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Site Conservation Planning
Gulf of Honduras
Belize, Guatemala and Honduras

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LIST OF ACRONYMS

APE	Área de Protección EspecialSpecial Protection Area
BTB	Belize Tourism Board
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (Central American Commission on the Environment and Development)
CCO	Cuerpo de Conservación Omoa Baracoa (Omoa Baracoa Conservation Corps, Honduras)
CEMA	Centro de Estudios del Mar y Acuicultura, Universidad de San Carlos de Guatemala(Center for Sea and Aquaculture Studies of the Guatemalan state university)
CISP	Comitato Internazionale per lo Sviluppo dei Popoli (International Committee for the Development of Peoples, based in Italy)
CITES	Convention on the Illegal Trade of Endangered Species
COCODES	Comité Comunitario de Desarrollo(Community Development Committee, Guatemala)
COHDEFOR	Corporación Hondureña de Desarrollo Forestal (Honduran Forestry Development Corporation, = Honduran forest service)
CONAMA	Comisión Nacional del Medio Ambiente (National Commission on the Environment, forerunner of MARN, Guatemala)
CONAP	Consejo Nacional de Áreas Protegidas (National Protected Areas Council, Guatemala)
CZMA/I	Coastal Zone Management Authority / Institute (Belize)
DIGEPESCA	Dirección General de Pesca y Acuicultura (General Directorate of Fishing and Aquaculture, Honduras)
EMPORNAC	Empresa Portuaria Nacional de Santo Tomás de Castilla (Santo Tomás de Castilla National Port Company, Guatemala)
ENP	Empresa Nacional Porturaria (National Port Company, Honduras)
FOPECO	Foro Permanente de Ecoturismo y Conservación de Guatemala (Guatemala Permanent Ecotourism and Conservation Forum)
FUNDAECO	Fundación para el Ecodesarrollo y la Conservación (Foundation for Eco-Development and Conservation, Guatemala)
FUNDARY	Fundación para la Conservación del Medio Ambiente y de los Recursos Naturales "Mario Dary Rivera ("Mario Dary Rivera" Foundation for Conservation of the Environment and Natural Resources, Guatemala)
GIS	Geographic Information System
GO	Government Organization
GOH	Gulf of Honduras
ICSED	Inter-American Center for Sustainable Ecosystems Development (Chile)
IDEADS	Instituto de Derecho Ambiental y Desarrollo Sustentable (Environmental Law and Sustainable Development Institute, Guatemala)
IHT	Instituto Hondureño de Turismo(Honduran Tourism Institute)
INAB	Instituto Nacional de Bosques (National Forest Institute, Guatemala)
INGUAT	Instituto Guatemalteco de Turismo(Guatemalan Tourism Institute)

INTECAP	Instituto Técnico de Capacitación (Capacity-Building Technical Institute, Guatemala)
MARN	Ministerio de Ambiente y Recursos Naturales (Ministry of Environment and Natural Resources, Guatemala)
MARPOL	International Convention for the Prevention of Pollution from Ships
MBC	Mesoamerican Biological Corridor
MBRS	Mesoamerican Barrier Reef System
MINUGUA	Misión de Verificación de las Naciones Unidas en Guatemala (United Nations Verification Mission in Guatemala)
MoES	Ministry of Education and Sports (Belize)
NGC/TDC	National Garifuna Council / Toledo Development Corporation (Belize)
IMO	International Maritime Organization
PA	Protected Area
PDO	Private Development Organization
PROARCA/APM	Programa Ambiental Regional para Centro América / Áreas Protegidas y Mercadeo Ambiental (Regional Environmental Program for Central America / Protected Areas and Environmental Marketing)
PROARCA/CAPAS	Programa Ambiental Regional para Centro América / Sistema Centroamericano de Áreas Protegidas (Regional Environmental Program for Central America / Central American Protected Areas System)
PROARCA/Costas	Programa Ambiental Regional para Centro América / Manejo de Zonas Costeras (Regional Environmental Program for Central America / Coastal Zones Management)
PROECO	Programa Ecológico de Centroamérica (Central American Ecologic Program. A Swiss Contact program based in Honduras)
PROLANSATE	Fundación para la Protección de Lancetilla, Punta Sal, y Texiguat (Foundation for the Protection of Lancetilla, Punta Sal, and Texiguat, Honduras)
SCP	Site Conservation Planning
SERNA	Secretaría de Estado en el Despacho de Recursos Naturales y Ambiente (State Secretariat for Natural Resources and Environment, Honduras)
SOLAS	International Convention for the Safety Of Lives At Sea
TASTE	Toledo Association for Sustainable Tourism and Empowerment (Belize)
TIDE	Toledo Institute for Development and Environment (Belize)
TNC	The Nature Conservancy
TRIGOH	Tri-National Alliance for the Conservation of the Gulf of Honduras
UN	United Nations
UNDP	United Nations Development Programme
UNIPESCA	Unidad Especial de Pesca y Acuicultura (Special Fishing and Aquaculture Unit, Guatemala)
USAID	United States Agency for International Development
UVG	Universidad del Valle de Guatemala (University of the Valley of Guatemala)
WB	World Bank

