding it in person.
 - Creating self-training data analysis training materials
- *Fish survey expertise:* Focus on capacity for fish data collectors to enhance standardization of collecting fish data and its use in the regional and global reports.
- *Writing and reporting expertise:* Strengthen regional expertise in reporting of coral reef activities in different contexts/formats, including:
 - Scientific report

- Manager report
- Policy briefs
- infographics
- *Regional and national skills inventory*: Identify and map the types of skills at the national and regional levels in order to identify the skill gaps that should be filled.

Resource needs

- *Monitoring Equipment*: find support for organizations that need monitoring equipment for their monitoring programs.
- *Financial sustainability*: Determine the means and the mechanisms that would be able to support monitoring programs across WIO countries, to consistently monitor coral reefs and the other related activities. Participants brainstormed on some priority financial needs and potential mechanisms:
 - link reef monitoring and assessment to assuring fisheries production through emphasizing the role of habitats in maintaining fish stocks.
 - through research institutions, such as university/parastatal organizations
 - by formalizing monitoring programs in the WIO
 - incorporation of digital technologies in monitoring to reduce dependence on personnel time in the water.
 - securing support through regional (e.g., GCRMN, Nairobi Convention support monitoring in the WIO) processes.
 - Securing access to academic journals and literature to build capacity.

Socio-economic Monitoring (SocMon)

Renewed attempts to revive SocMon in the WIO are being planned through the global GCRMN/SocMon coordinator and COMRED in Mombasa. More details on this will be sought and may be added to the TWG TOR.

Other coral reef activities

In addition to biophysical coral reef monitoring, additional technical areas were discussed for the TWG to build capacity and activities in the WIO.

Coral reef restoration

Coral reef restoration (CRR) is emerging as a priority area of work for reefs globally, given the continuing decline of reefs due to climate change and other threats. Work has started in the region with multiple projects, and the establishment of a working group through the WIOMSA Scientific Symposium in 2022. Engaging with and support for appropriate restoration was identified as a priority for the TWG to assure regional alignment and syntheses. The following areas were identified for initial focus:

- Develop a database of CRR activities in the WIO to facilitate collaboration and sharing of methods and experience. This should build on an existing database being established but with a focus in the Caribbean and supported by ICRI and NOAA (US).
- Expand awareness of CRR and its contribution in WIO countries through preparation of:

- a coral reef restoration report at national levels and for the WIO, using GCRMN indicators to standardize data, and to support reporting under the restoration target of the KM-GBF.
- a review paper of CRR in the WIO, providing a summary of ongoing initiatives, methods, successes & lessons learned.
- Initiate discussions to identify relevant approaches to develop legal frameworks for CRR in WIO.
- Create a platform/network to promote best practices - this should be done in conjunction with the WIOMSA coral reef restoration group and in alignment with existing global groups to best support the region.

Participants asked the question whether this platform/network should be a network or a subgroup of the TWG, or an objective.

Coral bleaching monitoring

Responding to coral bleaching through regional alerts, communication and citizen science has been supported since 2009 by CORDIO and in recent years through GMES-Africa. Participants discussed that this should be maintained as an activity of the TWG leading to:

- Formalized annual reporting of coral bleaching.
- Sensitization of countries and organizations to the value of coral bleaching response plans and development thereof.

Innovative coral reef monitoring methods

Broadening the scope of monitoring on coral reefs should be promoted by the TWG, recognizing the rapid innovations that can improve and expand data provisioning and support for decision making. These may include:

- New technologies such as 3D photogrammetry, mosaicking and automated classification of images from benthic transects/quadrats (e.g., as promoted through GCRMN global with Reefcloud, Coralnet).
- Promote more collection of abiotic data by providing guidance and standards, and a guide to the management and policy questions and challenges these may support.
- Promote further use of biodiversity assessments, particularly on corals, fish, and invertebrates.

Miscellaneous

Some additional topics were also mentioned, but may not be amenable to regional coordination or incorporation in the TWG, but for foresight/potential future addition:

- Community and participatory data – how to incorporate?
- Expand reef research to mesophotic reefs (from 50-150m depth) because of their potential role as refuges for reef species from shallower depths impacted by global warming.
- Promote and support regional participation in global processes and projects – e.g., 50 reefs, Coral Reef Rescue. A basic database may be needed to help keep track of these, so all are aware and make the most of the opportunities.

