

# New Guidelines for Monitoring Coral Reef Ecological and Socio-economic Data in the Caribbean

## Nuevas Directrices para el Monitoreo Datos Ecológicos y Socio-económicos de Arrecifes de Coral en el Caribe

## Nouvelles Lignes Directrices pour la Surveillance de Données sur les Récifs Coralliens Écologiques et Socio-économiques dans les Caraïbes

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### ABSTRACT

One of the findings of the recently released Global Coral Reef Monitoring Network (GCRMN) report on the status and trends of Caribbean coral reefs was that coral reef monitoring in the wider Caribbean is '*scattered, disorganized, and largely ineffective*'. This key finding highlights the weaknesses and inefficiency of the current coral monitoring network, in part due to the lack of information dissemination and inconsistency in application of monitoring methods and approaches throughout the region. The GCRMN in the Caribbean currently suffers from reduced functionality, at three levels of action: data collection, information archiving and dissemination, and internal network communication. Those weaknesses are often coupled with challenges of securing adequate funding as a means to support systematic and sustainable coral reef monitoring. This has potentially contributed to losses of information and capacity building due to major gaps in the exchange of approaches and expertise within the region.

To address the urgent need for a more effective coral reef monitoring in the wider Caribbean region, a workshop was convened in Curacao during August 6th - 8th 2014. The main goal of the workshop was to improve the regional cooperation for coral reef monitoring through the GCRMN. New coral reef monitoring minimum guidelines were proposed for ecological and socioeconomic data collection, hoping that these minimum requirements will facilitate long term monitoring of Caribbean coral reefs region-wide comparable data that can be used to enhance current management and conservation efforts, specially related to Marine Protected Area (MPA) Networks. Here, we present the proposed guidelines.

KEY WORDS: GCRMN, Caribbean, MPA coral reef monitoring, socioeconomic, data, archiving

### INTRODUCTION

The Global Coral Reef Monitoring Network (GCRMN) of the International Coral Reef Initiative (ICRI), recently published a groundbreaking report *Status and Trends of Caribbean Coral Reefs: 1970-2012*, in cooperation with UNEP and IUCN (Jackson et al. 2014). In this report, a number of startling conclusions are drawn from a region-wide assessment of forty years of coral reef data. The report concluded coral reef monitoring in the wider Caribbean is '*scattered, disorganized, and largely ineffective*'. The weaknesses and inefficiency of the current coral monitoring network, is in part due to the lack of information dissemination and inconsistency in application of monitoring methods and approaches throughout the region. The GCRMN in the Caribbean currently suffers from reduced functionality, at three levels of action:

- i) Data collection,
- ii) Information archiving and dissemination, and
- iii) Internal network communication.

Those weaknesses are often coupled with challenges of securing adequate funding as a means to support systematic and sustainable coral reef monitoring. This has potentially contributed to losses of information and capacity building due to major gaps in the exchange of approaches and expertise within the region.

To address these dysfunctions and the urgent need for a more effective coral reef monitoring in the Wider Caribbean region, a workshop was convened in Curacao, August 6 - 8, 2014 with funding provided by UNEP-CEP, its SPAW-RAC, and The Dutch Ministry of Economic Affairs. This event was organized under the leadership of the latter two institutions, along with NOAA, the Wait Foundation, the GCRMN science coordinator, and the UNEP Coral Reef Unit.

Coral reef experts from different monitoring programmes, as well as from the sub-regional 'monitoring nodes' established in the past, and relevant regional and international organizations, came together to discuss how to better coordinate ongoing Caribbean coral reef monitoring and stimulate and support monitoring in areas that lack capacity for sustained monitoring efforts.

The workshop aimed to support the region-wide coral reef monitoring, that is currently coordinated through the GCRMN and UNEP-CEP as focal point. The main goal was to revitalize and organize the coordination of coral reef monitoring conducted across the region by providing concrete solutions that would improve the capacity of the network, through the following specific objectives:

- i) Improve data collection & archiving,
- ii) Improve the network internal functioning for a better diffusion of information, and
- iii) Increase the support for regional and sub-regional cooperation.