PROARCA
PROARCA/APM
Componente de Areas Protegidas y Mercados Verdes
Programa Ambiental Regional para Centroamérica

The Protected Areas and Environmental Marketing Component of the Regional Environmental Program for Central America (PROARCA/APM) is an initiative of the Central American Commission on the Environment and Development (CCAD), funded by the United States Agency for International Development (USAID). The Nature Conservancy (TNC) is implementing this five-year initiative (2001-2006). Its general objective is *to contribute to the improved management of the Mesoamerican Biological Corridor (MBC)*, for which it is structured in two components:

Intermediate Result 1 (IR1): Improved protected areas management. This component comprises three fields of action to improve or assure the viability of biodiversity in the four MBC key functional landscapes. 1) *Development of effective alliances for protected areas management* supports a legal framework and policies oriented to improve management (environmental services, conservation in private lands, and co-management) and strengthen institutions (governments, private development organizations, communities). 2) *Improved financial management in protected areas* works on financial planning and management, and the increase of complementary investment. 3) *Application of best management practices* adopts and applies methods for ecoregional planning, Site Conservation Planning, management effectiveness, and defining indicators for biomonitoring and for the Central American Protected Areas System, among others.

Intermediate Result 2 (IR2): Expanded access to markets for environmentally sound products and service. This component works in two fields of action within forestry and sustainable tourism, to diminish threats to biodiversity in the four MBC key functional landscapes: 1) *Increased availability of environmentally sound products* publishes requirements, options, and benefits of adopting better production practices. 2) *Effective alliances for the commercialization of environmentally sound products and services* publishes information on the offer and demand for products, and strengthens the capacity of producers to participate in innovative markets.

PROARCA/APM emphasizes two areas considered key functional landscapes within the Mesoamerican Biological Corridor, which represent four priority areas of the Central American Biodiversity Agreement:

1. Gulf of Honduras (Belize, Guatemala, Honduras)
4. Amistad – Cahuita – Río Cañas (Coast Rica, Panamá)

The work PROARCA/APM has done in the functional landscapes will serve for case studies to systematize methods and experiences, contributing to the development of regional policies.

PRESENTATION

It is a pleasure for me, as Director of the Protected Areas and Environmentally Sound Marketing components of the Regional Environmental Program for Central America (PROARCA/APM) of CCAD, funded by USAID, to present the Site Conservation Plan for the Gulf of Honduras.

This Site Conservation Plan is the result of an approximately one-year-long process which collected information and analyzed strategies to conserve biodiversity in the tri-national area formed by the south of Belize, the Caribbean coast of Guatemala, and part of the north Caribbean coast of Honduras, known as the Gulf of Honduras. The chief virtues of this document are rooted in the following elements:

1. The Site Conservation Plan reflects the effort and cooperation of more than 60 persons over several workshops. All of them, concerned for conservation in this area, were summoned under the leadership of the Tri-National Alliance for the Conservation of the Gulf of Honduras (TRIGOH), one of the most successful coalitions that PROARCA has supported, by means of PROARCA/Costas and PROARCA/CAPAS in the beginning of PROARCA, and by PROARCA/APM at the present time.

2. Another important virtue of this work is the identification of conservation elements in the Gulf of Honduras (scored according to their viability) as well as the principal threats to them in the area. Long work hours were needed to prioritize and establish elements of the area's biodiversity that will allow an adequate representation of it. Local actors identified the threats and their sources, to enable the identification of mechanisms and strategies that will allow their attenuation or elimination.