Workshop closure

Following the speech of Mr. Theuri Mwangi from the Nairobi Convention, and Ismael Bachirou, Comoros focal point for the Nairobi Convention, the workshop was officially closed.

They were happy that the expected outputs have been produced including national, regional updates, elements for the action plan and terms of references of the coral reef working group. The workshop participants were thanked for their active participation and contributions. They also expressed their acknowledgement to CORDIO East Africa and AIDE Comoros for the effective organization and facilitation of the workshop. The Director committed himself to present these outputs to the Nairobi Convention Focal Points and to the Minister. He proposed the team keep in touch for a better follow up of the recommendations from the meeting.

Annexes

A - Workshop Agenda and Schedule

Table 1: Schedule and Agenda of the Workshop, with the names of the moderators and presenters

Day 1 Wednesday, 1st March 2023	
09:00-10:30	<p>Opening and Welcome (<i>Swaleh Aboud</i>)</p> <ul style="list-style-type: none"> - Host partner, AIDE: <i>Said Ahamada</i> - CORDIO East Africa: <i>David Obura</i> - Nairobi Convention Secretariat, <i>Dixon Waruinge</i> - Official opening: Minister of Environment, <i>Mr Houmedi Msaidié</i> - Introduction of Participants - Objectives of the meeting: <i>David Obura</i>
10:30 – 11:00	Coffee Break
11:00 – 12:30	<p>Technical Session – WIO GCRMN to 2022 and next steps (<i>Swaleh Aboud</i>)</p> <ul style="list-style-type: none"> - Country updates (8 minutes/5 slides each) <ul style="list-style-type: none"> o Comoros: <i>Said Ahamada, Nadjim Ahmed</i> o Kenya: <i>Juliet Karisa</i> o Tanzania: <i>Pagu Julius</i> o Mozambique: <i>Francisco Zivane (virtual), Maida Lobo</i> o South Africa: <i>Sean Porter</i> o Madagascar: <i>Gildas Todinanahary</i> o Mauritius: <i>Vijay Mangar</i> o Seychelles: <i>Gilberte Gendron</i> o Reunion: <i>Pascale Chabanet (virtual), Lionel Bigot (virtual)</i> - Summary of recent regional network activities (since WIO regional report, 2017): <i>Swaleh Aboud and Said Ahamada</i>
12:30-14:00	Lunch
14:00-16:30	<p>Technical session - WIO GCRMN 2023-24 (<i>Said Ahamada</i>)</p> <ul style="list-style-type: none"> - Updates from ICRI: <i>Thomas Dallison (ICRI)</i> - Updates from GCRMN global: <i>Britta Schaffelke (AIMS, GCRMN Global Coordinator)</i> - Update on WIO GCRMN plans and processes: <i>David Obura</i> - Brainstorm on key activities for 2023-2024. <ul style="list-style-type: none"> o Data and regional repository o Monitoring - methods, gaps o Reporting for the COP and other national priorities (CBD-GBF) o Introduction of workplan template – Nairobi Convention MSP Working Group ToR. - May break into working groups.

Day 2 Thursday, 2nd March 2023	
09:00-10:00	Working sessions (Said Ahamada) <u>Presentations</u> <ul style="list-style-type: none"> - Key variables and national needs for reporting for the Kunming-Montreal Global Biodiversity Framework: <i>David Obura</i> - Coral reef fish monitoring - technical and capacity needs: <i>Melita Samoily</i> - gcrmdb_benthos - A centralized and collaborative integration platform for benthic coral reef monitoring data: <i>Jeremy Wicquart</i>
10:00-10:30	Coffee break
10:30-12:30	Working sessions continued Working groups <ul style="list-style-type: none"> - 2023-2024 workplan/ToR development (including multiple elements) - Coral reef fish monitoring
12:30-14:00	Lunch
14:00-15:00	Working sessions continued
15:00-16:30	Plenary (Joshua Rambahinirison) <ul style="list-style-type: none"> - Presentations from working groups, for feedback. - Other items (as raised by participants, e.g., WIO participation at Asia-Pacific Coral Reef Symposium)
Day 3 Friday, 3rd March 2023	
9:00-10:00	Plenary Outputs (Swaleh Aboud/David Obura) <ul style="list-style-type: none"> - Report back from all working sessions - Presentation of Draft workplan and ToR, 2023-24
10:00-10:30	Coffee break
10:30-11:30	Closing (Said Ahamada) <ul style="list-style-type: none"> - Nairobi Convention Secretariat, <i>Theuri Mwangi</i> - Official closing, <i>Ismael Bachirou</i> – Comoros National Focal Point, Nairobi Convention

