



INDIAN OCEAN
COMMISSION



Ecological monitoring of Coral reef

In the South-West Indian Ocean region

**20 years (1997-2017) of activities
through regional network, and its perspectives**



Funded by
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Indian Ocean Commission

Created in 1982, the Indian Ocean Commission (IOC) is an intergovernmental organization which unites five island States of the South-West Indian Ocean (SWIO) region: the Union of the Comoros, France on behalf of Reunion Island, Madagascar, Mauritius and Seychelles. Being the only African regional organization formed exclusively of islands, it defends the specificities of its Member States on continental and international scenes. With the support of a dozen international partners, the IOC embodies the regional solidarity through cooperation projects covering a wide range of sectors, included biodiversity. This long experience makes the IOC an essential actor through its well-known expertise in numerous fields of sustainable development. Called upon several fronts, the IOC has been facilitating for more than thirty years the collective action of a whole region, the SWIO region named Indianoecania, inherently vulnerable but firmly ambitious.

European Union

As the world's largest contributor to development aid, the European Union (EU) is also the first development partner of the IOC. This relationship began in the early years of the IOC and has gradually strengthened over projects funded by European funds. Since 2005, the EU has funded 17 cooperation projects implemented by the IOC for a total amount of 156 million euros from the European Development Funds (EDF). The European Union's contribution to the development of the Eastern and Southern Africa and Indian Ocean region is expected to grow within the framework of the 11th EDF covering the period 2015-2020. Aware of island specificities, the EU supports the IOC in the areas of regional biodiversity conservation, regional connectivity, fisheries, climate change, renewable energy and energetic efficiency.

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Jean Pascal Quod, Indian Ocean Commission, University of Mauritius, J. Tamelander



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Coral reef ecological monitoring in the South-West Indian Ocean region

Coral reefs constitute an invaluable heritage and a common federating theme for regional cooperation for the South-West Indian Ocean (SWIO) islands and mainland states, due to the connectivity of their marine environments and the ecological and socio-economical services they produce.

As threats are increasing, a severe coral bleaching event occurred in 1997-1998 due to a rise in seawater temperatures, with significant ecological and socio-economic consequences. The 2015-2016, considered to be the third global El Niño-related coral bleaching event, affected a large number of reefs, with its severity varying from place to place

As coral reefs (and associated ecosystems: seagrass beds and mangroves) in the SWIO are important for coastal communities, and are of great commercial value, sustainable management of these sensitive and vulnerable habitats has been promoted since 1995. Annual monitoring of the health status of these unique ecosystems was recognised as a goal in 1997 in all the countries as part of the Global Coral Reef Monitoring Network (GCRMN). In the region, the Reef network created in 1997 is now 20 years old.

Global overview

Coral reefs habitats in the SWIO region are among the most valuable and diverse ecosystems on earth, producing huge ecological and socio-economical services. They have been studied for decades by scientists in order to ensure - through adequate knowledge - the ecological sustainability of their living resources for inhabitants and the services to e.g. tourism and coastal protection.

They occur in most mainland and islands countries members of the UNEP Nairobi convention, but their total area is still poorly known. The estimated area of coral reef in the SWIO is 16,600 km² (source: *Atlas of western Indian ocean coral reefs*, *Andrefouet et al., 2009*).

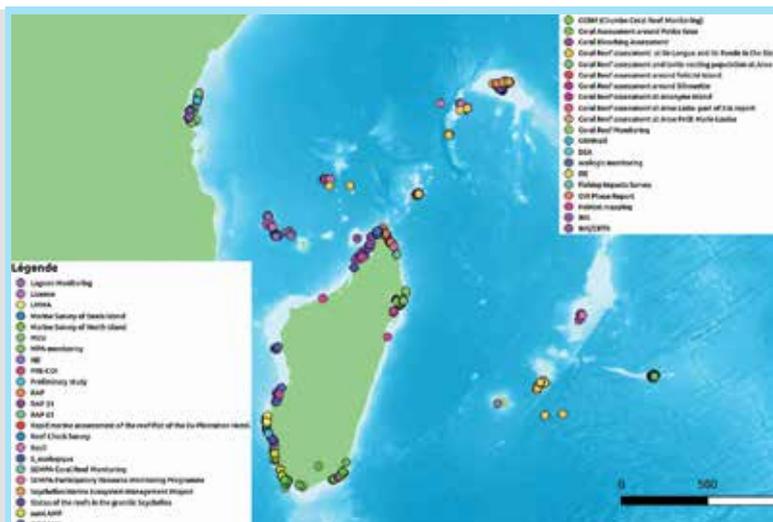


Figure 1: Coral reef monitoring stations in the SWIO



From a practical viewpoint, stakeholders (mainly scientists) require regular sampling of ecological & biological information of a representative part of an outer slope and inner reef flat, called a site, to monitor the health status of coral reefs.

