

CONSERVATION AND SUSTAINABLE USE OF THE MESOAMERICAN
BARRIER REEF SYSTEM (MBRS) IN MÉXICO, BELIZE, GUATEMALA AND
HONDURAS

Current Status of Environmental Knowledge, and
Environmental Monitoring Activities in the Mesoamerican
Barrier Reef Region, with particular reference to Belize,
Guatemala and Honduras

Report to MBRS PCU

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With National Reports on Belize, Guatemala and Honduras appended:

Belize Country Report by Isaias Majil
National report for Guatemala by Juan Carlos Villagrán
Diagnóstico del monitoreo de la ecología de arrecifes coralinos y ecosistemas asociados
en Honduras (Informe de país), by Carlos A. Cerrato B.

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Executive Summary

This report provides a summary for the MBRS region describing the existing governmental and non-governmental institutions involved in marine environmental management, their responsibilities or areas of interest, and their capacity for participation in a regional Synoptic Monitoring Program (SMP). In addition, the report briefly summarizes the various monitoring programs now operating, and the general extent of knowledge of the marine coastal ecosystems of the region. Section 3 consists of National Reports, in the national languages, provided by National Consultants for each of Belize, Guatemala and Honduras. These National Reports provide considerable added detail on the organizations, their capabilities, and their current activities in coastal marine environmental management, and include bibliographies of published and unpublished documents pertaining directly to the ecology and the management of marine systems within each country. Each National Report also includes specific recommendations, by the National Consultant, for institutions that could play a role in the SMP. In Section 4, we provide some general recommendations to assist in identifying appropriate participants in the SMP, but we do so knowing that our information is limited, and that many decisions concerning participation of different institutions have already been made.

In all four countries, sustainable management of coastal marine systems, including mangrove forests, seagrass beds and coral reefs, is a responsibility distributed across a number of governmental and non-governmental agencies. Data and programs are poorly integrated even within countries and a regional perspective is only weakly developed. Little environmental monitoring is being done, and, in reality, most monitoring programs should be termed baseline studies because they rarely run for more than a couple of years. Many institutions with management responsibilities in the region have a severe lack of capacity – informed personnel, equipment, and funds to support active data collection. A more effective sharing of limited resources will be necessary, although some redirection of national resources towards this sector should also occur. One major benefit of the planned implementation of an SMP by the MBRS/SAM project can be the development of a more regional perspective among managers, a greater awareness of the intrinsic interconnection among parts of the regional system of coastal marine environments, and a much more effective integration and sharing of environmental data.

The building of a regional SMP, to be sustained after the completion of the MBRS project so that a growing database of value for informing management decisions throughout the region, is a daunting task. For this component of the MBRS/SAM project to be successful, it will be necessary to address three particular deficiencies:

- a failure of most individuals who monitor to think regionally instead of locally,
- their lack of understanding of the principles of environmental sampling, or of the need for sampling procedures that are either kept constant, or are carefully and rigorously cross-correlated, over both space and time, and

- a failure of most agencies and governments that support monitoring programs to value the process, or the product, sufficiently to ensure it is sustained and the data used and disseminated.

In our Second Report, we consider needs for the ecological component of an SMP, review monitoring protocols, and set out a series of recommendations to enhance the likelihood of implementing a sustained SMP. Foremost among those recommendations is our proposal that an inclusive participatory process must continue to be used to plan the SMP. Such a process will both educate and inform participants, and build a program that will be enthusiastically implemented and sustained.

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1 Introduction

The Mesoamerican Barrier Reef System or MBRS extending from the northern Yucatan Peninsula, down through México, Belize, and Guatemala, to the Bay Islands of Honduras is the most extensive development of coral reef environments in the Caribbean, and of global importance for conservation for this reason. The primary goals of the GEF/CCAD program for the Conservation and Sustainable Use of the MBRS are to enhance protection of these vulnerable and unique marine ecosystems, and to assist México, Belize, Guatemala and Honduras to strengthen and coordinate national policies, regulations, and institutional arrangements for marine ecosystem conservation and sustainable use. This report summarizes the current state of ecological knowledge in the region, the monitoring activities in place, and the agencies and individuals that are doing this work. The primary focus is on the three southern countries, and we were assisted in completing it by the reports of National Consultants from each of Belize, Guatemala and Honduras.

In their report to the World Bank, Sale et al. (1999) summarized the status of marine environmental management and monitoring in the region at that time. They stated:

"The MBRS is at risk from coastal pollution, over fishing, other inappropriate uses, storms, episodes of warmer than usual temperature, outbreaks of disease and other "natural" phenomena that may have underlying anthropogenic causes. Several well conceived, and professionally done monitoring programs are in place and should be continued. A number of good baseline studies, intended to form the basis of future monitoring efforts, also exist.

"However, most monitoring programs are very local in focus, there is little evidence of even a national-scale perspective, and a regional focus spanning beyond national boundaries is rare. The focus is almost entirely on coral reef systems, to the exclusion of seagrass, mangrove and other important systems. Only in Belize and México are there geo-referenced databases covering a significant portion of the region under that nation's jurisdiction, and in both of these cases, the database can be accessed and modified by only a couple of people with the necessary skills. As a result, these databases are vulnerable, and less accessible than they could be. Integrated environmental information systems for coastal marine regions do not exist, even at a national scale. Data sharing is rare, and usually occurs through inter-personal, rather than inter-agency relationships. Much of the capacity for monitoring is in the NGO sector, and, especially in the south, there is limited evidence of a governmental commitment to the value of environmental monitoring programs. The efforts of many dedicated people maintain the current monitoring effort, but this effort is clearly fragile, insufficient in extent, severely constrained by a lack of resources, and does not provide a regional capacity for monitoring the "health" of the MBRS."