## OVERVIEW OF THE CURRENT REGIONAL SITUATION

Global reef monitoring was a major theme when the International Coral Reef Initiative (ICRI) was launched during the United Nations Global Conference on Sustainable Development of Small Islands Developing States in Barbados in 1994. It was during this time that the Global Coral Reef Monitoring Network (GCRMN) was established to support ICRI's Call to Action and Framework for Action. The GCRMN is supposed to work through a global network of stakeholders and within interacting regional networks, with a structure of node coordinator at sub regional level and local coordinator, to support the management and conservation of coral reefs and is focused on the several major objectives. It started from a modest beginning but with a good initial growth, thanks in particular to significant funding support from the United States Department of State.

Today, it is funded on sources of modest funding and actually has to rely on voluntary contributions from many players (<http://www.icriforum.org/gcrmn>).

In the last few years, GCRMN functions have been reduced with a stricter focus on communication and less on data. The Caribbean situation, however, is different and has focused on data and less on networking. The results of this reduction in effort (scope and function) were experienced by authors of the Jackson et al. 2014 *Status and Trends Caribbean* report. Some of the challenges experienced as part of the report preparation stage were shared with the Curacao workshop participants. The main problems outlined by Jeremy Jackson were the following:

- i) Data analyses: Much of data was not previously analyzed and raw data were often provided instead by researchers ,
- ii) Data quality: Inconsistent metrics, formatting errors, lack of data (location, reef type, depth, date of observation),
- iii) Data errors: Not a single set of data was without systematic errors,
- iv) Data usability: Approximately one quarter (¼) of the data was unusable and it took the team 1.5 years to get data in standard format,
- v) Data collection consistency: out of a total of 90 sites, only 21 locations have data from all periods, and
- vi) Data sharing: it sometimes was difficult or impossible to convince scientists to share their data.

Other workshop participants and representatives of regional coral reef organizations, as well as the *de facto* 'node coordinators', shared their experiences on coral reef monitoring and the effectiveness of the network in their own sub-region or areas. For each of their respective countries, the participants shared information on; monitoring organizations and entities, data collection protocols and core sets of data collected, archiving methods, main strengths and weaknesses, and where possible they provided suggestions and ideas for improvements. Table 1 below outlines some general suggestions that came from these discussions.

Based on these insights, it is clear that there are nearly as many locations than situations, which highlights the heterogeneity and complexity of this region. In most sub-regions, monitoring networks are not functional or fully functional. Different situations exist: coordinating systems that used to be efficient but no longer are (INVEMAR for the northern part of the South America sub-region where the communication stopped from 2008 as UNEP-CEP funding was no longer available), others were never established, or only cover part of an area (the Healthy Reefs Initiative HRI has a really strong network but was only set up for the Mesoamerican reef). Stronger systems exist among islands and archipelagos of the same nationality or political context/background (e.g. France and Netherlands) but for the most part there is no real cooperation or exchanges between neighboring countries/territories (e.g. in the Eastern Caribbean).

Most of the sites share common weaknesses and needs, leading to similar main recommendations as developed in the table below. A consensus clearly appears on the importance of refreshing and formalizing the regional network, with the adoption of a simple and accessible regional data set and associated methods, the need for a central database, and improved communication within the region (with standardized reporting and increased meeting frequency) but also externally, with the general public and governments in particular.

## DATA, METHODS AND ARCHIVING

As discussed previously, the Caribbean region is a complex and heterogeneous region, where coral reefs level of protection and monitoring have very large variations. It was mentioned repeatedly among the participants and beyond the scope of this workshop the importance of unifying the efforts and establishing a solid foundation for this network. In this context, it was crucial to have field work as the basis for the work of the network. This involved the review of, and new proposals for data collection, analysis, dissemination and archiving.

