

# **BELIZE COUNTRY REPORT**

## **“CORAL REEF ECOLOGY”**

### **FINAL**

SUBMITTED TO

MESOAMERICAN BARRIER REEF SYSTEM  
PROJECT



SUBMITTED BY

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# **BELIZE COUNTRY REPORT**

## **1. INTRODUCTION**

Environmental management in Belize dates back to the early settlers. In 1922 a Conservator of Forests was appointed under the Forest Department of the then British Honduras. This was the first step in modernizing the forest industry and the declaration of protected areas for specific purposes. In 1928 Half Moon Caye was designated the first nature reserve under the Crown Lands Ordinance (Rafael Manzanero, Unpublished Manuscript). By 1930 the Forest Department had declared five reserves and by 1984 the number had increased to sixteen. Today the number has increased to forty.

On May 2, 1987, the Fisheries Department declared the first marine reserve, Hol Chan, under the multi-use concept using the Fisheries (Amendment) Act of 1983. Today, the Fisheries Department has declared eight marine reserves of which four are World Heritage Sites.

Presently, many other governmental organizations have varied statutory management functions in the coastal and marine environment. (Appendix 1) Many non-governmental organizations are involved in coastal environmental management in Belize. (Appendix 2) However, very few organizations are involved in data collection and monitoring. These organizations with monitoring capabilities will be the main focus of this document although permitting agencies that have decision-making impacts in the coastal and marine environment will be briefly discussed.

## **2. BACKGROUND**

Belize has a population of 245,000 as per 2001 census. The country's 22,963 square Kilometers are sparsely inhabited. About one fifth of the population is

concentrated in Belize City. Of the rural population, about 50 percent live along the coast. Historically based on the extraction of forest products, the economy is predominantly oriented towards agriculture and tourism.

Belize has 200 km long barrier reef, second in length only to that of Australia, running parallel to the coast. The continental shelf extends to the reef and beyond to the three atolls of Lighthouse, Glovers and Turneffe Island. Scattered along the reef are hundreds of small islands (Cerelli Report, 1993). Over 600 species of fish, 67 species of corals and over 200 species of invertebrates have been identified.

Coral reefs are the most diverse ecosystems of the oceans and are considered vital to the economy of many developing countries in the tropics, providing an essential source of protein for the local populations and income through fishery exports and tourism industries (Regional Seas Programme, 1993). The Central American Region has extensive coral reefs, starting with the coral reefs off the Yucatan and the Belize Barrier Reef on the north, all the way south to the coral reefs of San Blas in Panama.

Despite their enormous value to mankind, coral reefs and associated habitats are being threatened from damages caused by man's activities such as over-exploitation of coastal resources, destructive fishing practices, pollution from sewage, oil and sedimentation (Spurgeon, 1991). As a result, there is the urgent need to strengthen the limited number of ongoing monitoring programs in the region especially in the MesoAmerican Barrier Reef System (MBRS) in order to detect changes in coral reefs so as to take corrective management actions. However, this capacity building can only be achieved through a concerted effort and with the knowledge of the status of the key organizations involved in monitoring, research and management.

### **3. LEGISLATIVE MANAGEMENT STATUTES**

Environmental management in the context of this report will focus primarily on those organizations working in the coastal and marine areas. In Belize several legal statutes for environmental management in these areas exist. These are as follows:



The National Park Systems Act (1981, Cap. 179 LoB) – The Minister of Natural Resources, Environment and Industry can declare any specified area of crown land to be a national park, nature reserve, wildlife sanctuary or natural monument. The Act specifies the activities, which are prohibited in these areas (Section 5 and 6), and empowers the Minister to make regulations for the “good management” of national parks and other areas (Section 8) (Rafael Manzanero, Unpublished Manuscript).



The Forest Act (1927, Cap 176 LoB) – This Act provides the necessary powers to the Minister of Natural Resources, Environment and Industry to declare Forest Reserves, administer such reserves, set and collect royalties and make regulations for the protection and sustainable use of the resources.



The National Lands Act (1992) – This Act governs the management of Government owned land and the way the land can be sold or leased to the public. The Act falls under the jurisdiction of the Ministry of Natural Resources, Environment and Industry.



Mines and Minerals Act (1988) and Regulations (1994) – The Act and regulations govern the extraction of minerals as well as dredging in Belize.



The Environmental Protection Act – Declared in 1992, this Act empowers the Department of the Environment (Ministry of Natural Resources, Environment and Industry) to regulate development in an environmentally conscious manner.



The Coastal Zone Management Authority Act (1998) – This Act provides for the institutional arrangements for coastal zone management in Belize through the establishment of a CZM Authority and its technical arm, the Coastal Zone Management Institute. The Act also provides for the preparation of a Coastal Zone Management Plan and for the introduction of fiscal measures to support the work of the Authority and Institute (Coastal Zone Management Authority Website).



The Fisheries (Amendment) Act (1983) – The Fisheries Act was amended to empower the Minister of Agriculture, Fisheries and Cooperatives to declare any area within the fishing limits of Belize and as appropriate any adjacent surrounding land to be marine reserves. The Fisheries (Amendment) Act # 12 of 1988 further empowered the Minister to make regulations for the control and regulations of the marine reserves (Rafael Manzanero, Unpublished Manuscript).



Several Laws govern coastal and marine planning in Belize: the Land Utilization Act (1981 and 1990), Housing and Town Planning Act (1947, Cap 148 LoB), Planning

Scheme for Belize (1995), Crown Lands Act (1866, Cap. 147 LoB), and the Land Surveyors Act (Cap. 152 LoB), Environmental Impact Regulations (1995), Ancient Monuments and Antiquities Act (1972, Cap. 259 LoB) and the Forests (Protection of Mangroves) Regulations (1989 and 1992).

#### **4. ORGANIZATIONS INVOLVED IN ENVIRONMENTAL MANAGEMENT**

Organizations involved in monitoring, research and management are of two basic natures: local organization and international organizations. The modus operandi of these organizations may be individualistic, partnerships or cooperative agreements to achieve a common goal such as co-management of a protected area or applied research.

#### **5. LOCAL ORGANIZATIONS**

The local organizations involved in monitoring, research and management are mainly composed of three legal statuses: Governmental organization, semi-governmental or quasi and non-governmental organizations.

##### **5.1 Governmental Organizations**

Government organizations are public institutions established under national law in order to provide goods and services to the Belizean people. The institutions addressed under this caption are departments under various line ministries. Not all are involved in monitoring but some have direct management inputs in decision-making in the coastal and marine environment.

##### **5.1.1 Forest Department**

The Forest Department, established in the early 1920's is responsible for managing the forestry resources of Belize, which includes all national forests, protected



areas, wildlife, and biological diversity of terrestrial zones. The responsibilities of the Department are primarily mandated in the Forest Act of 1927 Chapter 213 of the Laws of Belize, revised edition 2000, Forest Ordinance of 1958, National Park System Act of 1981, the Wildlife Protection Act of 1981 and the Protection of Mangrove regulations of 1989.

The Forest Department addresses all matters concerning Wildlife and Protected Areas, declared under its mandate, through its Conservation Division. With over 45% of the country under protection status, the Department is placing more emphasis on biodiversity management and conservation as opposed to the traditional logging focus. The Conservation Division issues various permits and licenses including CITES permits, scientific research permits, provisional game license, import and export permits for flora and fauna. This division also manages the national herbarium, which boasts a large collection of specimens. (Ministry of Natural Resources, Environment and Industry Website)

### **5.1.2 Fisheries Department**

The Fisheries Department was established in 1963 as a Unit of the Department of Agriculture. In 1966 it obtained its own building. The first two Fisheries Administrators were both expatriates who were on loan from the United Nations Food and Agriculture Organization (FAO). In 1977 a Belizean became Fisheries Administrator. In 1989 the Unit was upgraded to a full Department of Government. Included in that upgrade was a significant increase in staff and portfolio.

Prior to 1989 the focus of the Department was on research into the biology and behavior of the commercially exploited species, limited data collection, the

recommendation of management measures and limited enforcement. Since then the Department has evolved into a more structured entity with sections that deal with research, extension, data collection, protected areas, aquaculture, inland fisheries, environmental education and conservation compliance. Presently the Fisheries Department is composed of four units: Administrative Unit (AU), Capture Fisheries Unit (CFU), Aquaculture and Inland Fisheries Unit (AQUIF) and the Ecosystems Management Unit (EMU). (Fisheries Department Website)

The goal of the Fisheries Department is to manage the Fishery in Belize in a sustainable manner. This mandate involves the following major objectives:

### ***Capture Fisheries Unit***

- To determine the biological parameters of the fishery in order to develop management specific regulations;
- To maximize catches for domestic and export markets, while aiming to achieve sustainability through conservation exploitation;
- To determine the capacity to exploit the offshore fishery;
- To encourage the participation of the traditional fishers and the private sector in the development of exploitation and management ventures;
- To initiate a sound data collection program for this fishery in order to make adequate management decisions;
- To make changes legislative amendments wherever necessary;

- To generate annual statistical reports on the performance of the industry;
- To develop a capture fisheries policy and a five-year strategic plan;
- To develop alternative income generation projects for fishermen in order to reduce intensive fishing pressure on the existing resources.