B - Participant list

Table 2: List of workshop attendees who attended full or partial sessions.

#	Country	Name	Organisation	Attendance
1	Comoros	Faissoil Ahmed Said	DAHARI	In-person
2	Comoros	Mmadi Ahamada	AIDE Comoros	In-person
3	Comoros	Mouchtadi Mmadi	Moheli Marine Park Scientist	In-person
4	Comoros	Said Ahamada	AIDE Comoros	In-person
5	Comoros	Nadjim Ahmed	Universite des Comores	In-person
6	Comoros	Moustarchide Ben Soudjay	INRAPE	In-person
7	Comoros	Nassur Ahamada	AIDE Comoros	In-person
8	Comoros	Youssef Ellamine	GEF	In-person
9	Comoros	Farhan Med Rashid	NRAPE	In-person
10	Comoros	Housoyni Housseni	RPOC	In-person
11	Comoros	Mhoumodi Solhi Bou	RSE/DEEF	In-person
12	Comoros	Loubna Mohamed Salami Hamidi	AIDE Comoros	In-person
13	Comoros	Baraka Saindou	AIDE Comoros	In-person
14	Comoros	Salmata Issa	AIDE Comoros	In-person
15	Comoros	Soфия Ali Mohamed	AIDE Comoros	In-person
16	Kenya	Juliet Karisa	KMFRI	In-person
17	Kenya	Ewout Knoester	REEFolution	In-person
18	Tanzania	Pagu Julius Iswalala	MPRU	In-person
19	Mozambique	Maida Dinara Camal Lobo	AMA	In-person
20	South Africa	Sean Nixon Porter	ORI	In-person
21	Seychelles	Gilberte Isabelle Maire GENDRON	Sustainable Ocean Seychelles	In-person
22	Madagascar	RANDRIANJAFIMANANA Nambinintsoa Tahiry	Blue Ventures	In-person
23	Madagascar	Gildas Georges Boleslas TODINANAHARY	IHSM	In-person
24	Regional	David Obura	CORDIO	In-person
25	Regional	Swaleh Ali Aboud	CORDIO	In-person
26	Regional	Melita Samoilys	CORDIO	In-person
27	Regional	Joshua Rambahiniarison	CORDIO	In-person
28	Regional	Theuri Mwangi	Nairobi Convention	In-person
29	Regional	Dixon Waruinge	Nairobi Convention	In-person
30	Regional	Ambadi Issouf	Nairobi Convention	In-person
31	Others	Mouzna Ibrahim	Hayba FM	In-person
32	Others	Ika M Ben Said	Journalist ORTC	In-person
33	Mauritius	Vijay Mangar	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping	Virtual
34	France-Reunion	Pascale Chabanet	IRD	Virtual
35	France-Reunion	Lionel Bigot	University of Reunion	Virtual
36	Mozambique	Francisco Zivane	IIP (Fisheries research)	Virtual
37	Global	Thomas Dallison	ICRI	Virtual
38	Global	Britta Schaffelke	AIMS, GCRMN	Virtual
39	Global	Jeremy Wicquart	PSL Université, GCRMN	Virtual
40	Regional	James Mbugua	CORDIO	Virtual