One of the tasks of the workshop participants was to address key issues in small in working groups. The working groups were tasked with (i) defining a minimum core set of data to report and associated methods, and (ii) developing a model for the archiving of this data. It should be noted that an explicit request was made for the consideration of social-economic aspects of monitoring (human dimensions monitoring) and their links to coral reef ecosystems. The network participants agreed that it was essential to integrate the monitoring of this component into regular reporting of coral reef status and network.

## DEFINING THE CORE SET OF DATA AND RECOMMENDED COLLECTION METHODS

Data collection being a pillar of the monitoring process, it set off many discussions and debates during the three days of the workshop. Working groups were assigned to harmonize different approaches and at the end developed a draft that proposed a minimum core set of data to be collected, and their associated protocols, the methods and data sessions aimed at proposing a model for a simple, accessible, but also scientifically pertinent and sustainable

monitoring, both from a regional and local perspective. Working groups for both biophysical and socioeconomic monitoring developed the recommendations for the core data requirements. These are described below.

### Recommended Biophysical Data Collection Methods

The GCRMN methods have been developed to provide a systematic snapshot of the ecosystem health of coral reefs. Based on the conclusions of a retrospective analysis of trends in reef health over the past decades, GCRMN members have agreed that there is great value in coordinating future monitoring efforts. To date, Caribbean regional monitoring efforts often collect non-overlapping types of data about coral reefs, or the efforts use non-comparable methods for describing similar parts of the reef ecosystem. The goal of this document is to define a set of data and data collection techniques that will be used by Caribbean GCRMN members. These methods reflect long-standing, vetted scientific protocols and provide a compromise between practical applicability and ease of comparison between existing methods and long-term datasets.

The GCRMN methods describe six elements of the coral reef ecosystem:

- i) Abundance and biomass of key reef fish taxa,

- ii) Relative cover of reef-building organisms (corals, coralline algae) and their dominant competitors,
- iii) Assessment of health and
- iv) Recruitment of reef-building corals,
- v) Abundance of key macro-invertebrate species, and
- vi) Water quality.

These elements provide an overview of the current condition of the coral reef ecosystem as well as an indication of likely future trajectories. GCRMN recognizes that by collecting information about these elements across multiple locations, with regular re-sampling through time, it will be possible to more knowingly describe the status of coral reef health in the Caribbean and to link local and regional management with outcomes in the reef ecosystem.

These methods are designed to provide a basic and regional summary of reef health. Importantly, the elements that are included for GCRMN monitoring are not all-inclusive, and many partner members may be interested in collecting more detailed or spatially expansive data. However, the GCRMN methods should be viewed as a minimum and required snapshot of reef condition – data elements should not be selected individually but instead will be collected in sum. The multi-dimensional description of coral reef health is essential to provide a coherent