### ***Aquaculture and Inland Fisheries Unit***

- To promote the development of aquaculture;
- To develop policy and legislation for marine and inland aquaculture;
- To prepare and implement development plans for the aquaculture sectors;
- To review development proposals and convene site appraisal visits in relation to applications for aquaculture licenses, the EIA clearance process as well as in regard to compliance monitoring.
- To promote applied and adaptive research for aquaculture;
- To produce annual statistics on the status of the industry.

### ***Ecosystems Management Unit***

- To promote a sustainable fishery through ecosystems management and the creation of marine reserves as fisheries management tools;

- To enforce the Fisheries Regulations;
- To enhance biodiversity by promoting undisturbed areas;
- To encourage research and monitoring;
- To implement the National Coral Reef Monitoring Program;
- To promote recreation via tourism;
- To conduct environmental education to all user groups specifically to the fishers;
- To assist DOE, PGD and other line agencies in conducting EIAs for development and dredging operations;
- To assist the National Emergency Management Organization (NEMO) in disaster relief efforts.

All three units plan, organize and implement public education programs in regards to the three areas of work. The units also synthesize periodic reports on program activities within each unit. Advice and information are also provided to the public upon request.

### **5.1.3 Department of the Environment (DOE)**

The Department of the Environment (DOE) was established in September 1989 to protect the nation's environment. It became a full-fledged entity with the passage of the Environmental Protection Act (EPA) in November 1992, which conferred broad statutory powers on the department concerning a wide range of environmental issues.

The Department's principal objectives are to:

- Attain the widest range of beneficial uses of the Belizean environment without degradation, risk to health or safety;

- Seek the full participation of all ministries, departments and related agencies in the development and effective implementation of environment laws and policies;
- Enrich the public's knowledge and increase awareness of the importance of sound environmental practices;
- Assure all Belizeans safe, productive and aesthetically pleasing surroundings;
- Enhance the quality of renewable resources and approach the maximum attainable recycling of non-renewable resources;
- Enforce the provisions of the Environmental Protection Act.

The Department's major functions, as described by the Environmental Protection Act are:

(1) To advise government on the formulation of policies relating to good management of natural resources and the environment;

(2) To foster, through Inter-Ministerial Cooperation, the prudent use and proper management of the natural resources of Belize, the control of pollution and re-establishment of an ecological equilibrium;

(3) To provide decision-makers with the necessary information and direction so as to achieve long-term sustainable development;

(4) To provide information and education to the public regarding the importance of protection and improvement of the environment;

(5) To ensure the protection and rational use of natural resources for the benefit of the present and future generations;

(6) To undertake investigations and inspection to ensure compliance with the EPA or regulations made thereunder and to investigate complaints relating to breaches of the act or regulations made thereunder.

The DOE operates on one-year implementation and five-year development plans. The department's major tasks are to recommend national policies to promote improvements in environmental quality, to recommend priorities among environmental programs and to assist in achieving international cooperation in dealing with environmental problems. (Ministry of Natural Resources, Environment and Industry Website)

#### **5.1.4 Lands and Survey Department**

The Lands and Survey Department has prime responsibility for the administration of all land tenure in Belize. The structure through which the Department delivers its services to the public is divided into three distinct levels of authority namely:

- Land policy formulation level which Provides advise on technical matters regarding land tenure;
- Normative level that develop the technical norms in consonance with relevant legislative parameters;
- A service delivery level for direct provision of quality and efficient service to the public.

The Physical Planning Section (PPS) provides information on the best utilization of lands. To strengthen the planning process a statutory body has been formed for the recommendation and approval for development projects. In addition to subdivision proposals, the PPS provides guidance in land-use technology through the Special Development Area Program, under which zoning plans are prepared to direct potential investors towards meaningful and sustainable development.

The PPS also provides information to investors concerning the purchasing of land in Belize. The issuance of a Minister's License to erect e.g. piers, wharves, seawalls, groins, dive shops and other permanent structures over the seabed fall under this portfolio. Additionally, the section administrates issues related to the Alien Landholding License that is applicable to National Lands only. (Ministry of Natural Resources, Environment and Industry Website)

#### **5.1.5 Petroleum and Geology Department (GPD)**

To address the problem of skyrocketing oil price increases by the Organization of Petroleum Exporting Countries (OPEC), the United Nations responded by assisting non-producing countries in their national search for oil and stability in energy resources. Consequently, the Geology and Petroleum Department (GPD) was established in 1984 with initial funding from the United Nations Development Program to explore for oil in Belize. In 1996, The Government of Belize (GOB) assumed full responsibility of the GPD. (Ministry of Natural Resources, Environment and Industry Website)

Apart from managing the petroleum and hard minerals sector, GPD is in charge of issuing dredging permits in Belize. The permits can be for building marinas, land reclamation or deepening of waterways.

## **5.2 Quasi Organizations**

Quasi organizations are semi-governmental organizations established as Statutory Bodies with autonomous functions. Board of directors manages these organizations with direct link to the line ministry that established the organization.

### **5.2.1 Coastal Zone Management Authority (CZMA)**

The Coastal Zone Management Authority was established under the Ministry of Agriculture, Fisheries and Co-operatives in 1998. It is comprised of a Board of Directors appointed by the Minister and a Chief Executive Officer appointed by the Board.

The Authority is an autonomous public statutory body charged with the responsibility of coordinating and monitoring policies that govern the use and development of the coastal zone in Belize.

The major functions of the Authority are:

- Advise the Minister on all matters related to the coastal zone, and on the formation of policies;
- Assist in development of programs and projects;
- Foster regional and international collaboration;
- Commission research and monitoring;



- In consultation with stakeholders, assist in preparation of development guidelines and review the CZM Plan prepared in accordance with the Act;
- Maintain coral reef and coastal water quality monitoring programs.

### **Ongoing Programs**

**Coral Reef Monitoring Program** - A reef biologist heads Coral Reef Monitoring Program. The reef biologist works closely with the coastal water quality-monitoring program as the latter provides integral data to the reef-monitoring program.

The objective of the program monitors corals of a site for diseases, bleaching, percentages dead (old and fresh dead) and algal cover.

**Water Quality Monitoring Program** - The objective of CZMA/I Water Quality Monitoring Program is to maintain high water quality in the coastal zone environment necessary for the protection of the barrier reef complex, and the healthy enjoyment and use of the coastal zone by Belizeans and visitors.

**Coastal Planning Program** - The major goals of the program are:

- To develop a sound and functional national and regional planning mechanism for the proposed coastal planning regions;
- To contribute to the realization of an acceptable level of ICZM and sustainable use of Belize's diverse biological marine resources;
- To educate the Belizean public on the different coastal planning issues that influence development today.

The major objectives of the Coastal Planning Program are to:

- Draft development and planning guidelines for each proposed coastal planning region (and lobby for their acceptance);
- Establish local planning committee systems for each planning region;
- Liaise and coordinate with the relevant government departments concerned with planning/development;
- Monitor and document coastal development;
- Establish, in collaboration with the Data Analyst, a database on coastal development;
- Seek membership on the Land Utilization Authority;
- Promote low density levels of development that are socially, ecologically and economically acceptable; and
- Develop educational planning programs for the planning regions of Belize.

**Manatee Program** - The Manatee Project of the Coastal Zone Management Authority and Institute (CZMA&I) began in August of 1996. It is spearheaded by the National Manatee Working Group, which is comprised of representatives from the Forestry Department, Fisheries Department, Belize Audubon Society, University College of Belize (UCB), Toledo Institute for Development and Education (TIDE), researchers from the Florida Marine Research Institute, ECOSUR (Chetumal, Q.R., Mexico), and Belize, as well as the CZMA&I (the Director being the chairperson of the Group). The project began with research of the West Indian manatee in Belize and included interviews at

coastal communities, boat and aerial surveys, and preliminary examination and recording of strandings.

**Environmental Education Program** - The CZMA/I Public Awareness/Education Program seeks to accomplish this task and to also develop and disseminate public awareness material on the programs of CZMA/I. This is done primarily through the production of video and audiovisual materials, radio talk shows, the organizations quarterly newsletter Coastline, public education campaigns for communities, school visits, workshops/seminars, training, media releases and the provision of library services. (Coastal Zone Management Authority Website)

### **5.2.2 Institute of Marine Studies/University of Belize (IMS/UB)**

The University of Belize (UB) has been working to develop a Marine Studies Program and an associated research station since 1989. On August 1994, UCB signed a Memorandum of Understanding with the Government of Belize and Coral Cay Conservation (CCC), (a UK-based, non-profit marine conservation organization) to establish a Marine Research Center (MRC) on the Turneffe Islands atoll. The MRC Calabash Caye Field Station was officially opened on September 27, 1995. Ending of 1999, CCC's five-year contract expired and the management of the entire facility was handed over to UCB. The station became Belize's first nationally owned and managed marine research facility. August 1, 2000 marked another historic event in the growth of Belize's higher education. The University College of Belize with the amalgamation of five institutions metamorphosed into The University of Belize. The Marine Research Center was placed under the Faculty of Arts and Science and the Center's name

changed to University of Belize Institute of Marine Studies (UBIMS), with its office space in Belize City.