Three years later, this blunt assessment remains fundamentally true, although there has been definite progress during that time. Here, we briefly summarize for the region, while the three National Reports appended provide more detail for each of Belize, Guatemala

and Honduras. The newly developed monitoring protocol developed by CONANP was provided in lieu of a national report for México. This protocol is among the ones examined in our second report.

1.1 The stakeholders.

In each country, government departments responsible for fisheries and tourism, the fishing and tourism sectors, and the general public who care about their environment and their quality of life should all have a vested interest in the sustainable management of coral reefs and surrounding inshore environments. However, tourism (both government departments and the industry) is rarely an active participant in projects to advance sustainable environmental management. Other industries (agriculture, manufacturing, shipping), and the government departments regulating them, should be aware of, and concerned about possible impacts of their activities on the near-shore marine environment. With few exceptions, government departments of agriculture, environment, or industry and commerce place marine environmental concerns low on their priorities.

Recognition of the economic and aesthetic value, and the need for effective management of near-shore marine environments and coral reefs is not widespread, and the NGO community continues to play a vital role in raising consciousness about the need for effective environmental management.

1.1.1 Governmental agencies

Responsibility for coastal zone management is not centralized in a single agency in any of the four countries. Instead, fisheries, management of protected areas, management of pollution from shore-based activities, and other responsibilities are distributed among several governmental departments. Marine environmental management is also poorly integrated with terrestrial management, and governmental departments responsible for terrestrial activities such as agriculture or industry do not see regulation of these activities' impacts on the coastal ocean as a priority responsibility of theirs.

This situation is certainly not unique to these four countries. Governments develop their structures in response to a variety of needs, and the need to manage coastal marine environments sustainably has been recognized only recently. Nevertheless, the particular governmental structures create boundaries that can become barriers. Here I note specific examples of structural impediments to effective management of the coastal zone. The National Reports for Belize, Guatemala, and Honduras provide more detailed summaries of the governmental departments involved in coastal marine management in those countries.

In México, federal responsibilities for fisheries management, management of marine protected areas, and enforcement of that management were all within the large umbrella, SEMARNAP. While SEMARNAP may have been too large to function effectively to coordinate environmental management in the country, bringing these responsibilities together was appropriate. Late in 2001, SEMARNAP was restructured as SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales), removing responsibility for fisheries management to Agriculture, and elevating the unit responsible for protected area

management from a unit within INE (Instituto Nacional de Ecología) to a Comisión Nacional, still within the SEMARNAT umbrella: CONANP (Comisión Nacional de Areas Naturales Protegidas). These structural changes have raised the profile of protected area management, but they have separated fisheries management from other aspects of coastal resource management, and have not remedied the problems caused by the separation of enforcement (in PROFEPA) from MPA management (in CONANP). There is no national agency responsible, in general, for coastal marine environmental management.

The Coastal Zone Management Authority and Institute of Belize (CZMA&I) is the only governmental entity in these four countries with a mandate for environmental management of that country's coastal marine systems. Established only recently as a statutory authority, the CZM Authority remains dependent on international grants to fund its CZM Institute. It is small, fragile, and its longer-term future must be seen as in doubt unless a stronger government commitment to sustain it is developed. It has broad responsibility for sustainable management of coastal waters, but very little regulatory power. It and the Department of Fisheries have overlapping responsibilities, and a history that, in the past, has not always been cooperative. To complicate matters further, while the Fisheries Department has responsibility for declaration and management of Marine Reserves, marine protected areas in Belize have been established under a variety of legislation so that different MPAs are managed by a variety of governmental departments, usually in a 'lease-back' arrangement with the NGO that pushed for their establishment. In consequence, despite having the only national agency with overall coastal zone management responsibility, Belize's coastal marine management remains fragmented.

In Guatemala, both fisheries management (UNEPA) and management of protected areas (CONAP) are within MAGA, the Ministry of Agriculture, however, this separates the management of protected areas from CONAMA (Comisión Nacional para el Manejo del Ambiente) which lies outside that ministry. CONAMA has little regulatory power and has to work with other agencies. In Honduras, fisheries management (DIGEPESCA) is housed within SAG, the Secretariat for Agriculture, but the management of protected areas (DAPVS) is housed in SERNA, the Secretariat for natural resources and environment. In both Honduras and Guatemala, there is limited marine expertise in any government agencies dealing with environmental management.

Collection of tidal and other oceanographic data is the responsibility of the departments of meteorology in each country, and is not viewed as primarily an aspect of environmental management. Instrumentation is very sparse in the three southern countries, due partly to the effects of Mitch that have not yet been remedied. In Belize, new tide gauges and other instrumentation have been obtained through the participation of the Department of Meteorology in the CPACC program.

In each country, governmental agencies with responsibilities for land-based activities such as agriculture and industry provide little evidence that they consider the assessment or regulation of impacts of these activities on the coastal marine environment to be a priority responsibility for them. Even national agencies charged with maintaining geo-

referenced databases of a broad range of national statistics, such as INEGI in México or Belize's LIC, see their responsibilities as stopping at the shoreline. This situation is certainly not unique to these four countries, but improvements are unlikely until there are much stronger agencies in place with a clear mandate for coastal environmental management. The development of a regional EIS including a growing database generated by a Synoptic Monitoring Program for the MBRS region could facilitate the development of stronger governmental agencies in each country.