**Table 1.** Suggestions for improving coral reef monitoring in the Caribbean GCRMN

Zone/Entity	Suggested areas for Improvement
Dutch Islands	<ul style="list-style-type: none"> <li>- Regular training</li> <li>- Regional assistance teams for smaller islands</li> </ul>
US (NOAA-Coral Program.)	<ul style="list-style-type: none"> <li>- Integrated research planning (biophysical and human dimensions)</li> <li>- Simple but scalable metrics and indicators</li> <li>- Communication improvement: variable audiences, new tools</li> </ul>
Northern Caribbean	<ul style="list-style-type: none"> <li>- Demonstrate to governments and institutions the benefits of data sharing</li> <li>- Adopt regional protocols</li> <li>- Create a central data depository</li> <li>- Reintroduce Status reports</li> <li>- Re-launch GCRMN (Caribbean)</li> <li>- Restructure nodes</li> <li>- Establish achievable goals with realistic timeframes</li> <li>- Establish GCRMN specific site within each country</li> <li>- Provide opportunities for public to participate</li> </ul>
Southern American Zones	<ul style="list-style-type: none"> <li>- Simplify the methodology to fulfill basic level of requirements (recommend core set of data for collection)</li> <li>- Involve people who are not expert or professionally trained</li> <li>- Implement continuous methodology training</li> <li>- Involve new institutions for more support</li> <li>- Increased involvement in regional initiatives</li> </ul>
UK Overseas Territories	<ul style="list-style-type: none"> <li>- Need funding</li> <li>- Standardize methods for data collection, reporting, and archiving (Best practices workshop (methods, protocol)/ agreement upon key indicators to report)</li> <li>- Communication across the region (Core monitoring group (similar but perhaps more specialized than Coral-List Server)/ Online data access for regulatory agencies and scientists/ Outreach for general public and education programs</li> </ul>
Eastern Caribbean	<ul style="list-style-type: none"> <li>- Regional Roving Team (to collect and process region-wide data)</li> <li>- Standardized methodology</li> <li>- Establishment of a formal network, linked to positions</li> <li>- Standardize reporting frequency and requirements</li> </ul>
French West Indies	<ul style="list-style-type: none"> <li>- Revision of the structure of the French network GCRMN</li> <li>- Official nomination of representatives in each island with clear terms of reference</li> </ul>
CARICOMP <sup>2</sup>	<ul style="list-style-type: none"> <li>- Standardized methods</li> <li>- Central data depository</li> <li>- Periodic meetings</li> </ul>

'baseline' of coral reef condition in a dynamic and changing world.

The methods are organized into three sections, labeled as *highly recommended*, *recommended*, and *required*. The *highly recommended* method is the one that provides the most rigorous and comparable data for current and future applications. In many cases, this method provides higher resolution for archiving reef condition, and thus enables more detailed explorations of reef health today and into the future. The *recommended* method is the basic approach that provides the essential information defined by GCRMN, and uses a common and consistent field approach. The *required* methods are a collection of viable approaches for collecting the essential information while not using the recommended method. The required methods should be used only in cases where the local GCRMN partner has an established monitoring program, and thus changing methods may compromise the legacy and consistency of the local effort.

More details on the biophysical methods can be found in Annex D as part of the detailed workshop report (Belmont et al., *Curacao Workshop Report 2014*).

While a few sites in the region already or nearly meet the proposed criteria, many other sites will need a boost or extra effort to comply with it. The network is meant to support those sites and others in the Caribbean to the best available means in order for them to eventually achieve the proposed data set collection and circulate it to the network platform. Future projects in the WC relevant to coral reefs or with coral reef monitoring elements/components (e.g. GEF projects), will be encouraged to use the proposed *core set of data* for their assessments and monitoring activities in an effort to ensure a coordinated approach to coral reef data and assessments in the region.

### **Recommended Socio-economic Data Collection Methods**

The integration of socio-economic data in monitoring coastal ecosystems and coral reefs in particular, is a relatively recent phenomenon which is under development in the Caribbean region, but has not been implemented in a regular and sustainable manner. GCRMN recognized the need for collecting socio-economic data in coral reef and coastal areas from 2000. The development of the Socio-economic Manual for Coral Reef Management (Bunce et al. 2000) was intended to improve the understanding of the social and economic conditions, contexts, and motivations associated with the use of coral reef ecosystems.

Coral reef scientists and coastal resource managers are coming to the realization that coastal resources can no longer be effectively managed if biophysical scientific monitoring is the only focus. It is important that systematic monitoring of socio-economic indicators be implemented in conjunction with biophysical monitoring. Doing so may enhance the ability to make connections and inferences between observed changes the coral reef ecosystem quality and human and social parameters. These elements were unanimously recognized during the meeting in which it was demonstrated necessary, even essential, to provide a system for the entire region to begin socio-economic monitoring.