The principal aim of the IMS is to provide facilities for scientific monitoring, research and environmental awareness programs with an immediate focus on shallow water tropical marine ecosystems. Calabash Caye field station supports UB's developing degree programs in Natural Resources Management and Coastal/Marine Studies. It also provides a facility for short training courses and workshops on a wide range of marine related topics for students, teachers and others, from both Belize and overseas. The station is the headquarters for current national efforts to maintain the unique biodiversity of the Turneffe Islands Atoll. (University of Belize Website)

### **5.2.3 Belize Tourist Board (BTB)**

The Belize Tourism Board is a statutory board within the Ministry of Tourism which functions as a strategic partnership between government and the private sector to develop, market and implement tourism programs that will fulfill the emerging needs of our local industries and the international tourism market place for the benefit of Belize and Belizeans. (Belize Tourist Board Website)

BTB manages the tourism industry by setting standards and guidelines for hotels, live-aboard vessel operations and tour guiding services. These services are designed for best practices within the working environment.

### **5.3 Non-Governmental Organizations**

Non-governmental organizations involved in monitoring, research or management are nationally registered companies under the liability, limited liability and not for profit status under the Company's Act, Chapter 206 of the Laws of Belize.

### **5.3.1 Belize Audubon Society (BAS)**

The BAS was formed in 1969 as a foreign chapter of the Florida Audubon Society. In 1973, BAS became a completely independent organization, and was registered as a limited liability company in February 1991.

The BAS has been working for the past 26 years to conserve Belize's biodiversity, by gathering support for the respect of nature and people and for environmentally responsible attitudes through its complementary programs: Protected Areas, Environmental Education, and Advocacy.

The principal activity of the Belize Audubon Society is the management of several protected areas established under the National Parks System Act of 1981. In 1984, BAS was mandated by the Conservation Division (Forest Department, Ministry of Natural Resources, Environment and Industry, Government of Belize) to direct the financing, development and operation of the various areas. BAS has worked to make the sites attractive, comfortable and educational.

The overall objective of BAS' environmental education program is to promote appreciation of the beauty and value of nature. Education of the people of Belize is the most vital step towards widespread conservation. Other objectives are:

- To educate Belizeans about the environment;
- To educate Belizeans about environmentally sound practices;
- To develop protected areas as education centers;
- To develop and implement management strategies to ensure environmental education is integrated into BAS activities.

The overall objective of BAS' advocacy program is to proactively push for sound environmental behavior by the Belizean population and new residents. Specific objectives of the advocacy program include:

- To make the environmentally aware population active and participatory in advocating for sound environmental behavior;
- To advocate for policies and enforceable regulations with regards to sound environmental behavior amongst specific targeted groups such as businessmen, politicians, landowners and immigrants;
- To demonstrate successful approaches to sound environmental behavior.

The topics of special concern to the Belize Audubon Society's Advocacy Program include:

**Pollution** - Advocate for clean rivers and waterways, clean streets and roadways, civic pride, recycling of plastics, glassware and paper, proper disposal of inorganic waste, composting of organic waste.

**Endangered Species Protection** - Advocate for protection of endangered species.

**Environmental Legislation** - Advocate for appropriate revision of laws, improved enforcement of the current environmental laws.

**New residents/Immigrants** - Advocate for adherence of environmental laws by new residents and immigrants.

**Un-controlled Development** - Advocate for properly designed and environmentally sensitive residential and commercial developments.

**Marine Conservation** - Advocate for introduction of licenses for fishing and stronger monitoring of tourism on the reef.

**Environmental Monitoring** - Advocate for establishment of watchdog for agricultural/industrial and tourism sectors to monitor behavior.

**Protected Areas** - Advocate for harmonization and cooperation between government and NGOs, and positive image of the protected areas. (Belize Audubon Society Website)

### **5.3.2 Toledo Institute for Development and Environment (TIDE)**

The Toledo Institute for Development and Environment (TIDE) is a non-governmental organization (NGO) that promotes the sustainable development of the Toledo District by fostering the efficient and effective management of the region's resources, conducting relevant research and by providing training and advocacy to local residents in order to preserve our natural heritage for present and future generations. TIDE was founded in 1997 in response to urgent conservation needs in Southern Belize.

#### ***TIDE's Initiatives:***

##### **1) Community Outreach and Education**

- Education for schoolchildren
- Field camps to take Mayan children to the coast and Creole children to the jungles and field trips to take other Belizeans to aquatic preserves to observe and learn of their rebounding fisheries

##### **2) Planning and Management of Protected Areas**

- Patrolling and interpreting in Paynes Creek National Park

- Co-managing Port Honduras Marine Reserve

### 3) **Tri National Alliance**

- Working cooperatively with the governments, conservation groups, and communities of Honduras and Guatemala on sustainable resource use for the Gulf of Honduras.

### 4) **Protection and Interpretation of Existing Areas**

- Patrolling more than 800 square kilometers of Belizean waters to control illegal hunting and fishing
- Creating trails and interpretive signage for the land and waterways of Paynes Creek National Park, Port Honduras Marine Reserve and for the newly acquired Debt for Nature Swap Lands

### 5) **Research and Mapping**

- Monitoring coastal water quality, supporting hydrology, manatee, and fisheries research projects.

### 6) **Ecotourism**

- Guide training and licensing
- Small business development and facilitation
- Marketing and booking clearinghouses for microbusinesses—flyfishing, kayaking, guesthouses

(TIDE'S Website)

#### **5.3.3 Friends of Nature (FoN)**

In 2002 the Friends of Laughing Bird Caye (FoLBC) changed its name to Friends of Nature. Established in 1996, FoLBC was established to manage the Laughing Bird



Caye National Park as per mandate bestowed by the Forest Department through a memorandum of understanding. Now FoN, the organization is non-profit and is unique, as the board of directors is comprised from local representatives of five coastal communities (Placencia, St. Beight, Monkey River, Independence and Hopkins).

FoN has broadened its mandate through an MOU with the Fisheries Department in 2002 as it co-manages the Gladden Spit and Silk Cayes Marine Reserve. With local and international assistance, FoN has acquired the capacity to play an important role in the management of marine protected areas through its office in Placencia, Belize.

#### **5.3.4 Toledo Association for Sustainable Tourism and Empowerment (TASTE)**

TASTE, a Toledo Association established in 2000 is a non-profit, non-governmental, apolitical organization that promotes an understanding of, interest in, the practice of and facilitates the sustainable development of tourism, sustainable small scale organic agriculture, agro-forestry, afforestation, appropriate technology, environmental conservation, mari-culture, rural and urban development, and management of protected areas. (TASTE Website)

In 2001, TASTE signed a MOU with the Fisheries Department to co-manage the Sapodilla Cayes Marine Reserve. In 2002 TASTE received grant funding to equip an office, hire staff and purchase equipment for the co-management process as well as institutional strengthening.


#### **5.3.5 Green Reef**


Green Reef Environmental Institute Ltd. is a non-governmental organization, registered under the Company's Act, Chapter 206 in Belize. The organization was founded in 1997, as Belize's first, non-profit conservation & education organization


exclusively dedicated to the protection of its Barrier Reef and surrounding marine environment. Green Reef is largely a community-based NGO with interests in training, management & research. Its board of directors, which are comprised of San Pedro Island residents, governs the organization.


Green Reef is involved in a variety of areas and is working on an array of programs that help promote the sustainable use of Belize's coastal and marine resources:


 Mooring Buoys – Deployment of mooring buoys to minimize anchor damage.


 Nassau Grouper Research and Advocacy Program – Compile information and conduct research on the status of the grouper and disseminate the information to stakeholders.


 Goliath Fish Monitoring – Compiling data on the status of this endangered species in Belize.


 Coral Monitoring – Conducting small scale monitoring at designated sites.

 Bird Sanctuary – Mandated by the Forest Department, Green Reef is managing the bird cayes behind Ambergris Caye.

 Advocacy – Promoting sustainable use of the natural resources and best practices.

 Environmental Education – An integral part of the conservation process, targeted groups are the school children and stake holders.

 Public Awareness – In order for the general public to appreciate the work being conducted, Green Reef writes articles in the local newspapers and holds an annual reef festival.

 Indigenous Plant Nursery – Due to the loss of littoral forest because of development

on Ambergris Caye and along the coastal environment, many species of plants are being lost especially those of medicinal values. The nursery is expected to create viable stocks for replanting. (Green Reef Website)

#### **5.3.6 Forest and Marine Reserves Association of Caye Caulker (FAMRACC)**

FAMRACC was created specifically to assist in the management of the Caye Caulker Forest Reserve and the Caye Caulker Marine Reserve. FAMRACC is a non-governmental umbrella organization. The Caye Caulker Tour Guide Association, local Belize Tourism Industry Association Chapter, the Northern Fishermen Cooperative Society Ltd., SIWABAN Foundation and the Village Council are some of the major organizations represented by FAMRACC.