1.1.2 The Research and Education Community

Academic institutions, including appropriately skilled faculty, make use of the coastal marine ecosystems to teach, to advance fundamental knowledge, and to apply their skills to questions of management concern. The research capacity of these institutions is limited, except in México. There, institutions such as CINVESTAV in Merida, ECOSUR in Chetumal, and UNAM, with a branch campus in Puerto Morelos include well-qualified faculty, some advanced instrumentation, and a tradition of research, while several other institutions are oriented more strongly to undergraduate teaching. Research-intensive Mexican institutions outside the Yucatan also will have some capacity to contribute because México can afford the additional travel costs for work at a distance from the home campus. The Universidad Nacional Autonoma de Honduras, and the Universidad de San Carlos, and Universidad del Valle, both in Guatemala include a few faculty active in marine environmental research, but they are constrained by time, and a general lack of research funding. The University of Belize offers only an undergraduate program in marine studies, and currently has little marine research capability although it does maintain a basic field facility at Calabash Caye, Turneffe Islands, that has capacity for about 25 scientists or students.

1.1.3 The NGO Community

The NGO community is a major player in coastal marine environmental management, particularly in the southern portion of the region. This community comprises numerous, locally based organizations, some larger national or regional ones, and the international conservation agencies such as WWF, WCS and TNC. Many examples of environmental conservation or management are the result of collaboration between small, local, and larger, regional or international agencies, which provide guidance and financial support. In México, Amigos de Sian Ka'an A.C. is the largest, and oldest NGO (established 1986) active in the coastal region of Quintana Roo. It maintains a head office in Cancún, and small branch offices in Chetumal, Carillo Puerto, Sian Ka'an, and Xcalac (combined staff ca. 20 persons). Amigos de Sian Ka'an was responsible for the establishment of the Sian Ka'an Biosphere Reserve, and Arrecifes del Xcalac. It has carried out a number of other environmental assessment, or planning studies on the coast of Quintana Roo, and has collaborated with both TNC, and the Coastal Zone Management Unit of University of Rhode Island. At its Cancún office, it maintains the only georeferenced database for the coastal waters of Quintana Roo.

By contrast, Centro Ecológico de Akumal, CEA, is typical of the several, smaller NGOs in México. It is deliberately local in its focus, providing informed advice, public education, and limited data-gathering capacity on environmental issues impacting on the

Akumal community -- one that is typical of the Cancún - Tulum Corridor, growing rapidly as tourism expands to the south. The NGO communities in the three southern countries are summarized in the National Reports.

While NGOs play a major role in the region, they are occasionally not as effective as they could be because of duplication of effort due to lack of effective communication among them. Nevertheless the existence of collaborations such as TRIGOH shows that when they provide for effective collaboration, the NGO community can be very effective.

1.1.4 The private sector

The fisheries and tourism industries have major stakes in a sustainably managed marine environment. Individuals in these industries recognize that their economic success depends upon the continued existence of healthy natural systems. However, with rare exceptions, they do not see the implementation of sustainable use of marine resources as their responsibility. This unfortunate circumstance is not unique to the MBRS region. It probably arises because their contact with government is largely in the context of regulation/restriction of their activities, while the conservation movement has tended to paint industry as the cause of environmental problems, instead of as a potential partner in their mitigation.

The fishing industry, and several components of the tourism industry contain significant capacity to make observations and collect environmental data from broad areas of the MBRS region. An effort to involve them more actively would pay off directly, as well as indirectly. The quality of fishery catch data would improve if fishermen were better informed about why it is needed and how it is used. The enforcement of fishery regulations is greatly enhanced if the fishery understands, and buys into the regulations. In tourism, dive operators, in particular, recognize that their clients increasingly value environmentally sensitive actions, and can become very willing participants in regulating use of specific sites. The first marine protected area off Roatán was developed through the efforts of the proprietor of Anthony's Key Resort.

The shipping, oil, construction, and agro industries, all have potentially large impacts on the quality of the coastal marine environment. Economic success of each of these industries is largely independent of the quality of that environment, so there is little incentive to act in ways that will minimize negative impacts. There is also little evidence that individuals in these industries are aware of the sensitivity of coastal marine ecosystems to pollution. There are preliminary plans for oil spill mitigation for the Gulf of Honduras, developed by industry, government and other personnel. There is a broadly held view that these are far from adequate. The limited and weak capacity of governmental agencies with responsibility for marine environmental management, and their limited authority over agriculture, shipping or oil and similar industries, mean that impacting actions by these industries are scarcely monitored, and poorly regulated.

1.1.5 The local community

With few exceptions, the general community in these four countries is not well informed about the economic or the biodiversity value of their coastal marine resources. Nor are

the people well informed about the sensitivity of coastal marine ecosystems to mismanagement, or to the impact of pollution caused by activities upstream. There is a major need for public education. Particularly towards the south, this education must be combined with development of new employment options, so that some members of the artisanal fishery can gain new livelihoods. While sustainable environmental management is compatible with continued fishery and tourism activity, it is likely that in many parts of this region, fisheries already exceed sustainable levels and need to be scaled back.

Certain NGOs appear to be having some success in directly engaging the local population in conservation initiatives, or in modifying their own activities in ways that improve environmental management. In Belize, TIDE's activities in moving individuals from fishing to being fly fishing guides are a good example of what might be done. Governments, however, do not appear to be addressing this educational need effectively, and **there could be real benefits in using the data from the SMP, or even the process of collecting those data, as a part of public education in the region.** Sale et al (1999) specifically recommended use of components of the SMP and the resulting EIS as integral parts of an effective public education program aimed at the schools, the tourism operators and staff, and the general public.