Usually, this portion of reef is about 400-500 m², and different methods are implemented to survey categories such as the substrate cover (attached animals like hard corals, algae; substrata like sand, rock, rubble), the fish and invertebrates communities. The main methods used are Line Intercept Transect (LIT), Point Intercept Transect (PIT) and Quadrats.

At the regional level, a total of 227 sites constitute the physical network, and are optimally surveyed once a year to allow long-term trends analysis.



Reefs under threats

Natural and anthropogenic threats are increasing and it is estimated that, today, 75% of remaining reefs are currently affected, and many have been lost during the previous decades. Overfishing and land-based pollution are of great concern in the SWIO, while simultaneously, warming temperatures may induce thermal stress, severe and persistent coral bleaching and, finally, the death of reef-building corals.

A network in action

As the Reef network was set up in 1997, its activities have covered two main coral bleaching events: 1997-1998 and 2015-2016. Are they a sign of a new cycle starting?

A global analysis of the network findings since its creation, reveal the following highlights from its key phases.

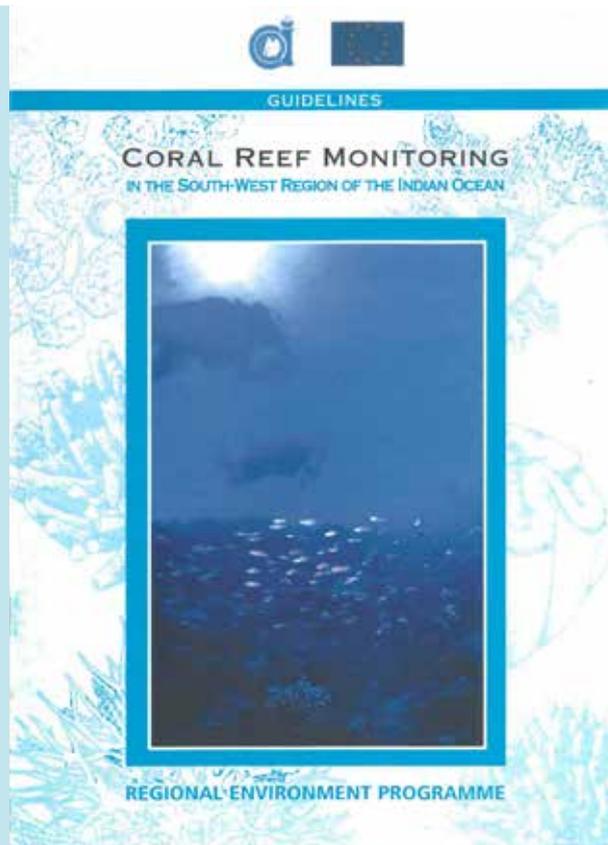
The REP-IOC Project (1995-2000)

At the International Coral Reef Initiative (ICRI) East African and Western Indian Ocean Workshop meeting held in Seychelles (1996), the WIO islands states have been designed as the node 3 of the GCRMN (East Africa being the node 4), and Indian Ocean Commission (IOC) was proposed as the responsible institution for coordinating, monitoring and reporting (confirmed by GCRMN - Global Coral Reef Monitoring Network in December 1999). As part of the action plan of the REP-IOC, the diagnosis concluded that degradation of coral reefs and associated ecosystems was one of the main problem in the region and a common target for all member countries of the IOC (Comoros, Réunion/France, Madagascar, Mauritius, Seychelles). The on-going severe coral bleaching was a trigger for decision-makers to promote a regional monitoring initiative.

The Reef network was officially launched during the Nosy Be meeting "*Man and Recif*" in October 1997, while there was simultaneously the onset of the coral bleaching event and that 1998 to be claimed as International Year of Reefs (IYOR).