In 2000, FAMRACC signed Memorandum Of Understandings (MOUs) with the Fisheries and Forest Departments in order to co-manage the local reserves. However, due to the lack of institutional capacity, FAMRACC has not been very active in the management agreements.

#### **5.4 Others**

The organizations described in this section are not individualistic but rather umbrella organizations that represent various governmental and non-governmental organizations. The later two organizations below are transboundary which have membership organizations from two or more neighboring countries. The transboundary organizations have also become the transboundary commissions for the MBRS Project.

##### **5.4.1 National Coral Reef Monitoring Working Group**

The Fisheries Department recognized that no one organization in Belize is capable of implementing the National Coral Reef Monitoring Program by itself basically

because of various constraints such as funding, logistics and manpower. As a result, under the auspices of the Fisheries Department the National Coral Reef Monitoring Working Group (NCRMWG) was formed in order to establish an integrated management approach as monitoring is continuous, interactive, adaptive, participatory and consensus-building comprised of a related set of tasks, all of which must be conducted to achieve the National Coral Reef Monitoring Program's set of goals and objectives. The Fisheries Department and its marine reserves, Coastal Zone Management Institute, Belize Audubon Society, University of Belize Marine Center, SIWABAN Foundation, Green Reef, Toledo Institute for Development and Environment, The Nature Conservancy, Wildlife Conservation Society, Oceanic Society, Friends of Nature, Smithsonian Institute and some individual researchers (e.g. Dr. Melanie McField) conducting monitoring programs in Belize are members of the NCRMWG.

The goals of the NCRMWG are as follows:

- Strengthen the members' ability to conduct coral reef monitoring within their respective areas through sharing resources and coordinating efforts;
- Participate in monitoring related activities that compliment both the National Coral Reef Monitoring Program for Belize as well as the goals of the participating members' organizations;
- Contribute to educational outreach programs by coordinating and planning displays;
- Increase communications among conservation agencies that are involved with long-term coral reef monitoring;

## Objectives:

- Compile a set of methodologies that measure physical and biological parameters on the coral reef utilizing basic equipment;
- Create an annual operational plan that indicates intense survey periods, which allow for members to receive assistance from the working group. The plan should depict what type of assistance will be needed and who will be able to provide assistance;
- Explore the possibility of utilizing volunteers to assist with monitoring;
- Plan and coordinate an annual 2-day coral reef display;
- Assist in the establishment of a data management center.

(NCRMWG Terms of Reference Document)

### **5.4.2 TRIGOH**

The Tri-National Alliance of Non-Governmental Organizations in the Gulf of Honduras was established in 1995-96 in order to address transborder issues in Belize, Honduras and Guatemala. The organizational membership is composed of non-governmental organizations of these three countries. The organization is composed of a secretariat, which handles the administrative functions and rotates every two years to a different country. Presently, TIDE is the secretariat for the alliance.

TRIGOH works through five commissions: protected areas, fisheries, endangered species, tourism and institutional strengthening. The organization has been very active and has had major achievements in manatee research, education, establishment of protected areas and workshops on decision making, fundraising and community participation.

One of TRIGOH's stated objectives is to develop, coordinated environmental research and monitoring activities, supporting the systematic application of integrated management processes of the marine-coastal zone.

#### **5.4.3 BEMAMCCOR**

The Belize-Mexico Alliance for the Management of the Common Coastal Resources (BEMAMCCOR) was established by a group of non-governmental organizations and research institutions of both Belize and Mexico so as to carry out a commitment of coastal resource management. BEMAMCCOR's objectives are:

- To develop and implement activities and specific project addressing the environmental problems of the region relating sustainable use of resources, monitoring and conservation of biodiversity;
- To assess and analyze the socio-environmental situation of the region in order to generate action and strategies plans;
- To promote and support development of sustainable economic alternatives that are compatible with the conservation of the natural resources;
- To develop strategies for fund raising and technical assistance;
- To influence the harmonization of national policies and regulations that have effects on the coastal and marine resources of the region.

(BEMAMCCOR Terms of Reference Document)

An executive committee manages BEMAMCCOR. The administrative affairs of the organization are handled by a secretariat, which is Amigos De Sian Kann, Mexico. The organization is relatively new and has just started to seek block funding in order to address priority transborder issues.

## **6. INTERNATIONAL ORGANIZATIONS**

Various international organizations have made Belize an in vivo laboratory for many of their field programs. Most of the work conducted is hardcore research or marine environmental education training. Individual or a team of scientists conducts specific research or various professors from different universities bring group of students to conduct fieldwork. The very few institutions conducting monitoring are mentioned below.

### **6.1 Smithsonian Institute**

The Caribbean Coral Reef Ecosystems (CCRE) program has its roots in a collaborative field research project conceived by six National Museum of Natural History scientists during the early 1970s. This initial group of Smithsonian researchers represented several major disciplines that are essential in the study of reef ecology: invertebrate and vertebrate zoology, botany, carbonate geology, and paleobiology. The immediate aim was the synoptic investigations of Caribbean coral reefs. Since it was expected that comparative studies would eventually be carried into other coastal environments, the original program was named Investigations of Marine Shallow Water Ecosystems (IMSWE).

In February 1972, Carrie Bow Cay, a 0.4 hectare (1 acre) island on top of the southern Belize Barrier Reef was chosen as a site for the field laboratory. Beginning in 1985, the National Museum of Natural History, strengthened by the research experience derived from the IMSWE and SWAMP programs, received an increase to its budget base for the study of Caribbean Coral Reef Ecosystems. This "umbrella" program, now known by its acronym CCRE, encompasses reef, mangrove, seagrass meadow, and

plankton community studies, and maintains its primary focus on the Carrie Bow Cay, Belize, region. To date, about 50 scientists a year have conducted studies there. In addition, comparative studies in other places in the Caribbean basin have been initiated or are planned. As of October 1998, nearly 600 research papers have been published; preliminary results and work in progress are summarized in yearly reports.

Focal Research Areas:

- Oceanography and Historical Development of Communities
- Biodiversity, Morphology and Evolution
- Processes, Linking Species and Environment
- Population Dynamics, Recruitment, and Production
- Species Interactions, Food Chains, and Nutrient Cycling

(Smithsonian Institute Website)

## **6.2 Wildlife Conservation Society (WCS)**

Glover's Reef Marine Research Station, operated by WCS since 1977, has a three-part mission of research, conservation and public education. The first goal is to facilitate first-rate research on the ecology, geology, archeology, zoology and botany of the island and its surrounding waters. To promote these activities, the station has been developed with researchers in mind, with ample lab space, dormitories and other facilities.

The Wildlife Conservation Society has a long and proud history of science-based conservation, and the research station exemplifies that spirit. Working in conjunction



with the government of Belize, Glover's Reef Marine Research Station has forged a strong conservation relationship.

Glover's Reef Marine Research Station has recently begun an active public education program. The station has been the training ground for several Ph.D. dissertations and housed countless school groups. Moreover, the station has served as served as a technical training ground for Belizean officials and students.

The station's research and conservation efforts center on identifying science and management tools to improve the long-term conservation of this and other tropical marine ecosystems. The research portfolio emphasizes studies of coral reef ecology, fish ecology and the management of local fisheries and trophic interactions. Though studies of the atoll's archeology, botany, and ornithology have been conducted using the station as a field base.

### **6.3 Oceanic Society**

The Oceanic Society has conducted research at Turneffe Atoll since 1992. In 2001, the Society entered into a long-term lease agreement to maintain a year-round field station at Blackbird Caye.

The Blackbird-Oceanic Society Field Station is situated on a peninsula with miles of white sand beach, adjacent to a series of coral islets that comprise Turneffe Atoll's fringing reef. The facility includes a classroom, library, office, simple lab and staff housing, plus three vessels to provide all transfer and excursion needs. The Field Station's exceptional location offers easy access to reefs and surrounding wildlife habitats. Research programs include:

***Dolphin Surface & Underwater Research*** - Assist researchers studying the behavioral ecology of bottlenose dolphins at the Oceanic Society's research station located at Blackbird Caye, Turneffe Atoll.

***Biodiversity Study/Scuba*** - The Oceanic Society is conducting a program of applied research and coral reef monitoring to provide baseline data on current conditions of reef health.

***Reef Health Monitoring Program (Non-scuba)*** - The Oceanic Society, in cooperation with the Belize Coastal Zone Management Authority and Belize Fisheries, has initiated a coral reef monitoring plan to collect basic ecological data on reef and seagrass habitats. The goal is to answer questions related to coral reef community population, structure, health and viability over time. In addition, participants study population dynamics of ecologically important queen conch, reef fish, and long-spined sea urchins.