1.2 Existing ecological data in the region

Coral reefs in the MBRS region have received considerable attention from the international scientific community over many years, in addition to the attention given to them from marine scientists within the region. The products of this attention are broadly scattered in, and form a coherent part of, the world's collective knowledge on the oceanography, geology and biology of coral reef systems. This broad and sustained research effort is facilitated by the existence of a number of universities and equivalent research institutions in the region, and by the existence of a small number of research facilities based on or near reefs. In addition, the network of MPAs of various types has encouraged the focusing of field research at particular sites where a combination exists of management interest in building local knowledge, and logistic support for field activities. The marine biota of this region is typical of the Caribbean, as are the geological and climatic processes that shape coral reefs. For this reason, basic scientific knowledge from throughout the Caribbean in particular, and to a lesser extent from other coral reef regions, is readily transferred to this region.

While the activities of (chiefly academic) scientists build fundamental knowledge, these rarely contribute in a coherent way to building a database of site-specific environmental data that could be used to assess the state of, or temporal changes in, the ecological condition of the region as a whole, or of specific locations within it. The building of site-specific databases is a management, rather than a research function, and the region has been poorly served in this respect. Geo-referenced environmental datasets are few and scattered. The most comprehensive is undoubtedly that held by CZMA&I for Belizean waters, and many MPAs in the region lack accurate habitat maps based on remotely sensed data. Although a number of environmental monitoring programs have been initiated, few have been sustained for more than 1-2 years, and, in many cases the monitoring data are stored on paper or in spreadsheets, rather than in GIS databases. There appears to be a growing awareness that the effective combining and archiving of

available information for the region would create a very useful data source for management decisions, and some limited attempts to do this have taken place. Recent work by WWF has helped identify and bring together the data for the region, but as of yet, those data have only been made available in printed form.

The MBRS SMP has the potential to be the impetus for a major improvement in this situation. A sustained monitoring program, on a regional scale, with data deposited in a regional EIS will build a framework for a regional database of environmental information. To be successful in reaching this goal, the MBRS SMP must avoid the errors of earlier monitoring programs. Our recommendations for the SMP are designed with that daunting task in mind.

Sale et al (1999) provided a summary of data available in each country. The National Reports for Belize, Guatemala and Honduras update that report and summarize the environmental data available in each country. In addition, each National Consultant has provided a set of ecological/environmental reference articles for his country as a bibliographic archive for the MBRS project.

2 Existing monitoring programs.

2.1 Reef condition

The great majority of environmental monitoring programs aim to assess reef condition, most typically as percentage cover of living coral, but frequently using additional or alternative indices. Prevalence of coral disease, and prevalence of coral bleaching have been considered increasingly important to monitor. Few programs have monitored fish or other components of the biota than corals. Most programs are locale-specific with no attempt to achieve a regional focus. In reality, most monitoring programs that have been initiated should be called baseline surveys, because the monitoring is seldom continued beyond a year or two. They have used a variety of different monitoring protocols, and this complicates any attempts to combine data from different projects. Sale et al (1999) summarized monitoring projects at that time, and the three National Reports bring those data up to the present for Belize, Guatemala and Honduras.

2.2 Mangrove and Seagrass Habitats

Few monitoring efforts in place attempt to monitor these important non-reef communities. CARICOMP has established protocols for monitoring primary production in each, but even at many CARICOMP sites, these protocols are not being applied.

2.3 Water quality

Despite the widespread expectation that poor water quality is likely to be an important factor in MBRS health, few on-going programs other than that of CZMA&I address this issue. There are no programs that monitor accumulation and possible inputs of persistent organic pollutants that can result from agriculture (pesticides), shipping (hydrocarbons), and municipal effluents (trace metals and organochlorides). The difficulties of monitoring impacts of poor water quality seem unappreciated, so it may be fortunate that there are not large numbers of projects dedicated to analyzing water samples collected on

a regular basis. Such periodic analyses of water samples are unlikely to be able to detect changes before their consequences become very obvious in changes in the health or abundance of biota impacted. In other words, routine water sample analysis, unless it is done very frequently, using high precision instruments, and precisely measuring a broad range of attributes, is unlikely to be helpful in detecting seriously deleterious conditions.

Despite the need for more effective ways of assessing impacts of poor water quality, the lack of attention to this issue remains disturbing. An effort to monitor water quality effects must become a part of the SMP, however, as our recommendations will make clear, the procedures for doing this in an effective way are not yet developed.

2.4 Oceanography

Meteorological departments in México, Belize, and Guatemala collect very limited data on tidal fluctuations and on currents. As well, the HCRF facility at Cayos Cochinos includes a NOAA oceanographic/meteorological instrumentation package. There is a general lack of suitable instrumentation in the region, and data sets are frequently interrupted by the loss of instruments in storms. These data are not widely perceived as part of environmental monitoring.

2.5 Notable gaps

Despite dedicated effort by many individuals, current monitoring programs leave many gaps. Water quality is only monitored in Belize, other than for human health concerns, or, on a very local scale by NGOs concerned about water quality at specific sites. Further, as noted above, most of the monitoring of water quality that is being done uses methods that are unlikely to be able to detect small changes in quality that still will have major effects on reef ecosystems.