3. Finally, the greatest virtue of the Site Conservation Plan is that it has allowed the establishment of a series of strategies, which you will find in this document. These establish a criterion of priorities as to what needs to be done urgently in the Gulf of Honduras to guarantee the main objectives of the Site Conservation Plan: first, achieve the maintenance, and if possible, improvement of the viability of the most important conservation elements, and second, the attenuation or elimination of the threats and their sources.

I would like to thank the unnamable list of persons and institutions that participated in this process, especially the Tri-National Alliance for the Conservation of the Gulf of Honduras (TRIGOH), which demonstrated its leadership and summoning power, without which it would have been impossible to make this Site Conservation Plan.

I leave this work instrument in your hands, which will surely change over the next years as the environmental situation in the Gulf of Honduras changes, hopefully for the best.

I thank any comment that allows improving the information provided here. I remind you that this plan reflects the information that the participants collected and used to arrive to the conclusions poured into this document. Nothing remains but to encourage the readers and beneficiaries of this Site Conservation Plan to transform it into living words and deeds, in order to achieve the conservation of the natural resources of the Gulf of Honduras and to promote their sustainable use.

Very faithfully yours,

Néstor Windevoxhel, M.S.
Director

EXECUTIVE SUMMARY

PROARCA, with technical support from TNC, has implemented Site Conservation Planning as an instrument for regional planning in functional landscapes. This document presents the work done by members of the Tri-National Alliance for the Conservation of the Gulf of Honduras (TRIGOH), diverse actors from governmental and private development organizations, projects, and diverse initiatives and organizations to identify the conservation priorities in the Gulf of Honduras tri-national site (Belize, Guatemala, and Honduras).

The Gulf of Honduras is defined as the marine and coastal areas between Punta Izopo, in the northern coast of Honduras, and Gladden Spit in Belize. It therefore includes the southwest end of the Mesoamerican Barrier Reef System. The Gulf covers approximately 10,000 Km^2, which include parts of the Exclusive Economic Zones of the three countries. Marine productivity within the Gulf is maintained to a large extent by the contributions of the most important rivers, their estuaries, and the humid coastal lands bathed by tides, populated especially by mangroves. The Gulf has populations of shrimp (*Penaeus* spp.), lobster (*Panulirus argus*), queen conch (*Strobus gigas*), as well as commercially exploited scale fish and important sport fish populations. The Gulf also provides habitat for several endangered species, including: West Indies manatee (*Trichechus manatus*), Atlantic spotted dolphin (*Stenella frontalis)*, bottlenose dolphin (*Tursiops truncates)*, whale shark (*Rhincodon typus)*, yellow-headed parrot (*Amazona oratrix)*, and the following sea turtles: green (*Chelonia mydas)*, hawksbill (*Eretmochelys imbricata)*, leatherback (*Dermochelys coriacea)*, and loggerhead (*Caretta caretta*). The Gulf has half a million inhabitants, mainly concentrated in the port cities of Santo Tomás de Castilla and Puerto Barrios (100,000+), Puerto Cortés (100,000), and Livingston (40,000).

Site Conservation Planning has allowed the identification of some of the most important systems that need to be protected to guarantee the conservation of the largest possible sample of biodiversity in this tri-national site. All the selected conservation elements are coastal-marine ecosystems: coral reefs, mangrove forests, marine grasslands, beach systems, estuaries and coastal lagoons, and herbaceous wetlands (which include flood forests). The viability of all these conservation elements is considered good.

The identification of the main conservation elements has in turn allowed the identification of the main sources of stress acting on the long-term viability of the elements. The greatest stress is "altered composition and structure", which strongly affects 4 conservation elements, and has a medium effect on another. All the coastal elements –mangrove forests, beach systems, and herbaceous wetlands– have highly fragmented habitat. The greatest threat to them is urban development and the construction of access roads, which is very strongly degrading the beach systems, and strongly degrading the mangrove forests, estuaries and coastal lagoons, and herbaceous wetlands. Other threats with a "high" global score include inappropriate agricultural and animal farming practices, tourism development, wildlife poaching, inappropriate fishing practices, and climate change. The threatened state for focal objects and the site as a whole is very high.