***Crocodile Monitoring and Coral Reef Monitoring/Non-scuba*** - Crocodiles are often referred to as living dinosaurs having existed nearly 200 million years. They have survived extinction events such as the ice age but today the American Crocodile is endangered throughout its range. Belize may be one of its last strongholds, and the largest population in Belize occurs in Turneffe Atoll. The Oceanic Society is initiating a long-term monitoring program to detect population trends and provide recommendations for effective conservation strategies. (Oceanic Society Website)

#### **6.4 University of Mississippi Consortium**

The University of Mississippi Consortium involves NOAA in the United States of America and the Dangriga Ecological Station for sustainable Environment and Development, which is the local representative for the consortium in Belize.

## Objectives:

1. Identify unique bioactive compounds with biomedical/agrochemical commercial potential from marine organisms;
2. Perform biodiversity assessments of the coral reef, along with the associated critical habitats;
3. Conduct a hydrographic and hydro-geochemical study of bathymetry, regional/local tides and currents, and chemistry in the coastal and offshore areas of Belize;
4. Coordinate and instruct in the area of scientific education both US and Belize scientists and students.

This initiative will build on existing research and educational collaborations ongoing with Belize's coastal resource management and fisheries organizations.

### **6.5 The Nature Conservancy (TNC)**

The Nature Conservancy has been working in Belize since 19--. It has assisted TIDE and FoN with institutional capacity building and through its local science officer, it has undertaken hydrographic and biological research especially in the Port Honduras and Gladden Spit areas. At Gladden Spit, one of the largest and healthiest known fish spawning sites, the Conservancy, Friends of Laughing Bird Caye and the Belize Fisheries Department are collaborating with local fishermen to study the spawning phenomenon and develop a management plan for the area. The partners created a marine reserve here that sets guidelines for divers and other visitors and will ultimately establish catch limits during critical spawning times. The clouds of eggs released during the spawning attract dozens of wale sharks each year.

## **7. ORGANIZATIONAL CAPACITY/MONITORING/CONTACTS**

Green Reef, Belize Audubon Society, Toledo Institute for Development and Environment, Friends of Nature, Fisheries Department, Fisheries Marine Reserves, Coastal Zone Management Institute, Institute of Marine Science/University of Belize, Wildlife Conservation Society, Oceanic Society and The Nature Conservancy have the institutional capacity to monitor coral reefs and associated habitats. Most of the biologists working with the National Coral Reef Monitoring Working Group have been trained in various monitoring methodologies. The training involves basic observation methods to video transects. Personnel from the different marine reserves have established monitoring programs for commercially important species such as the spiny lobster and the queen conch. Monitoring of these species is important to demonstrate that no-take zones within protected areas can greatly benefit national fisheries by enhancing reproductive viability, increase in number and size of fishes and establishing the spill over effect into adjacent areas.

The CZMI is the only local institution that has a water quality program. The Smithsonian Institute and the University of Mississippi Consortium collect water samples and conduct the analysis abroad.

The CZMI and BAS are the two local institutions working in the coastal and marine environment that have ongoing GIS programs even though other agencies have received training in this discipline. Except for CZMI and the international organizations, the databases that exist at many of these monitoring institutions need restructuring. Most monitoring institutions have an education component, which is instrumental in gaining public appreciation for the ongoing efforts.

The table below lists various organizations along with their monitoring capabilities.

MONITORING CAPABILITIES						PROGRAMS		
Organization	Coral Reef	Seagrass	Mangroves	Commercial Species	Water Quality	GIS	Database	Education
Green Reef	Yes			Yes			Yes	Yes
BAS	Yes	Yes		Yes		Yes	Yes	Yes
TIDE	Yes	Yes	Yes	Yes	Some	Yes	Yes	Yes
TASTE								Yes
FAMRACC								
FoN	Yes			Yes			Yes	Yes
Fisheries Department	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Fisheries Reserves	Yes	Yes	Yes	Yes		Yes	Yes	Yes
CZMA/I	Yes	Yes	Yes		Yes	Yes	Yes	Yes
IMS/UB	Yes	Yes	Yes	Yes			Yes	Yes
WCS	Yes	Yes		Yes			Yes	Yes
Oceanic Society	Yes	Yes		Yes			Yes	Yes
Smithsonian Institute	Yes	Yes	Yes		Yes		Yes	
Mississippi University	Yes	Yes	Yes		Yes	Yes	Yes	
Nature Conservancy	Yes	Yes	Yes			Yes	Yes	

*Institutional Capacity Matrix - September 2002*

The table below lists the monitoring institutions, ongoing monitoring and organizational contacts:

ORGANIZATION	ONGOING MONITORING	CONTACTS
Green Reef	<ul style="list-style-type: none"> <li>• Spawning aggregations (various sites along the barrier reef)</li> </ul>	Guillermo Paz San Pedro Town Ambergris Caye Belize Phone: 606-3786 Email: <a href="mailto:greenreef@btl.net">greenreef@btl.net</a>
BAS	<ul style="list-style-type: none"> <li>• Lobster and conch</li> </ul>	Sergio Hoare 12 Cork Street Belize City, Belize Phone: 223-5004 Fax: 223-4985 Email: <a href="mailto:bamarine@base.bz">bamarine@base.bz</a>
TIDE	<ul style="list-style-type: none"> <li>• Coastal development</li> <li>• Some water quality</li> </ul>	Lynette Gomez Punta Gorda Toledo District, Belize Phone: 722-2274 Fax: 722-2655 Email: <a href="mailto:tide@btl.net">tide@btl.net</a>
FoN	<ul style="list-style-type: none"> <li>• Spawning aggregations (Gladden Spit)</li> <li>• Lobster and conch</li> </ul>	Roberto Pott Placencia Stann Creek District Belize Phone: 523-3377 Fax: 523-3395 Email: <a href="mailto:folbc@btl.net">folbc@btl.net</a>
Fisheries Department	<ul style="list-style-type: none"> <li>• Spawning aggregations</li> <li>• Marine products catch landings</li> <li>• Caye Chapel area (sedimentation &amp; seagrass productivity)</li> <li>• CPACC sites (corals, benthos)</li> <li>• Fish</li> </ul>	James Azueta P.O. Box 148 Belize City, Belize Phone: 224-4552/223-2623 Fax: 223-2983 Email: <a href="mailto:species@btl.net">species@btl.net</a>
Fisheries Reserves	<ul style="list-style-type: none"> <li>• Spawning aggregations</li> <li>• Lobster, conch, turtles</li> <li>• Catch landings</li> <li>• CPACC sites (corals, benthos) at Hol Chan, Glovers &amp; South Water Caye</li> <li>• Carrying capacity studies</li> <li>• Fish</li> </ul>	Isaias Majils Bacalar Chico Marine Reserve Email: <a href="mailto:bacalarchico@yahoo.com">bacalarchico@yahoo.com</a>  Miguel Alamilla Hol Chan Marine Reserve Email: <a href="mailto:hcmr@btl.net">hcmr@btl.net</a>  Francis Staine Caye Caulker Marine Reserve Email: <a href="mailto:species@btl.net">species@btl.net</a>

		<p>Albert Munnings Glovers Reef Marine Reserve Email: <a href="mailto:species@btl.net">species@btl.net</a></p> <p>Fred Martinez South Water Caye Marine Reserve Email: <a href="mailto:species@btl.net">species@btl.net</a></p> <p>Florita Castillo Sapodilla Cayes Marine Reserve Email: <a href="mailto:fcastill_99@hotmail.com">fcastill_99@hotmail.com</a></p>
CZMI	<ul style="list-style-type: none"> <li>• Corals (Coral Gardens, Caye Chapel &amp; Gallows Point)</li> <li>• Water quality (throughout Belize)</li> <li>• Manatee</li> </ul>	<p>Nadia Bood Coral Reef Monitoring</p> <p>Eugene Arriola Water Quality Monitoring</p> <p>Manatee Monitoring</p> <p>Phone: 223-0719/223-5739 Fax: 223-5738 Email: <a href="mailto:czmbze@btl.net">czmbze@btl.net</a></p>
IMS/UB	<ul style="list-style-type: none"> <li>• CARICOMP Program</li> <li>• Mangrove habitat complexity &amp; seedling dynamics</li> </ul>	<p>Eden Garcia College Street West Landivar Belize City, Belize</p> <p>Phone: 223-0256 Fax: 223-0255 Email: <a href="mailto:egarcia@ub.edu.bz">egarcia@ub.edu.bz</a></p>
WCS	<ul style="list-style-type: none"> <li>• Nassau groupers</li> <li>• Long-term Assessment Monitoring (fish, conch, lobster &amp; corals)</li> <li>• Sharks</li> <li>• Nutrients</li> </ul>	<p>Andrew Branson P.O. Box 272 Dangriga Stann Creek District Belize Phone: 522-2153 Email: <a href="mailto:wcsghlover@starband.net">wcsghlover@starband.net</a></p>
Oceanic Society	<ul style="list-style-type: none"> <li>• Dolphins</li> </ul>	<p>Brigitt Winnings Fort Mason Center San Francisco, Ca 94123 Phone: 800-326-7491 415-474-3395 (USA) 501- 223-4412 (Belize)</p>
Smithsonian	<ul style="list-style-type: none"> <li>• CARICOMP Program</li> <li>• Mangrove complexity (insects, reptiles, rodents etc.)</li> <li>• Corals</li> </ul>	<p>Mike Carpenter Carrie Bow Caye Stann Creek District Belize</p>