Monitoring of reef ecosystems is concerned almost exclusively with species abundances rather than with dynamics and the processes driving these. Monitoring efforts are few, except in Belize, and there is an unfortunate tendency for monitoring of reef ecosystems to be localized within MPAs, or at sites that are in the process of being declared as MPAs. Without monitoring unprotected sites, it will never be possible to demonstrate that the resources dedicated to management of protected areas are being used effectively.

With the exception of productivity measurements at a few CARICOMP sites, there is no quantitative monitoring of mangrove or seagrass ecosystems, despite the recognized value of these systems for fisheries, and for protection from coastal erosion. Instrumentation for monitoring physical conditions (tides, ocean states, weather) is sparsely distributed and frequently not operational. Further, these data do not end up in databases that house other environmental monitoring data. Similarly, most fisheries data are used to monitor the fishery rather than fish stocks, and are not integrated with other environmental monitoring data, even when the same agency is responsible for both.

The lack of effort to maximize the value of monitoring data by making them accessible, and by integrating the data from different monitoring programs is a widespread and serious failing. It is one that the MBRS/SAM SMP should strive to remedy. This lack of effort to maximize availability likely arises from the fact that monitoring data do not

appear to be seen as useful for informed decision making, even by the agencies that collect them. Instead, they seem to be viewed as primarily a public relations exercise. The existing data are not used to the extent they could be, particularly if the many local data sets were assessable in a common EIS and were reanalyzed in the context of questions posed at the scale of the MBRS. The lack of importance given to monitoring programs by agencies charged with environmental management, is also indicated by the frequency with which programs are suspended due to lack of funding, and the fact that most were funded from external sources rather than line budgets.

2.6 Problems for developing an effective Synoptic Monitoring Program.

Despite the broad institutional experience of implementing monitoring programs, and the presence in these institutions of dedicated, experienced people, we are concerned that implementing a sustained Synoptic Monitoring Program will be difficult. The fundamental problems seem to be:

- a failure of most individuals who monitor to think regionally instead of locally,
- their lack of understanding of the principles of environmental sampling, or of the need for sampling procedures that are either kept constant, or are carefully and rigorously cross-correlated, over both space and time, and
- a failure of most agencies and governments that support monitoring programs to value the process, or the product, sufficiently to ensure it is sustained and the data used and disseminated.

In building the Synoptic Monitoring Program, it will be necessary to confront these problems and develop solutions. Otherwise the SMP will suffer the same fate as myriad monitoring programs that have preceded it: It will fade away in a few years. Its accumulated data, derived from methodology that varied unsystematically through space and time, will be stored but not readily available, and will not be used for any management purpose. The MBRS/SAM project provides the opportunity to do a far better job than that.

3 Recommendations for Organizations with Capacity to Implement a Synoptic Monitoring Program

These recommendations are put forward tentatively. We are not in a position to know the capabilities of many of these institutions in any detail, and we also recognize that a number of decisions on which organizations will be involved have already been made in the course of developing the MBRS/SAM project. In general, we anticipate that monitoring for the Synoptic Monitoring Program will be done most effectively if those groups responsible for management of specific locations participate in the monitoring of them. Nevertheless, there will need to be a structure within each country to coordinate these separate monitoring efforts, and the SMP must include locations that are currently not being actively managed, and therefore not already the responsibility of any particular group. Our suggestions focus on organizations that may fulfill the needed coordination

and leadership roles in each country. In addition, each National Report contains specific recommendations on participants.

In Mexico, CONANP should logically be the lead governmental organization implementing the Synoptic Monitoring Program because of its size and capacity, and because its responsibilities directly concern the sustainable management of a number of protected areas in the region. Indeed, CONANP has been developing a monitoring protocol for Mexican reefs that we review in our 2nd Report. In addition to CONANP, there are likely to be several academic institutions that will be capable of, and interested in playing a role in the implementation of the SMP. In addition, we anticipate that academic institutions in Mexico may take on the challenge of developing new methodologies that will make the SMP more effective over time in monitoring such things as water quality, nutrification, and specific contaminants. Finally, the NGO sector could also play a role, particularly if CONANP's legislated responsibilities prohibit its personnel from monitoring locations outside protected areas under CONANP management. **An SMP that does not monitor locations that are not being actively protected can never assess the effectiveness of the protection given to MPAs.**

In Belize, the Department of Fisheries and/or the Coastal Zone Management Institute must be the lead governmental agency implementing the SMP. We see CZMI as very well equipped by philosophy, mandate, and experience, but we recognize that Fisheries may be better resourced, and does have specific responsibility for management of Marine Reserves. We think it important that CZMI expertise be centrally included, regardless of which agency becomes the lead.

In Guatemala it will be necessary to rely on the very small number of institutions with individuals possessing some knowledge and experience in marine conservation. At present we lack a clear appreciation of which institutions are best equipped to help.

In Honduras, the National Committee on coral reefs, CNACH, includes representatives of 17 governmental and non-governmental organizations. The National Report for Honduras indicates that there have been substantial discussions within that committee concerning the organizations that should play a role in the SMP. Our impression is that the National Committee may be tending to divide up the responsibility among too many partners, however, again we stress that our knowledge of the capabilities of the various organizations is very limited.

Throughout the Gulf of Honduras, TRIGOH member organizations, if not TRIGOH itself, should be invited to play a role. In general, NGOs will have to play a major role in the southern part of the region, simply because the expertise in government departments is relatively more limited there. There exists an important need to build capacity in this part of the region, and the SMP should be used as one mechanism to achieve that.

4 National Reports

4.1 Belize National Report

The report, titled, "Belize Country Report", by Isaias Majil, is appended (60pp.)