Socio-economic (human dimensions) monitoring requires specific techniques, methods, and training. Combined with the fact that coral reef managers and data collectors usually have a biological background and expertise, it was important for the workshop participants to propose a simple and scalable method. For the past ten years, a number of socio-economic assessments and monitoring programmes have been implemented at coastal management sites and communities throughout the Caribbean as components of Global Socio-economic Monitoring Initiative for Coastal Management (SocMon) projects implemented by the Centre for Resource Management and Environmental Studies (CERMES), at The University of the West Indies, Cave Hill Campus.

SocMon is a simple, flexible participatory monitoring methodology developed specifically for coral reef and coastal management to enhance understanding of communities and their relationship to coastal and marine resources. SocMon is a globally networked, regionally adapted, practical methodology of socio-economic monitoring for coastal management. Socio-economic monitoring has been implemented in 12 countries in the region at 23 study sites, 16 of which have been Marine Protected Area (MPA) sites and seven at coastal community sites, particularly fishing villages.

The model of monitoring proposed for GCRMN will allow for the collection of socio-economic data readily available from secondary data or observation without the need for significant human or financial investment from people on the ground. More detailed or site-specific monitoring was recommended for future adoption and implementation that will allow for more detailed analysis of the impacts of people on reefs and inter-relationships between people and coral reef ecosystems.

Collection of these site-specific data will require some capacity building in SocMon (existing capacity in a number of countries where SocMon has already been implemented). This will require the adoption of a core set of SocMon Caribbean variables to allow comparison of data among sites and study areas at the sub-regional and regional level. Of course, additional financial resources will be needed to support sustained monitoring. The Global SocMon Initiative and the regional SocMon node for the English-speaking Caribbean, CERMES, will help in supporting sites wishing to develop socio-economic aspects of monitoring. An example of the socio-economic variables and recommended methods is shown in Table 2 below. More details on the proposed socioeconomic methods are provided in Annex F of the workshop report (Belmont et al. 2014).

### **Recommendations for Data Archiving**

A desired outcome of the regional GCRMN activities is the creation of an open, independent, secure, and interactive archiving system of coral reef monitoring data. As is the case with monitoring, the same is true for data archiving in the Caribbean. Archiving systems are also very heterogeneous and scattered. Several databases currently exist but none unifies the entire area, for example the Atlantic and Gulf Rapid Reef Assessment (AGRR) or Caribbean Coastal Marine Productivity Program

(CARICOMP). In general each site or sub-location has its own system of archiving, and all systems vary considerably in terms of development, access, security etc. This makes it very difficult to assemble the data at the regional level, as was stressed during the preparation of the last GCRMN Caribbean report: “*due to this absence of regional data centralization, and sometimes of collaborative will, the work of data collection turned out to be huge and very tedious for the authors, more than 1000 emails were sent, difficulties raised regarding data sharing, etc.*” (Jackson et al. 2014).

Therefore, it was one of the specific objectives to set up a central database for the region that will allow an easy input of collected data, facilitate reporting, and support information sharing and communication. The dedicated group worked on this subject with the support of the Waitt Institute who offered to build and maintain such a tool. However, this suggestion is currently under further discussion by the network participants as other mechanisms for data archiving and dissemination are being considered. There is a crucial need of coordinating the substantial number of existing and up coming databases within the Caribbean region. One of the task of the Caribbean GCRMN Network steering committee is,

therefore, to explore and identify databases/platforms/information systems in place and to be developed, in order to find synergies, coordinate with relevant actors and seek for the best opportunity for storing and sharing data of GCRMN-Caribbean sites.

#### GCRMN CARIBBEAN: NEXT STEPS

An important challenge for the network is to find a balance between gathering as many monitored sites as possible eventually, while still keeping the necessary scientific data quality to ensure the proper use of the latter. Faced with the realities of lack of funding, human resources and means, the main question that was posed was how to start getting countries and people to commit to monitoring of specific indicators and get them involved in the network.