		Phone: 520-2070 Fax: 522-2004 Email: <a href="mailto:sales@pelicanbeachbelize.com">sales@pelicanbeachbelize.com</a>
Mississippi University	<ul style="list-style-type: none"> <li>• Water quality</li> </ul>	Richard Belisle 3/5 Halfmoon Avenue Belmopan Belize  Phone: 822-2079 Fax: 822-2979 Email: <a href="mailto:beaus@btl.net">beaus@btl.net</a>
The Nature Conservancy	<ul style="list-style-type: none"> <li>• Currents</li> <li>• Fish</li> </ul>	Dr. Wil Heyman Punta Gorda Town Toledo District Belize  Phone: 722-2503 Fax: 722-8155 Email: <a href="mailto:wil@btl.net">wil@btl.net</a>
Ongoing Monitoring Matrix - September 2002		

The CARICOMP projects conducted by IMS/UB and the Smithsonian Institute monitor changes in corals and productivity in mangroves and seagrass habitats. The CPACC project (Component 5) looks for coral and benthic changes due to climate change.

## **8. EQUIPMENT**

Most organizations in order to undertake their established monitoring and research protocols, have acquired the basic needed equipment. Depending on the level of monitoring, the equipment can be simple (snorkel gear and transect lines for visual surveys) or expensive and complex (dive and video equipment for video transects). International organizations conducting monitoring and research in Belize have all the necessary equipment. Below is a list of the local institutions with all or partial monitoring equipment:



Organization	Research Vessel	Dive Equipment	GPS	Hydrolab	Video Digital Camera	Laptop	Software Programs
Green Reef	Yes	Yes	Yes		Yes	Yes	Some
BAS	Yes	Yes	Yes		Yes	Yes	Some
TIDE	Yes	Yes	Yes			Yes	Some
FoN	Yes	Yes	Yes		Yes	Yes	Some
Fisheries Department							Some
Fisheries Reserves	Yes	Yes	Yes	Yes	Yes	Yes	Some
CZMA/I	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IMS/UB	Yes	Yes	Yes			Yes	Some
FAMRACC							
TASTE	Yes						
Monitoring Equipment Matrix - 2002							

## 9. MONITORING AND RESEARCH PRODUCTS

Of the various organizations working in the coastal and marine environment either through hardcore research or monitoring, many publications, periodicals, articles, manuals and gray literature has been produced. (Appendix 3a, 3b, and 3c and 3d) WCS, Smithsonian Institute, the University of Mississippi Consortium and various individuals mainly conduct hard-core scientific research. Local organizations conduct monitoring 90% of the time. The literature generated includes various disciplines such as reef ecology (community structure, social interactions, adaptive responses),

paleobiology, mangrove and seagrass ecology and geological studies to name a few. The Smithsonian Institute has compiled past research publications in a compact disk entitled "Smithsonian Caribbean Coral Reef Ecosystem. The Atlantic Barrier Reef at Carrie Bow Cay, Belize, Selected Studies 1971-1997," which can be purchased from the institute. A habitat map for the whole coastal and marine environment for Belize has been produced through collaborative efforts from various national and international organizations. Appendix 3d lists various reports which contain vital baseline data for the SMP.

## **10. RECOMMENDATIONS**

Detecting changes in complex ecosystems such as coral reefs requires the establishment of long-term monitoring programs over broad geographical scales (Regional Seas Programme, 1993). Due to its complexity, it is impractical to monitor and study all aspects of reef structure and function. Therefore, it is recommended that reef assessment programs take place at three levels within the MBRS:

5. Routine gathering of data on basic environmental parameters such as temperature, salinity and turbidity;
6. Tracking of benthic reef organisms with a combination of existing methodologies;
7. Experimental research on system components following detection of change such as coral bleaching (Rogers, 1988).

The data generated from these programs will provide the necessary information to managers and decision-makers for more effective management of the MBRS resources. However, in order to implement a regional monitoring program such as the Synoptic Monitoring Program under the aegis of the MBRS Project, a restructuring of

the National Coral Reef Monitoring Program is essential as well as the refocusing of the implementing mechanism (s).

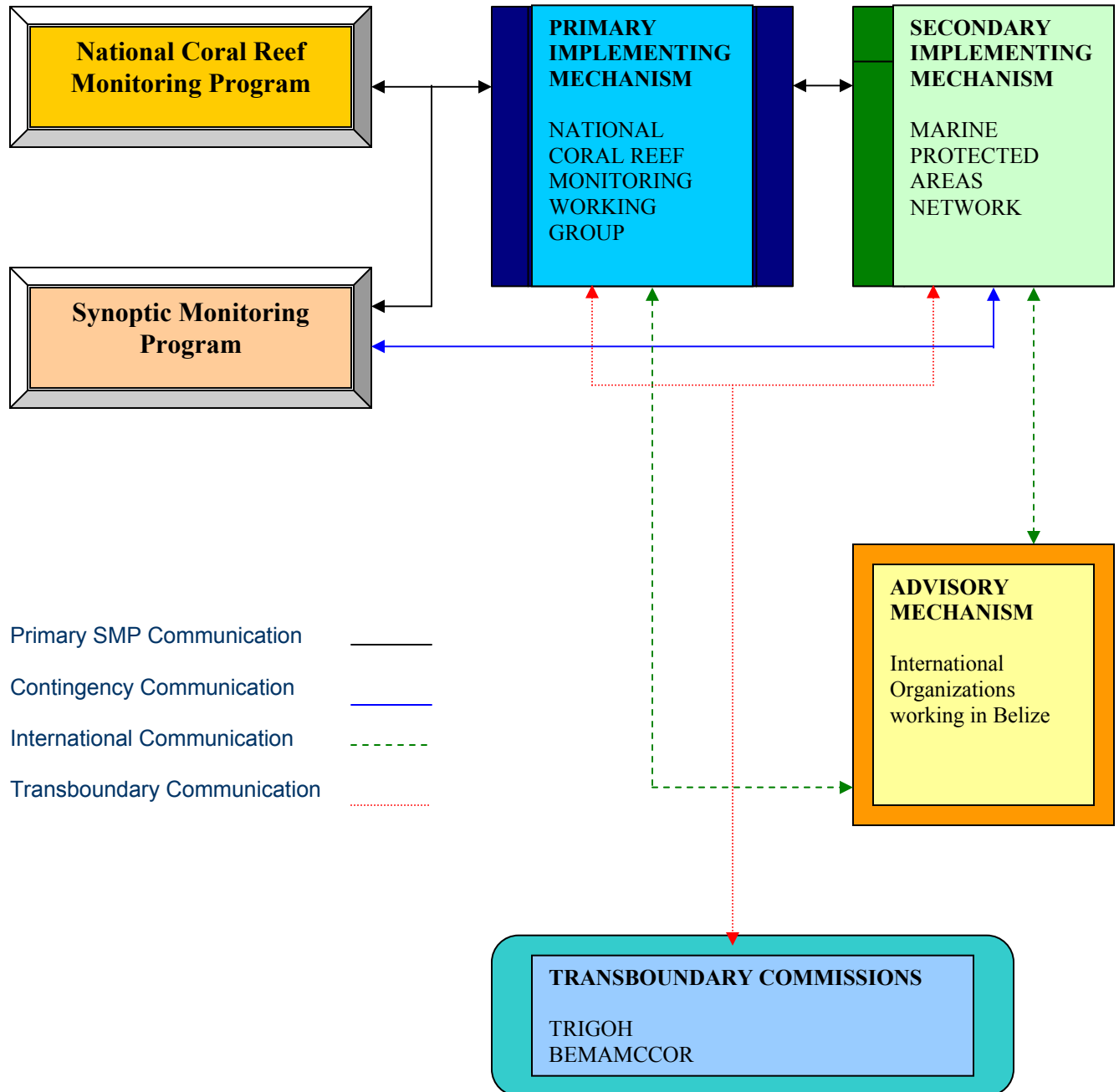
All the international monitoring institutions in Belize have their own agendas. However, since the Fisheries Department has the legislative authority to license monitoring and research in the Coastal and aquatic environments in Belize, to a degree it has inputs in prioritizing monitoring and research conducted by these organizations. The Fisheries Administrator sit on the board for the Smithsonian Institute that vets and approves research conducted at the Carrie Bow Field Station in Belize. The Fisheries Department and marine reserves personnel are affiliated with ongoing monitoring programs conducted by WCS, Oceanic Society and TNC.

The best approach to implementing the Synoptic Monitoring Program (SMP) in Belize is to institutionally capacitate the National Coral Reef Monitoring Working Group and the key monitoring institutions. This capacity building would include field (boats/dive equip/GPS etc) equipment and some office equipment (computer/software). The equipment is vital since many field-programmed exercises by the group have to be aborted because the key organizations had to respond to urgent matters using the only available equipment.