4.2 Guatemala National Report

The National Report for Guatemala, by Juan Carlos Villagrán, is appended (23pp.)

4.3 Honduras National Report

The report, titled "Diagnóstico del monitoreo de la ecología de arrecifes coralinos y ecosistemas asociados en Honduras (Informe de país)", by Carlos A. Cerrato B., is appended (32pp.)

5 Appendices

5.1 Governmental Departments and Responsibilities in each Country

Governmental Department	Relevant functions
MEXICO	
SEMARNAP (Secretaría de Medio Ambiente y Recursos Naturales)	
INE (Instituto Nacional de Ecología)	Ecological research and application.
CONANP (Comisión Nacional de Areas Naturales Protegidas)	Management of terrestrial and marine protected areas of Mexico
PROFEPA (Procuraduría Federal de Protección al Ambiente)	Enforcement of regulations in protected areas.
CNA (Comisión Nacional del Agua)	Management of water supply, water quality monitoring from health perspective.
Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentación	
INP (Instituto Nacional de Pesca)	Fisheries management.
INEGI (Instituto Nacional de Estadística, Geografía y Infomatica)	National GIS database, does not include subtidal environmental data.
BELIZE	
Ministry of Natural Resources, Environment and Industry	
Forestry Department	National Parks, Natural Monuments (management often contracted to NGOs), Mangrove protection
Department of Environment	
Land Information Centre	maintains terrestrial GIS database
Geology and Petroleum Department	issues dredging permits
Ministry of Agriculture, Fisheries and Cooperatives	
Fisheries Department Ecosystem Management Unit	manages Marine Reserves (management often contracted to NGOs)
Coastal Zone Management Authority	Coastal Zone Management Institute, maintains coastal marine GIS database, various monitoring programs

GUATEMALA	
MAGA (Ministerio de Agricultura, Ganadería y Alimentación)	
UNEPA (Unidad de Ejecución Pesquera y Acuicola)	Manages fisheries and aquaculture
CONAMA (Comisión Nacional para el Manejo del Ambiente)	Coordination of environmental management activities.
Ministerio del Ambiente y Recursos Naturales	
CONAP (Consejo Nacional de Areas Protegidas)	Oversees management of protected areas.
Fondo Nacional para la Conservacion de la Naturaleza	Conservation and management of biodiversity.
INSEVUMEH (Instituto Nacional de Sismología, Vulcanología, Meteorología y Hidrología)	Responsible for oceanographic data, including tidal data.
HONDURAS	
SERNA (Secretaria de Recursos Naturales y Ambiente)	
DIBIO (Direccion General de Biodiversidad)	Conservation of biodiversity in Honduras, chairs CNACH, little in-house marine experience
CONADES (Consejo Nacional de Desarrollo Sostenible)	Coordinates activities to promote sustainable development.
SAG (Secretaria de Agricultura y Ganaderia)	
DEGEPESCA (Direccion General de Pesca y Acuicultura)	Fisheries and aquaculture management and regulation, member of CNACH
SECTUR (Secretaria de Turismo)	
PMAIB (Programa de Manejo Ambiental de Islas de la Bahia)	SECTUR promotes ecotourism, PMAIB manages major IDB-funded project, is member of CNACH
Secretaria de Salud (SS)	
CESCCO (Centro Para el Estudio y Control de Contaminantes)	Water quality monitoring, principally with respect to human health
Municipalidad de Puerto Cortes	
UGA (Unidad de Gestion Ambiental)	Municipal environmental office for Puerto Cortes region, member of CNACH
FNH (Fuerza Naval de Honduras)	
ENP (Empersa National Portuaria)	Manages port installations, oceanographic, tidal, bathymetric data and charts

5.2 The Major Non-Governmental Organizations in each Country

Non-governmental organization	Relevant activities, relationships
MEXICO	
UNAM (Universite Nacional Autonoma de México)	Branch campus and research facilities at Puerto Morelos, graduate training (Ph.D.), research.
CINVESTAV (Centro de Invstigacion y de Estudios Avanzados del IPN)	Branch campus in Mérida, Yucatan, includes Depto. de Recursos del Mar conducting graduate teaching (Ph.D.) and research.
ECOSUR (El Colegio de la Frontera Sur)	Graduate training (Ph.D.) and research, several campuses in region.
Comité Arrecifal Nacional del SAM para México	
CEA (Centro Ecológico de Akumal)	Small NGO dedicated to sustainable development of Akumal region
Amigos de Sian Ka'an A.C.	Largest, oldest NGO in Quintana Roo, offices in Cancun, Chetumal, Carillo Puerto, Sian Ka'an, and Xcalac
BELIZE	
University of Belize Institute of Marine Studies	Undergraduate education, field station at Calabash Caye, Turneffe Islands, maintains CARICOMP site
National Coral Reef Monitoring Working Group	Representatives from Coastal Zone Management Institute, Fisheries Department, Belize Audubon Society, University of Belize Institute of Marine Studies, SIWABAN Foundation, Friends of Nature, Green Reef, Toledo Institute for Development and Environment, The Nature Conservancy, Wildlife Conservation Society, Oceanic Society, Smithsonian Institute, WWF Belize.
Belize Audobon Society	manages Half Moon Caye Natural Monument
Forest and Marine Reserves Association of Caye Caulker	co-manages Caye Caulker Marine Reserve co-manages Caye Caulker Forest Reserve
Friends of Nature formerly Friends of Laughing Bird Caye	manages Laughing Bird Caye National Park, co-manages Gladden Spit and Silk Cayes Marine Reserve
Green Reef	manages Bird Sanctuary off Ambergris Caye
Toledo Association for Sustainable Tourism and Empowerment	co-manages Sapodilla Cayes Marine Reserve
Toledo Institute for Development and Environment	co-manages Port Honduras Marine Reserve, current Secretariat for TRIGOH