Numerous activities have been conducted during the 1998-2000 period, supported by the European Union to IOC and additional funding from Global Environment Fund (GEF):

- A bilingual technical field guide was produced by experts from the region, including adequate protocols to skill levels
- Regular technical meetings of the network occurred at national and regional levels (e.g. Tuléar, 1999),
- Communication output products were implemented to international level as chapters of the GCRMN reports (Wilkinson, 1997, 2000, 2002, 2004) and participation to international coral reef meetings such as ITMEM (Townsville, Australia) in November 1998, ICRS in December 2000, (Bali, Indonesia) and ICRI in 2001,
- Development of a regional data entry system, adapted from ARMDDES, named COREMO (Coral Reef Monitoring), with successive versions.





Mauritius reef network members

Active members of the network were key national scientists and organisations comprising marine NGOs that regularly collect field data.

As directed by the GCRMN, activities were focused primarily on regular, “easily” monitored habitats such as outer slopes, as these are common to all reefs. Nevertheless due to the enthusiasm of stakeholders and the necessity to implement Integrated Coastal Zone Management (ICZM), additional sites were added in the inner parts of the reefs ecosystems, to be surveyed as well as the outer slopes.

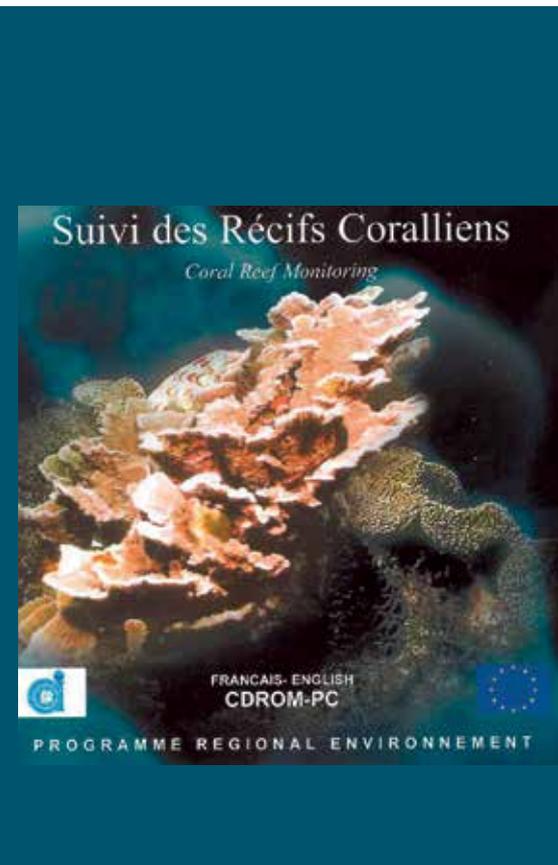


Figure 2: Technical guides were edited in English and French, as well as a CD for training.

The REP-IOC-GEF Phase (2001-2005)

In 2001, ICRI held its second regional meeting in Maputo (Mozambique).

Despite the fact that the REP-IOC project, with support of the European Union, concluded in 2000, some monitoring activities continued with remaining funding from the REP-IOC and additional GEF funding.

GEF supported the action plan by subcontracting regional coordination by ARVAM which was recognized as an effective and efficient agency for this task. Moreover, ARVAM was at that time the focal point in the Islands States for implementation of the CORDIO initiative (Coral Reef Degradation in the Indian Ocean), focusing on the ecological and socio-economic impacts of the 1997-1998 El Niño coral bleaching event.

Activities were implemented to ensure data collection by national teams, databasing in COREMO, capacity building for reef mapping of habitats, etc. Other institutions and regional initiatives were associated with the process in order to ensure optimal interoperability between projects (SEACAM, WIOMSA, CORDIO).

Requests, originating from the Reef network stakeholders, were considered to update COREMO, including for example the Reef Check categories for “substrate”, “fish” & “invertebrates”.

This phase allowed the network to produce, with rotating governance, a contribution to the 2002 and 2004 world status reports.

Difficulties in sustainability of the regional approach, for coordination were identified and highlighted such as data collection in some countries, regional meetings, training workshops.

The Reef Network continued to be hosted by the IOC during this period, piloted by relevant national focal points in public organisations. The network has anyway struggled for regular funding, especially for regional meetings, which were recognized as key events to stimulate the team and produce synthesised reports.

This period (2005-2006) may be considered as the “first gap period” in network functioning.



Steering committee in Comoros in 2005

The RECOMAP Project (2006-2011)

From 2006 to 2011, the IOC implemented the Regional Coastal Management Programme (ReCoMap) with the financial backing of the European Union. ReCoMap supported the Reef Network in 2007 with a review of the activities that included SWOT analysis (Anderson, 2007), and a meeting of key stakeholders to compile the data in a regional report (Mauritius), transmitted to the GCRMN (Wilkinson, 2008). The “Status of Coral Reef of the World: 2008” report was the 5th global report since GCRMN commenced. Two chapter reports were included for the island states (Ahamada et al., 2008) and East Africa (Muthiga et al., 2008).