Some training in data analysis and meta data creation will be necessary in order to fully equip personnel involved in the Synoptic Monitoring Program for Belize. The SMP should use existing standardized monitoring methodologies such as the Caribbean Coastal Marine Productivity (CARICOMP), Atlantic and Gulf Rapid Reef Assessment (AGRRA) and Caribbean Planning Adaptation for Climate Change (CPACC). Below is a proposed working model:

# SYNOPTIC MONITORING PROGRAM IMPLEMENTATION PLAN

## For Belize



## **11. CONCLUSION**

With Belize being a small country, it can be said that much research has been conducted along the barrier reef system. Implementing the SMP should not be difficult because according to the National Coral Reef Monitoring Program, the barrier reef complex has been divided into three provinces (North, Central and South) on the basis of community distribution and geomorphic characteristics. Monitoring can be conducted at representative areas within these provinces. However, the SMP has to have identified specific locations and defined monitoring parameter.

Monitoring can have the following approaches:

1. Designate monitoring of an area to an institution or institutions and researchers that may be operating in the providences;
2. Conduct scheduled monitoring in all providences by the same group of institution or institutions and researchers;
3. Use a combination of both of the above.

Taking an integrated holistic approach to monitoring in Belize will strengthen the national capacity to the implementation of long-term monitoring programs. The NCRMW Group as well as the marine protected areas network staffs have the capacity to implement the SMP. However, apart from providing equipment and some training, the MBRS Project will have to assist with fuel for traveling to the monitoring sites. Fuel is a major expense in ongoing projects.

International organizations have a major role to play in the form of technical and scientific advice. In the case of emergency responses, some of these organizations can even provide logistic support through the existing collaborative efforts. The

transboundary commissions will work closely with their memberships in order to implement and coordinate border projects.

## **CITATIONS**

Belize Audubon Society Website – [www.aububonbelize.org](http://www.aububonbelize.org)

Belize Tourist Board Website – [www.travelbelize.com](http://www.travelbelize.com)

BEMAMCCOR Terms of Reference Document

Cerelli Report – FAO Technical Cooperation Programme (1993) TCP/BZE.6754

Coastal Zone Management Authority Website – [www.coastalzonebelize.org](http://www.coastalzonebelize.org)

Fisheries Department Website – [www.caricom-fisheries.com/belize-fisheries](http://www.caricom-fisheries.com/belize-fisheries)

Glovers Reef Field Station Website – [www.glover.org](http://www.glover.org)

Green Reef Website – [www.greenreef.org](http://www.greenreef.org)

Manzanero, Rafael – Unpublished Manuscript (No date)

Ministry of Natural Resources, Environment and Industry Website – [www.mnrei.org](http://www.mnrei.org)

National Coral Reef Monitoring Working Group Terms of Reference Document

Oceanic Society Website – [www.oceanicsociety.org](http://www.oceanicsociety.org)

Regional Seas Program – UNEP Program 1993

Spurgeon 1991

Toledo Association for Sustainable Tourism and Empowerment Website – [www.cities.com/t\\_a\\_s\\_t\\_e2002/index.html](http://www.cities.com/t_a_s_t_e2002/index.html)

Toledo Institute for Development and Environment Website – [www.tidebelize.org](http://www.tidebelize.org)

University of Belize Website – [www.ub.edu.com](http://www.ub.edu.com)

## Appendix 1 - Government Organizations working in coastal & marine environment

<b>PRIMARY FUNCTION</b>	<b>RESPONSIBLE AGENCY</b>	<b>LEGISLATION</b>
Agricultural development and management	Department of Agriculture	Pesticides Control Act Banana Industry Act Citrus Control Act Sugar Cane Act Agricultural Fires Act
Aquaculture management	Fisheries Department	Fisheries Act
Coastal construction	Lands and Surveys Department Housing and Planning Department Ministry of Works	National Lands Act Housing and Town Planning Act Dangerous Buildings Building Act Public Roads Act
Community development	Ministry of Rural Development Department of Human Development	Village Councils Act
Dredging and land creation	Geology and Petroleum Department Lands and Surveys Department	Mines and Minerals Act National Lands Act
Emergency preparedness	National Emergency Management Organization	
Environmental protection and impact assessment	Department of the Environment Public Health Bureau	Environmental Protection Act Dumping at Sea Act Public Health Act
Source: Coastal Zone Management Strategy Plan		



<b>PRIMARY FUNCTION</b>	<b>RESPONSIBLE AGENCY</b>	<b>LEGISLATION</b>
Establishment and management of protected areas	Forest Department Fisheries Department  Department of Archaeology	National Park Systems Act Fisheries Act  Ancient Monuments and Antiquities Act
Fiscal incentives and investment promotion	Belize Trade and Investment Development Service Ministry of Trade and Investment	Trades and Investment Promotion Services (Amendment) Act Export Processing Zone Act Fiscal Incentives Act
Fishing management	Fisheries Department	Fisheries Act
Integrated coastal zone management	Coastal Zone Management Authority and Institute	Coastal Zone Management Act
Land speculation and marketing	Lands and Surveys Department	Aliens Landholding Act Land Tax Act
Land use planning	Land Utilization Authority Physical Planning Section Central Housing and Planning Authority	Land Utilization Ordinance  Housing and Town Planning Act
Mangrove alteration	Forestry Department	Forest (Protection of Mangrove) Regulations
Marine transportation management and regulation	Belize Port Authority Customs Department Police Department	Belize Port Authority Act Merchant Shipping Act
Natural resource allocation	Lands and Surveys Department Forest Department Geology and Petroleum Department	National Lands Act Forest Act Mines and Minerals Act Petroleum Act
Recreation	Local municipalities  Sports Council	Belize City Council Act Town Councils Act Village Councils Act
Source: Coastal Zone Management Strategy Plan		

<b>PRIMARY FUNCTION</b>	<b>RESPONSIBLE AGENCY</b>	<b>LEGISLATION</b>
Tourism development, marketing and maintenance of standards	Belize Tourism Board	Belize Tourism Board Act
Waste management	Department of the Environment Public Health Bureau Water and Sewage Authority City, town and village councils	Environmental Protection Act Public Health Act Water and Sewerage Act Belize City Council Act Town Councils Act Village Councils Act Solid Waste Management Authority Act
Water management	Water And Sewerage Authority Public Health Bureau Department of the Environment Hydrology Unit	Water and Sewage Act Public Health Act Environmental Protection Act
Wildlife management	Forest Department  Fisheries Department	Wildlife Protection Act  Fisheries Act
Source: Coastal Zone Management Strategy Plan		

## Appendix 2 – NGOs working in coastal and marine environment

<b>Organization</b>	<b>Location of interest</b>	<b>Description</b>
<b>Aquaculture Association of Belize</b>	Nationwide	Representation of the aquaculture industry, product development, marketing and protection of standards
<b>Association of National Development Agencies</b>	Nationwide	A leading organization for policy analysis and change in the development sector
<b>Belize Audubon Society</b>	Entire country and specifically Lighthouse Reef atoll	Preservation of the country's natural resources through co-management, advocacy, education and research
<b>Belize Alliance of Conservation Non government Organizations</b>	Nationwide	Umbrella association for environmental and natural resources management organizations
<b>Belize Association of Producer Organizations</b>	Nationwide	Umbrella organization for environmental and natural resources management organizations in Belize
<b>Belize Business Bureau</b>	Nationwide	Developing and strengthening the production and service sectors
<b>Belize Chamber of Commerce and Industry</b>	Nationwide	Private sector organization to foster economic and social well-being of the nation through free enterprise
<b>Belize Civil Society Movement</b>	Nationwide	A network organization for civil society organizations to establish a role in the governance and development of Belize
Source: Coastal Zone Management Strategy Plan		

<b>Organization</b>	<b>Location of interest</b>	<b>Description</b>
<b>Belize Enterprise for Sustainable Technology</b>	Nationwide	Working with the poor and other in need to improve their social, economic and environmental conditions
<b>Belize Fishermen Cooperative Society</b>	Nationwide	Representation of the fishermen, training, product development and marketing
<b>Belize/Mexico Alliance for the Management of Common Coastal Resources</b>	Shared resources between Belize and Mexico	Umbrella organization for environmental and natural resources management organizations for shared resources for Belize and Mexico
<b>Belize Tourism Industry Association</b>	Nationwide	Official private sector organization representing over 300 members of the tourism industry through product development and advocacy
<b>Caribena Fishermen Cooperative Society</b>	Nationwide	Fisheries management, product development, marketing and training
<b>Community Initiated Agricultural and Resource Development Project</b>	Toledo	A quasi government agency working towards sustainable rural development
<b>Cruise Ship Industry Association</b>	Nationwide	Representation of cruise ship operators and affiliates through product development, advocacy and industry management
<b>Forest And Marine Association of Caye Caulker</b>	Caye Caulker Forest Reserve and Marine Reserve	Co-management of local protected areas
<b>Friends of Laughing Bird Caye</b>	Laughing Bird Caye National Park and Gladden Split and Silk Caye Marine Reserve	Co-management, advocacy
Source: Coastal Zone Management Strategy Plan		