GUATEMALA	
Universidad de San Carlos de Guatemala	Provide undergraduate education, have some qualified faculty in aspects of marine science.
Universidad el Valle de Guatemala	Provide undergraduate education, have some qualified faculty in aspects of marine science.
FUNDAECO (Fundación para el desarrollo y la Conservacion)	Guatemala's largest, oldest NGO, commencing monitoring study of Bahia de Amatique
FUNDARY (Fundación Mario Dary Riviera)	Has done limited monitoring study in Caribbean coastal waters.
HONDURAS	
UNAH (Universidad Nacional Autonoma de Honduras)	Undergraduate education in marine biology, some limited expertise, member of CNACH
CNACH (Comite Nacional de Arrecifes Coralinos)	National coral reef monitoring committee for Honduras, including 17 governmental and non-governmental organizations.
BICA Bay Island Conservation Association)	Manages 2 marine reserves (on Utila and Roatan), member of CNACH.
CRIPCCA (Centro Regional de Investigaciones Pesqueras del Caribe Centroamericano)	In Bay Islands, fisheries investigations.
FUCAGUA (Fundacion para la Proteccion de Capiro, Calentura y Guaimoreto)	Manages 2 protected areas near Trujillo
HCRF (Fundacion Hondurena para la Proteccion de los Arrecifes Coralinos, Honduras Coral Reef Fund)	Manages Cayos Cochinos Marine Reserve, member of CNACH
PROLANSATE (Fundacion para la Conservacion de Lancetilla, Punta Sale y Texiguat)	Manages 4 coastal-marine reserves, member of CNACH
RIMS (Roatan Institute for Marine Sciences)	Based at Anthony's Key Resort, primarily environmental education activities
Multi-national within region	
Belize-Mexico Alliance for the Management of the Common Coastal Resources (BEMAMCCOR)	Newly formed organization to facilitate cross-border management of coastal and marine resources.
Tri-National Alliance of Non-Governmental Organizations in the Gulf of Honduras (TRIGOH)	An alliance of some 17 non-governmental organizations, from Belize, Guatemala, Honduras, or international, and active in conservation or management of coastal or marine environments of the Gulf of Honduras.

International non-governmental	
Smithsonian Institute	Research facility at Carrie Bow Caye, Belize
Oceanic Society	Field station on Blackbird Caye, Turneffe Islands, dolphin research, some monitoring of local environmental conditions, other research
University of Mississippi Consortium	Dangriga Ecological Station is local member
Coral Cay Conservation (CCC)	Monitoring studies at Roatan and Utila, previously in Belize
Wildlife Conservation Society	Research facility at Glovers Reef, active in conservation in the region.
The Nature Conservancy	Active throughout region, Belize collaborators include TIDE and FON
WWF (World Wildlife Fund, or Worldwide Fund for Nature)	Active throughout region, frequently in cooperation with local NGOs, major office in México

5.3 List of Acronyms

AFE-COHDEFOR	Administración Forestal del Estado – Corporación Hondurena de Desarrollo Forestal
BAS	Belize Audobon Society
BCIE	Banco Centroamericano de Integración Económica
BEMAMCCOR	Belize-Mexico Alliance for the Management of the Common Coastal Resources
BICA	Bay Islands Conservation Association (Honduras)
BID	Banco Interamericano para el Desarrollo = IDB
BTB	Belize Tourist Board
CARICOMP	Caribbean Coastal Marine Productivity Programme
CATIE	Centro Agronomico Tropical de Investigación y Enseñanza
CCAD	Comisión Centroamericano de Ambiente y Desarrollo
CCC	Coral Cay Conservation
CCE	Comunidad Economica Europea = EEU
CCMC	Cornerstone Chamber and Medical Services
CDC	Centro de Datos para la Conservación (Guatemala)
CEA	Centro Ecológico de Akumal (México)
CEMA	Centro de Estudios del Mar y Acuicultura (Universidad de San Carlos, Guatemala)
CESCCO	Centro Para el Estudio y Control de Contaminantes, SSP (Honduras)
CIEL	Centro de Investigación y Estudios Legales del CN (Honduras)
CINVESTAV	Centro de Investigación y de Estudios Avanzados del IPN (México)
CITES	Convention on the International Trade in Endangered Species
CN	Congreso Nacional de la Republica (Honduras)
CNA	Comisión Nacional del Agua (México)
CNACH	Comite Nacional de Arrecifes Coralinos de Honduras
CONAMA	Comisión Nacional para el Manejo del Ambiente (Guatemala)
CONANP	Comisión Nacional de Areas Naturales Protegidas (México)
CONAP	Consejo Nacional de Areas Protegidas (Guatemala)
CPACC	Caribbean Program on Adaptation to Climate Change
CRIPCCA	Centro Regional de Investigaciones Pesqueras del Caribe Centroamericano
CZMA	Coastal Zone Management Authority (Belize)
CZMA&I	Coastal Zone Management Authority and Institute (Belize)
DAPVS	Departamento de Areas Protegidas y Vida Silvestre, AFE (Honduras)
DGRH	Dirección General de Recursos Hidricos, SERNA (Honduras)
DIBIO	Dirección General de Biodiversidad, SERNA (Honduras)
DIGEPESCA	Dirección General de Pesca y Acuicultura, SAG (Honduras)
DMM	Dirección de Marina Mercante, SOPTRAVI (Honduras)
DOE	Department of the Environment (Belize)
ECOSUR	El Colegio de la Frontera Sur (México)
EEU	European Economic Union, now EU, European Union
EIA	Environmental Impact Assessment