Other supporting activities included a training of network members in the CoReMo V.3 database information system and a meeting dedicated to establish a growing regional trust fund for sustainable funding which has unfortunately not succeeded yet.

Once again, key conclusions emerged from this phase: when the local members of the Reef Network were nested within public organisations such as a research institute or an MPA, monitoring was not a priority, but in organisations such as NGOs, annual monitoring was deemed critical, as well as the sustained in training stakeholders year after year. The main cause of these shortcomings was the lack of funding. Another key aspect was that, if the network aims to improve decision-making (as initially requested by the GCRMN), the type of information collected needed to be adequately defined (e.g. water quality, climate change indicators). Moreover, outputs from the Reef network needed to be better integrated in national as well as regional strategies (e.g. through the coral reef task force (CRTF), including in continental countries). Finally, non-state organisations as well as citizens should be requested to participate to monitoring coral reef health with adequate protocols.

During this period, the international initiative of participatory science in Reef Check began implementation in the region.

As a direct consequence of the above limitations, only countries with national funding for coral reef monitoring ensured that data collection was correctly accomplished, while the others were in a “gap status”.

The gap period for monitoring (2012-2013)

2012-2013 was considered by all as a serious “gap period” due to both weak institutional arrangements and insufficient funding to undertake a regional approach.

The Coral Reef Task Force of the Nairobi Convention

GCRMN supports the ICRI action plan by working within a global network to strengthen the provision of the best available scientific information on (and communication of) the status of and trends in coral reef ecosystems. This substantive activity is linked to existing Regional Seas mechanisms which are, for the SWIO, the Nairobi Convention and its protocols. The Coral Reef Task Force (CRTF) was set up as part of the Conference of Parties in 2001, covering both nodes 3 and 4 of the GCRMN. While each country of its members has a national CRTF, only a few (Kenya, Tanzania) have active local committees.

Finally, the Parties have suggested the systematic organization of a CRTF meeting during each WIOMSA scientific symposium.

The ISLANDS Project (2011-2014)

One of the main objectives of the ISLANDS project, managed under the IOC umbrella, was the relaunching and strengthening of dynamics initiated by all partners especially on coral reefs, with an extension to Zanzibar. Supported activities were identified as following:



- Rebuilding sub-committees under national ICZM committees, publishing newsletters,
- A Reef Check pilot project for citizen reef monitoring,
- Setting up a vision for the future of coral reefs facing climate change (Quod, 2012), prioritizing the near-future sustainability of the network to (i) install N-CRTF, (ii) promote alternative activities to reduce pressure on reefs and (iii) set-up and implement a “coral reef observatory”, involving both scientist and non-scientists,
- Implementing a coral reef information system (CRIS) to replace the CoReMo data entry system,
- Regional reporting on metadata (Obura, 2013) and a second methodological guide for reef monitoring (Obura, 2014)
- An atlas of coral reefs for the region (Klauss, 2014).

Reef Check, a pilot project for citizen reef monitoring

Technical and scientific assistance was provided for the network by CORDIO East Africa with partnership by The Nature Conservancy.

The situation remain critical for local teams which still have no (or weak) resources to ensure regular monitoring.

No regional reporting was undertaken subsequent to the 2008 world status report in which chapters covered the SWIO region (Ahamada et al., 2008 ; Muthiga et al., 2008), despite most countries continuing to collect data according to the initial protocol.

Stakeholders re-affirmed the need to link ecological indicators in a more holistic framework, and add socio-economic indicators as well as Climate Change relevant indicators.

The Biodiversity Programme (2014-2018)



Regional training on CRIS in 2015 at Albion, Mauritius with Biodiversity Programme

The Coastal, Marine and Island Specific Biodiversity Management Programme – Biodiversity Programme – is being implemented over 5 years (2014-2018), and its geographical coverage includes IOC member states, with addition of Kenya and Tanzania (ESA-IO Coastal States).

In pursuit of the previous successful story of the Reef Network, the specific interventions of this phase commenced by organizing a regional workshop with 40 members of the network in Albion, Mauritius, in February 2015, where the status of national networks and a regional roadmap were discussed, covering 4 key components reporting on the health status of reefs, capacity-buiding of the members, development of the information system, and enhancement of governance.