Several proposals and ideas were discussed, including the determination of Wider Caribbean GCRMN index sites if all indicators could not be measured at each site, the setting up of a complete list of countries' sites for future invitations and a broadly cast net to invite those who are willing and capable of monitoring. Consensus was reached on starting a list of sites which have already proved capable of fulfilling the network requirements.

**Table 2.** Examples of socioeconomic parameters and methods for data collection.

Driver/Industry	Tourism	Fishing
Variable Description	Tourism Infrastructure	Fishing Infrastructure
<i>Rationale</i>	Coral reef locations/countries are often highly dependent on coastal tourism for their economies. The collection of statistics on the number, size and location of tourism establishments (hotels and coastal attractions) can provide an indication of potential impacts to the coast from coastal development. These types of infrastructure can be linked to water and energy demand, coastal pollution and general indicators of carrying capacity. The information can therefore be used as a proxy for pressure on coastal ecosystems including coral reefs. This information can also be used to track impacts from infrastructure development occurring in specific for example increased sedimentation from damage from hotel construction, seagrass removal for swimming area and beach creation as well as dredging for port maintenance( cruise and cargo shipping)	This information is useful for making a link to the level of fishing activity from specific landing sites (fishing beaches). Fishing pressure is directly linked to (in water) abundance and biomass. Information on the location of fishing beaches, other features such as sanitation, storage facilities, waste management etc. is also useful.
<i>Data Collection Methods/Sources</i>	1) Tourism Board, Published lists of registered companies, chambers of commerce, web searches, Planning agencies – Maps and GIS information 2) Port Authority, Cruise ship schedules (number per year, capacity), web sites of major cruise lines	1) National Fishing statistics, fisheries agencies, MPAs/NGOs that interact directly with fishers at/near the GCRMN site. 2) National export statistics (if any), Ministry of Fisheries/Trade etc – for example Lobster and Conch are typically key species for export. 3) In person visual census (at landing sites that may have an impact on the GCRMN site of interest). Field sampling to count and enumerate number of landing sites, number of vessels, estimates of fishers etc.
<i>Reporting Format/Units</i>	1) Number and size of hotels per unit area (room numbers) 2) Number and types of large coastal attractions (water parks, aquaria, dolphinarium etc.) 3) Number and size of cruise shipping piers 4) Number of ship calls per annum	Number of Beaches/Landing sites Number of Fishing Vessels – type and size of boats and type of gear
<i>Periodicity</i>	Every 4 years (or timed for the production of the GCRMN report). Baseline information should be collected initially	Every 4 years – completed in time for GCRMN Report (collect initial data in the first year – baseline)

Participants identified sites currently able to meet the prerequisites related to data and methods for bio-physical parameters, and for which access to socio-economic data would be relatively easy. The first tentative list includes the strongest 21 sites cited in the GCRMN Caribbean report (Belmont et al. 2014 - Annex H) to which several other sites of the CARICOMP, AGRRA, Healthy Reefs for Healthy People networks may be added.

### Proposed New Network Structure

The experience of the participants' and shared experiences allowed for the identification of several structural parameters that explain the challenges that impacted the previous GCRMN network (Figure 1). Those main elements, listed below, represented many lessons learned and from this the current network participants proposed a new organisational model. These elements and recommendations for success are discussed below.

*The importance of institutions and people/individual's involvement* — Several examples within the Caribbean region showed that a lot of the communication and network collapsing came from the departures of individuals who were committed, and when their institution could not provide necessary replacement and dynamism. A network is defined before everything by its members therefore the involvement of the latter is a crucial element that must be taken into consideration.

*The importance of not dividing the region into sub-zones thus leading to isolation and miscommunication* — Rather than dividing the region into distinct sub-units, it was proposed that it would be better to gather relevant actors, with various but complimentary expertise and representation, not focusing on their geographical origin for decisions processes and expert advice. This was the basis for organizing the composition of the steering committee. This new structure replace the previous sub-regional nodes system, and thus the entire network is expected to benefit from everyone's assets and experience, as well as being representative of the region's heterogeneity and richness, in terms of geography, language, culture, governance, and technical expertise.