EIS	Environmental Information System
EMU	Ecosystems Management Unit (of Belize Fisheries)
ENP	Empresa Nacional Portuaria (Honduras)
EPA	Environmental Protection Act (Belize)
FA	Fiscalia del Ambiente, MP (Honduras)
FAMRACC	Forest and Marine Reserves Association of Caye Caulker (Belize)
FAO	Food and Agriculture Organization of the United Nations
FNH	Fuerza Naval de Honduras (Honduras)
FOA	Organización de las Naciones Unidas para la Agricultura y la Alimentación. = FAO
FoN	Friends of Nature (Belize)
FPACH	Fundación Para los Arrecifes Coralinos de Honduras = HCRF
FUCAGUA	Fundación Caprio, Calentura y Guaimoreto (Honduras)
FUNDAECO	Fundación para el Desarrollo y la Conservación (Guatemala)
FUNDARY	Fundación Mario Dary Riviera (Guatemala)
GEF	Global Environmental Facility (Fondo Global para el Ambiente)
GIS	Geographical Information System
GPD	Petroleum and Geology Department (Belize)
HBOI	Harbor Branch Oceanographic Institution (USA)
HCRF	Honduras Coral Reef Fund
IDB	Interamerican Development Bank
IGN	Instituto Geografico National, SOPTRAVI (Honduras)
IMS	Institute of Marine Studies (of University of Belize)
INA	Instituto Nacional Agrario (Honduras)
INE	Instituto Nacional de Ecología (México)
INEGI	Instituto Nacional del Estadística *** (México)
JICA	Agencia de Cooperación Internacional Japon
LIC	Land Information Centre (Belize)
MAGA	Ministerio de Agricultura, Ganadería y Alimentación (Guatemala)
MBRS	Mesoamerican Barrier Reef System
MOPAWI	Fundación Moskitia Pawisa (Honduras)
MP	Ministerio Público (Honduras)
MPA	Marine Protected Area
NCRMWG	National Coral Reef Monitoring Working Group (Belize)
NGO	Non Governmental Organization
NOAA	National Oceanographic and Atmospheric Administration (USA)
OAS	Organization of American States
OEA	Organización de Estados Americanos = OAS
OFRAHNE	Organización Fraternal Negra de Honduras
PMAIB	Proyecto Manejo Ambiental de Islas de la Bahía, SECTUR (Honduras)
PMS	Programa de Monitoreo Sinoptico = SMP
PNUD	Programa de las Naciones Unidas para el Desarrollo = UNDP
PNUMA	Programa de las Naciones Unidas para el Medio Ambiente = UNEP

PROARCA	Programa Ambiental Regional para Centro America (PROARCA-COSTAS and PROARCA-CAPAS are components)
PROFEPA	Procuraduría Federal de Protección al Ambiente (México)
PROLANSATE	Fundación para la Conservación de Lancetilla, Punta Sal y Texiguat (Honduras)
REIS	Regional Environmental Information System
RIMS	Roatan Institute for Marine Sciences
RNTMH	Red Nacional de Tortugas Marinas (Honduras)
SAG	Secretaría de Agricultura y Ganadería (Honduras)
SAM	Sistema Arrecifal Mesoamericano = MBRS
SANAA	Servicio Autonomo Nacional de Acueductos y Alcantarillados (Honduras)
SD	Secretaria de Defenza (Honduras)
SE	Secretaria de Economia (Honduras)
SECTUR	Secretaria de Turismo (Honduras)
SEMARNAP	Secretaría de Medio Ambiente, Recursos Naturales, y Pesca (México)
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (México)
SERNA	Secretaria de Recursos Naturales y Ambiente (Honduras)
SMP	Synoptic Monitoring Program
SOPTRAVI	Secretaria de Comunicaciones, Obras Publicas, Transporte y Vivienda (Honduras)
SRE	Secretaria de Relaciones Exteriores (Honduras)
SRIA	Sistema Regional de Monitoreo e Informacion Ambiental = REIS
SSP	Secretaria de Salud Publica (Honduras)
TASTE	Toledo Association for Sustainable Tourism and Empowerment (Belize)
TIDE	Toledo Institute for Development and Education (Belize)
TNC	The Nature Conservancy
TRIGOH	Tri-National Alliance of Non-Governmental Organizations in the Gulf of Honduras
UB	University of Belize
UCB	University College of Belize
UMA,UGA	Unidades de Gestión Ambiental de las Alcaldías Municipales (Honduras)
UNAH	Universidad National Autonoma de Honduras
UNAM	Universidad Nacional Autonoma de México
UNDP	United Nations Development Program
UNEP	United Nations Program for the Environment
UNEPA	Unidad de Ejecución Pesquera y Acuicola, MAGA (Guatemala)
UNESCO	United Nations Education, Science and Culture Organization
UVG	Universidad del Valle de Guatemala
WCS	Wildlife Conservation Society
WIDECAST	Red para la Proteccion de Tortugas Marinas del Gran Caribe
WWF	World Wildlife Fund, also World Wide Fund for Nature, Fondo Mundial para la Naturaleza