C - Working group participation

Table 1: Participants in the discussions of each of the working groups

Group title	Team
Coordination mechanisms	David Obura, Gilberte Isabelle Maire GENDRON, Sean Nixon Porter, Randrianjafimanana Nambintsoa Tahiry, Swaleh Aboud, Maida Dinara Camal Lobo
Fish methods and variables	Melita Samoily, Pagu Julius Iswalala, Joshua Rambahiniarison, Mouchtadi Mmadi, Moustarchide Ben Soudjay, Mmadi Ahamada, Said Ahamada
Data management, sharing, reporting and communication	David Obura, Gilberte Isabelle Maire Gendron, Sean Nixon Porter, Randrianjafimanana Nambintsoa Tahiry, Swaleh Ali Aboud, Maida Dinara Camal Lobo, Gildas Georges Boleslas Todinanahary, Ewuot Knoester
Coral reef restoration	Juliet Karisa, Gildas Georges Boleslas Todinanahary, Ewuot Knoester, Nadjim Ahmed, Faissoil Ahmed Said, Salmata Issa, Loubna Mohamed Salami Hamidi
Capacity and Resource needs	Melita Samoily, Pagu Julius Iswalala, Joshua Rambahiniarison, Mouchtadi Mmadi, Moustarchide Ben Soudjay, Mmadi Ahamada, Said Ahamada, Juliet Karisa

D - Fish Indicators

Table 4. List of fish indicator families that have been used previously in the WIO for discussion by the fish methods working group. Reference source* of published research on the effectiveness of the different families as indicators is tabulated.

X = families that were surveyed by the paper

◆ = Families that were sensitive to reef condition and/or fishing pressure

◆◆ = very sensitive as diversity indicators

Family	2017 WIO GCRMN report	2018/19 papers Density and biomass data	2022 paper Diversity (species presence) data	In prep. Aggregate biomass indicators
GCRMN – 15 families		11 families	19 families	11 families
<i>Chaetodontidae</i> (butterfly fishes)	x	X◆	X◆◆	X◆
<i>Scarinae</i> (parrot fishes)	x	x◆	X◆◆	X◆
<i>Acanthuridae</i> (surgeon fishes)	x	x◆	X◆	X◆
<i>Lutjanidae</i> (snappers)	x	x◆	X◆	X
<i>Lethrinidae</i> (emperors)	x	X◆	X	X
<i>Carangidae</i> (trevally)	x		X	
<i>Balistidae</i> (trigger fishes)	x	x◆	X	X

<i>Caesionidae (fusiliers)</i>	x	X	X	X
<i>Haemulidae (grunts)</i>	x	X	X♦	X
<i>Labridae (wrasse)</i>	x		X♦♦	
<i>Mullidae (goat fishes)</i>	x		X	
<i>Pomacanthidae (angel fishes)</i>	x	X	X♦	X
<i>Pomacentridae (damsel fishes)</i>	x		X♦♦	
<i>Epinephelidae (groupers)</i>	x	X♦	X♦♦	X♦
<i>Siganidae (rabbitfishes)</i>	x	X	X	X
<i>Ostracidae (Boxfishes)</i>			X♦	
<i>Tetradontidae (Pufferfish)</i>			X	
<i>Monacanthidae (Filefishes)</i>			X	
<i>Nemipteridae (Bream)</i>			X	

*Reference Sources:

Obura, Gudka, Abdou Rabi, Gian, Bijoux et al 2017. Coral reef status report for the Western Indian Ocean (2017). GCRMN/ICRI. pp 144.

Samoilys, MA, Roche, R, Koldewey H, Turner, JT (2018). Patterns in reef fish assemblages: insights from the Chagos Archipelago. PLoS ONE 13(1): e0191448. <https://doi.org/10.1371/journal.pone.0191448>.

Samoilys, MA, Halford, A., Osuka, K. (2019). Disentangling drivers of the abundance of coral reef fishes in the Western Indian Ocean. Ecology and Evolution 9 (7): 4149-4167. <https://doi.org/10.1002/ece3.5044>

Samoilys, Alvarez-Filip, Myers and Chabanet (2022). Diversity of coral reef fishes in the western Indian Ocean: implications for conservation. Diversity. <https://doi.org/10.3390/d14020102>

Samoilys, Roche, Osuka. in prep. Fish as indicators of coral reef ecosystem status.

E - Workshop Photos

Photos of the workshop are available [HERE](#).