*The importance of a coordinating actor* — With any network there is the need for a point of contact (organization and/or individual) who acts as a catalyst, to ensure open and regular dissemination of information and to provide sustainability to the network. This coordinating entity should also facilitate continuity and, along with the support of the Steering Committee and a regional coordinator, will be instrumental as an informative and exchange platform for the entire region and its actors.

### Caribbean GCRMN Steering Committee

The proposed Steering Committee is composed of a chair, a co-chair and several members from the people present at the Workshop. The composition of the Committee reflects the cultural and geographical diversity of the region, represents a variety of technical, scientific and policy expertise in order to fulfill the roles identified. It

will allow partnerships and collaboration enhancement, promote expertise exchanges, and support and extend coral reef monitoring outreach through internal and external communication. Gaps and needs in the region will be more easily identified, and efforts will be directed towards reinforcing fund-raising and gathering forces for co-financing. It will help developing cooperative, concrete projects specifically addressed to build local capacity through training programs and expert support.

Any individual member of the steering committee may be responsible for one or more of the previously described roles. This Steering Committee will also assist with internal and external communication of the regional network, address building local capacity through training programs and expert support, and will try to engage all countries in the region to join this network. Members will meet regularly, on an opportunistic basis using other relevant regional meetings as a platform whenever possible.

To coordinate these efforts the UNEP/SPAW-RAC was designated as the WC GCRMN regional coordinator: Its representative will be member and chair of the Steering Committee and work together with the latter to lead and provide guidance with respect to its specific roles. The regional coordinator will also help facilitate meetings' venues and necessary logistics, ensure communication within the network and be a catalyst for encouraging collaboration among members. SPAW-RAC will ensure the continuity of the regional coordinator mission.

### CONCLUSION & PERSPECTIVES

The considerable work and scientific effort made to produce the report *Status and Trends of Caribbean Coral Reefs: 1970 - 2012* has allowed, among other things, to identify issues in the coral reef monitoring organisation of the region. Following this assessment, a quick reaction and a strong motivation appeared at the regional level for a common search for solutions. The objective of the work described in this report was therefore to handle and improve the cooperative processes between the stakeholders and experts of the region, with for ultimate goal to improve the coral reef monitoring and data management, including dissemination. As noted above, this is a delicate and complicated regional cooperation exercise in the light of this region's heterogeneity.

One major objective of the new Caribbean GCRMN is the provision of a set of core methodological approaches for contemporaneous collection of biophysical and social science (human dimensions) coral reef monitoring data. Contemporaneous data collection is important because of the need to make the link between changes to coral reef ecosystem health and human impacts at the local, regional, and global scales.

It is hoped that the outputs of the Caribbean GCRMN workshop will lay the foundations that will lead to a better network, by proposing a new and improved model and its associated technical guidelines and solutions. The support required to develop this model towards a functional and reliable system is a challenge given the number of countries involved and the limited resources at site level for most of them. It will be important to keep in mind the

regional dimension at all times, and it will require commitment and consensus in order to get as many actors as possible to adhere and therefore create a real cooperative effort, standardized monitoring, and consistent information flow.

In addition to considerations at the local level, it is crucial for stakeholders to include consideration within a regional context, taking into account existing ecological connections, but also socioeconomic aspects and the heterogeneity of the region. Regional and sub-regional organizations such as UNEP-CEP and SPAW-RAC,

AGGRA, HRI, or CARICOMP will therefore have a major role to play to mobilize coral reef actors at national and local levels. In this context, a tentative workplan has been developed to prioritize actions following the Workshop, with achievable goals within realistic time frames for developing the network over the coming two years. The Caribbean region is the first of the global GCRMN to start this 'network revitalization' work. This effort will hopefully also provide a basis for other regions facing similar problems.