Regional training on Reef Database (BD récif) in 2016 at Nosy Be, Madagascar with Biodiversity Programme

This phase includes the *Fond Français pour l'Environnement Mondial* (FFEM) support project at key pilot sites: Mohéli marine park (Comoros), Rodrigues (Mauritius) and Sainte Marie (Madagascar). By contracting with experts in the region, key output products are proposed to be shared inside and outside the Reef network:

- Evaluation during and after bleaching, including publication of a technical guide shared with stakeholders in February 2016,
- Establishment of a Reef Check initiative in the Comoros archipelago (Grande Comore and Anjouan),
- National reports to be compiled in a regional report,
- Communication tools (posters, brochures, leaflet...), field training, document-sharing on the online platform

<http://www.reefresilience.org/groups/network/indian-oceancommission/>

Ensuring the continuous activity of the Reef Network remains the main goal of the Biodiversity Programme, so that members and partners can meet as regularly as necessary.

During the 9th WIOMSA scientific symposium held in October 2015 (Durban, South Africa), a session was held on compiling national monitoring data to be used in the next Status of Coral Reefs report for the Western Indian Ocean, under the umbrella of the GCRMN. Meanwhile, CRIS is recognized as a real need in all countries (although Mauritius has some reservations about this tool and sharing of data in general). Various technical issues still need to be fixed before the CRIS can be used properly. Alternatives to CRIS, such as BD Récifs, are being assessed in order to decide whether to pursue CRIS development or adopt another system.



Regional meeting in Zanzibar

Then, in May 2016, a regional meeting occurred in Zanzibar. During that event, France/Réunion presented the BD Récifs project, which aim to replace CoReMo, and which would have to be interoperable with the CRIS. IFRECOR (French ICRI) supported this tool development with assistance of Ifremer. Participants focused their activities on in-course acute scientific themes (coral bleaching events, coral diseases and Acanthaster monitoring), progress in national reporting, governance of the network, 2017-2018 priorities.

When the thermometer is to red, corals go white

The 2015-2016 austral summer engendered the 3rd global coral bleaching event in the region. Its ecological consequences are being surveyed with support of the Biodiversity programme as well as other donor sources. A severe event affected the region during the 1997-1998 El Niño, causing massive coral mortality, and resistance and resilience processes have varied from place to place.

Warning systems exist in the region, derived mainly from remote sensing and are shared with the Reef Network members at e.g: <http://cordioea.net/wio-coral-bleaching-alert/>).



Perspectives

From the retrospective analysis of the history of the Reef Network since its formation in 1997, which corresponded to a period between two major coral bleaching events (1997-1998 then 2015-2016), it can be concluded that an operative regional network for reef health monitoring does exist, constituted of national teams, whose capacities vary from place to place and from time to time, depending on the sustainability of both funding and human resources.

Critical needs were identified in 2005-2006 and have still to be solved to ensure long-term data collection at sites within the ecological network. Throughout the regional meetings, it has been recognized that it is important for stakeholders to meet to share and build the strategy and action plans, as well as to promote continuous capacity-building amongst new stakeholders, develop new ecological (and socio-economical) indicators to add to classical coral cover (CCHC) and fish techniques, e.g coral diseases, invasive species (Acanthaster...).

If collecting field data is the first step in the process, subsequent reporting and communication has to be ensured. Databasing remains a key task to achieve as part of the CRIS, and must be interoperable with the BD-Récifs developed by France to replace CoReMo3.

The Indian Ocean Commission is facilitating a rebirthing process of the Reef Network under the umbrella of the Nairobi Convention and this is on course, aiming first of all to produce a regional 2017 report with the scientific coordination of CORDIO. Now that the Reef Network has established a 20 years baseline, and has a scientific network involving historical partners, it has huge resources to expand the network by employing non-scientific stakeholders (MPA managers, NGOs, diving operators...). Such a participatory science program using well-trained and already certified personnel would be of great value to enhance the spatial cover of the program and involve local communities in the monitoring activities on their reefs.

And last but not least, ensuring financial sustainability and a governance chart would be essential to initiate the life of the reef network in its third decade.

Indian Ocean Commission

Blue Tower, 4th floor, rue de l'Institut

Ebene, Mauritius

Tel : +230 402 6100

Fax : +230 465 6798

secretariat.biodiv@coi-ioc.com

www.coi-ioc.org