<b>Organization</b>	<b>Location of interest</b>	<b>Description</b>
<b>Friends of Gra Gra Lagoon</b>	Dangriga vicinity	Preservation of the Gra Gra Lagoon south of Dangriga Town
<b>Friends of Placencia Lagoon</b>	Placencia Lagoon	Protection of the lagoon's natural values for conservation and eco-tourism
<b>Golden Stream Corridor Preserve</b>	Toledo	Conservation of the Golden Stream corridor preserve running from the Maya Mountains to the coastal area in Toledo
<b>Green Reef</b>	Ambergris Caye and specifically the several cayes reserved as bird reserves	Sustainable use and conservation of Belize's marine and coastal resources
<b>Help For Progress</b>	Nationwide	Specializes in rural community development work in the poorest districts of Belize
<b>Institute of Marine Studies / University of Belize</b>	Nationwide	An arm of the university which focuses on research in the marine environment
<b>National Development Foundation Bank of Belize</b>	Nationwide	Institutional loans to small businesses
<b>Northern Fishermen Cooperative Society</b>	Nationwide	Fisheries management, product development, marketing and training
<b>National Land Alliance for Development</b>	Nationwide	An alliance of non-government organizations dedicated to a land policy in Belize based on equitable allocation, accountability and transparency
Source: Coastal Zone Management Strategy Plan		

<b>Organization</b>	<b>Location of interest</b>	<b>Description</b>
<b>Protected Areas Conservation Trust</b>	Nationwide	A quasi government agency responsible for funding the management of protected areas, training, and publicity
<b>Raleigh International</b>	Nationwide	Development of young people through participation in a series of demanding environmental, community and adventure projects
<b>Sarstoon Temash Institute for Indigenous Management</b>	Sarstoon-Temash National Park area	Promoting local community enhancement through co-management
<b>Shipstern Nature Reserve</b>	Shipstern private Nature Reserve and the Sarteneja vicinity	Managing the only nature reserve in Belize protecting seasonally dry northern hardwood forests, lagoons and wildlife. Also promotes local research
<b>Sibun Watershed Alliance</b>	Sibun River watershed	Community based environmental education organization working in the watershed
<b>Siwa-Ban Foundation</b>	Caye Caulker and vicinity	Helping to maintain the integrity of tropical marine systems through education, conservation and research
<b>Society for the Promotion of Education And Research</b>	Nationwide	Empowerment of people to struggle for justice, democracy and sustainable development through education, advocacy and training
<b>SouthernAlliance for Grassroots Empowerment</b>	Toledo	An alliance of non government organizations in Toledo that undertake advocacy campaigns
Source: Coastal Zone Management Strategy Plan		

<b>Organization</b>	<b>Location of interest</b>	<b>Description</b>
<b>Tri-National Alliance of Non-Governmental Organizations in Gulf of Honduras</b>	<b><u>Gulf of Honduras</u></b>	Alliance of NGO's from Belize, Guatemala and Honduras working for the benefit of the Gulf of Honduras
<b>Toledo Association for Sustainable Tourism and Environment</b>	Sapodilla Cayes Marine Reserve	Co- management of the marine reserve with a view to enhancing its value for conservation and tourism
<b>Toledo Eco-Tourism Association</b>	Toledo	Promoting eco-tourism and sustainable development amongst Maya and Garifuna communities
<b>Toledo Institute for Development and Environment</b>	The Toledo coastal environment and specifically the Port Honduras Marine Reserve and Payne's Creek National Park	Working to attain sustainable development for the benefit of present and future generations in the Toledo District, through co-management, education, publicity, and research
<b>United Nations Development Programme</b>	Nationwide	An intergovernmental agency that promotes and supports activities within the framework of sustainable human development. Administration of the Global Environmental Facility Fund
<b>Wildtracks</b>	North eastern Corozal District	Education and awareness with specific reference to wildlife
<b>Watershed Reef Interconnectivity</b>	Belize, Stann Creek and Toledo Districts	Research on river catchment, sediment transport and its effect on the marine environment
Source: Coastal Zone Management Strategy Plan		

### Appendix 3a IMS/UB Research

1. *Survey of Turneffe's crocodile population*. Dr. Steven Platt, Clemson University, SC, USA. 1994-1998.
2. *Terrestrial habitat survey of Turneffe Atoll*. Dr. Simon Zisman, University of Edinburgh, UK. 1995.
3. *Caribbean Coastal Marine Productivity (CARICOMP): mangrove, seagrass and coral reef habitats*. University of Belize Institute of Marine Studies. 1996-ongoing.
4. *The role of mangroves as nurseries for fauna of commercial importance*. Clare Muller, University of Edinburgh, UK. 2000-2001. Dissertation report not yet completed.
5. *The hermaphroditic behavior of the Island Goby*. David Allsop, University of Edinburgh, UK. 2001-2001. Dissertation report not yet completed.
6. *Status of the coral reef health in Belize*. Melanie McField, University of South Florida, USA (Calabash reef was a study site in this project).
7. *The spawning behaviors and recruitment patterns of reef fishes in the Turneffe Islands Atoll*. Dr. Peter Sale et al. University of Windsor, Canada, 2001-ongoing.
8. *Mangrove seedling dynamics: recruitment and mortality in high energy vs low energy areas*. Eden Garcia, Institute of Marine Studies. 2002-ongoing.
9. *Recovery of Mangrove forests and Islands after a Hurricane Hattie in Belize: Turneffe Islands Atoll*. Collaboration between the SERC, IMS and Mr. Faustino Chi (IMS Staff on study leave) from University of Bremen, Germany. 2002 -ongoing.

Source: University of Belize Website



### **Appendix 3b (Glovers Reef Research)**

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Mumby, P.J. and Wabnitz, C.C.C. (2002) Spatial patterns of aggression, territory size and harem size in five sympatric Caribbean parrotfish species. *Environmental Biology of Fishes* 63:265-279

Sala, E., Ballesteros, E. and Starr, R.M. (2001) Rapid decline of Nassau grouper spawning aggregations in Belize: fishery management and conservation needs. *Fisheries* 26(10)23-30.

Source: Glovers Reef Research Station Website

### Appendix 3c (Fisheries Department's Database Research List)

- Gischler Eberhard et al.2000. Last interglacial reef growth beneath Belize barrier and isolated platform reefs.
- Gischler Eberhard et al. 1999. Shallow water rhodoliths from Belize reefs.
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- G.R. Sedberry, J. Carter, P.A. Barrick A comparison of Fish communities Between Protected and Unprotected Areas of the Belize Reef Ecosystem: Implications fro Conservation and Management.
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### ***Ongoing Research***

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2. A study of the abundance and diversity of elasmobranch fauna of Glover's reef Atoll.2001 Dr. E Piritch WCS
3. The relationships between coral, algal growth, nutrient levels, and fish feeding behavior. Dr. Tim McLanahan 2001
4. A study of the geographic extent of dispersal among populations of reef fish ; studying larval coral reef fish between and within the reserves of Belize by DNA analysis. John Purcell 2001
5. Continuation of a study of the status of coral populations on the seaward fore-reef , effects of algal growth upon coral, territoriality in parrot fish. Dr. Peter Mumby 2001
6. Evaluating the effectiveness of the marine protected area at Glover's Reef by tagging fin fish species commonly sold at fish markets. Tom Ihde 2001
7. Physiological and genetic diversity in the algal symbionts of Belizean reef building corals. Dr. Andrew Baker 2001

8. To investigate the role of Mangroves as nurseries for marine species of commercial value, on Calabash Caye, Turneffe Atoll. Muller V. Clare

Source: Fisheries Department

## **Appendix 3d (Reports with baseline data for SMP)**

### **AGRRA (Atlantic and Gulf Rapid Reef Assessment)**

Belize Barrier, Turneffe Island, and Glover's Reef Atoll – 2000 Surveys

<http://coral.aoml.noaa.gov/agra/reports/belize2000.htm>

South Central Belize, Central America

<http://coral.aoml.noaa.gov/agra/reports/fieldscbelize.html>

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### **CARICOMP**

CARICOMP Data Report 1992 – 1995

<http://www.unesco.org/csi/pub/papers/data9295.htm>

*CARICOMP Site Descriptions:*

Clabash Caye, Turneffe Island Atoll, Belize

<http://www.unesco.org/csi/pub/papers/garciaa.htm>

Carrie Bow Cay, Belize

<http://www.unesco.org/csi/pub/papers/koltes.htm>

### **CPACC**

Midterm Report for Component 5

<http://www.cpacc.org/c5wn.html>

Yearly Report - Coastal Zone Management Institute

**Others**

Marine Reserves Yearly Reports – Fisheries Department

Coral Reef Monitoring Yearly Report – Coastal Zone Management Institute

Water Quality Monitoring Yearly Report – Coastal Zone Management Institute