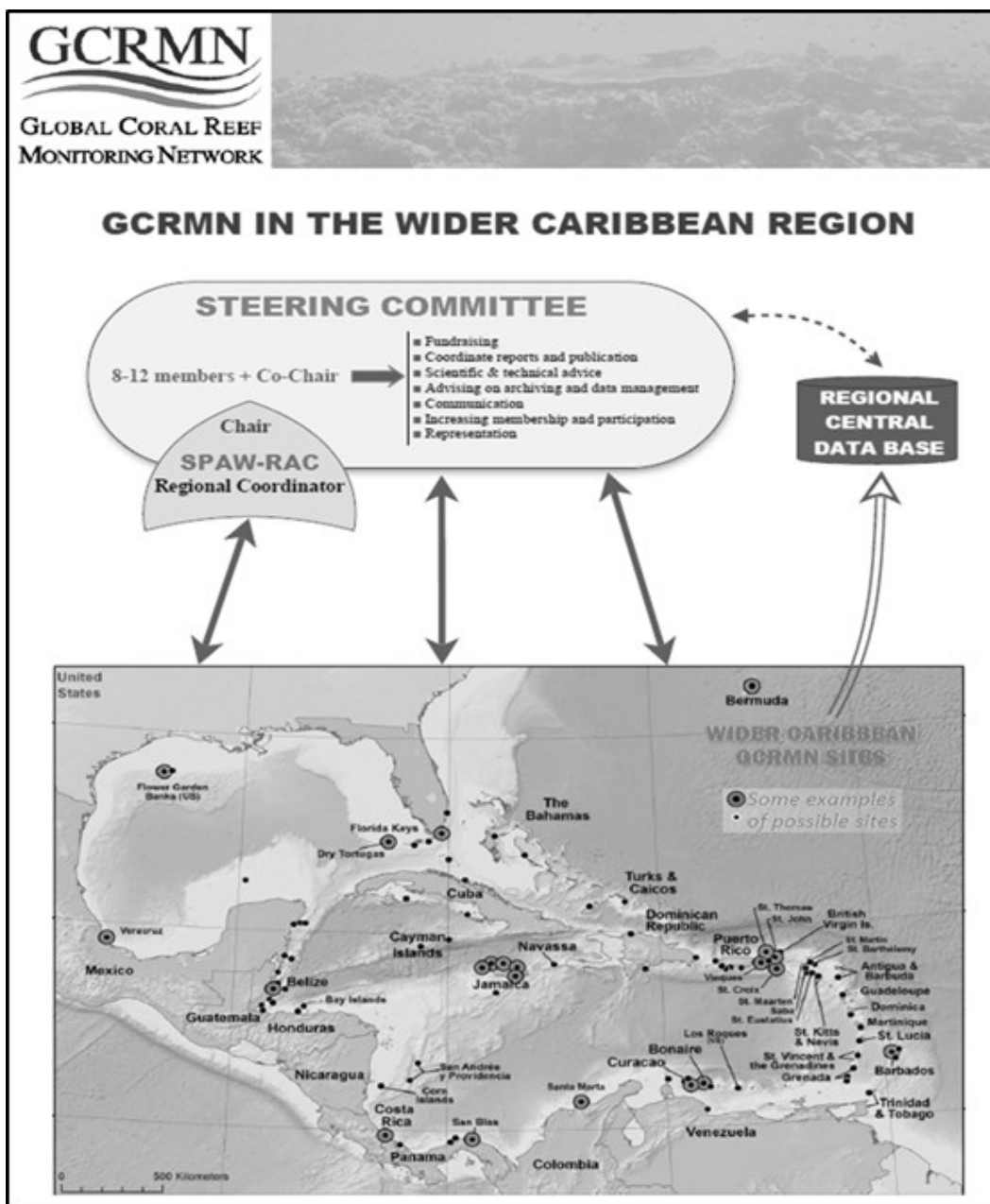


Figure 1. Proposed structure of Caribbean GCRMN.

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