This analysis allowed the identification of institutional capabilities and the strategies needed to attack the critical threats and to improve the viability of biodiversity in the medium and long terms. Nine principal strategies were identified, of which "complete the protected areas system"; "support the regulation of fisheries" and "promote alternate economic activities" were defined as the most effective to mitigate the threats. The effectiveness of efforts to conserve biodiversity associated to these important coastal-marine ecosystems can be evaluated with this information, using the "Measures of conservation success" method.

I. INTRODUCTION

1.1 Background and Plan Objectives

The Tri-National Alliance for the Conservation of the Gulf of Honduras (TRIGOH) was created in 1996, with the support of PROARCA/Costas, by representatives of private development organizations (PDOs) from Belize, Guatemala, and Honduras, who recognized the Gulf as a shared ecosystem and saw the need to collaborate in the management of the coastal-marine resources of the Gulf. At this time, there were PDOs working on protected areas management in each country: TIDE in Port Honduras and Paynes Creek, FUNDAECO in Cerro San Gil and Sarstún, FUNDARY in Punta de Manabique, and PROLANSATE in Punta Sal (Jeannette Kawas National Park) and Punta Izopo. Other PDOs were working on environmental policy in the three countries. Recognizing that the conservation of the Gulf required a tri-national vision, they decided to begin working on landscapes.

The mission of TRIGOH is to conserve the biodiversity of the Gulf of Honduras and to improve the quality of life of the local communities, through tri-national coordination in the sustainable management of the coastal-marine resources. TRIGOH founds its work on the following values: 1) an ecosystemic and integral vision of the Gulf of Honduras, 2) the participation of all the actors, without any discrimination, 3) tri-national coordination at all levels, 4) the application of multidisciplinary scientific information, and 5) respect for traditional values and knowledge of the several ethnic and indigenous groups (TRIGOH, 1999).

TRIGOH held a series of strategic planning exercises, and decided to focus its work on the following seven objectives:

1. Develop a tri-national system of coastal-marine protected areas, co-managed by public and private entities, with the active participation of local communities. Have all areas endowed with management plans, long-term financial plans, and adequate resources.

2. Promote the development of a legislative, regulatory, and institutional framework compatible among the three countries, and a tri-national agreement for the sustainable management of fishing in the Gulf, based on scientific information and the organizational and participative structures of local fishermen and other key actors.

3. Promote the development and strict enforcement of environmental criteria and standards for the large economic development activities in the Gulf, especially coastal development and the environmental management of ports and maritime traffic.

4. Promote and consolidate economic activities compatible with the conservation of nature, especially the establishment and joint marketing of tri-national sustainable tourism routes, with high participation and leadership from local inhabitants.

5. Protect endangered species, especially the West Indies manatee and sea turtles, in a joint, coordinated manner.

6. Carry out joint, coordinated research and environmental monitoring activities, in support of the systematic application of coastal zone integrated management processes.

7. Strengthen the coordination forum by developing a communications system, periodic meetings, publications, capacity building, fund raising, exchange programs, and the creation of alliances with international institutions.

TRIGOH and PROARCA, first through Costas and now through APM, have collaborated on the development of this Site Conservation Plan for the Gulf, with the active participation of other institutions. The development of this plan complements the objectives and activities of TRIGOH, by creating a framework to establish priorities of action.

The purpose of the plan is to define which ecosystems and species are to be conserved, which threats are being faced by these ecosystems and species, which strategies and actions can be implemented to reduce the threats, and how progress in conservation can be measured.

The Site Conservation Plan is a work instrument that allows the prioritization of actions, and the efficient focusing of the use of limited resources available for conservation. This work will have multiple evaluations with the purpose of measuring management effectiveness and new needs that might arise from the dynamic changes caused by the use of resources and their conservation in the Gulf of Honduras tri-national site.

1.2 Site Description

PROARCA/Costas defined the Gulf of Honduras as the coastal-marine areas between Punta Izopo, (N15.9 and W87.6) in the northern coast of Honduras, and Gladden Spit (N16.5 and W88.0), Belize, therefore including the southwestern end of the Mesoamerican Barrier Reef System (see the "Base map of the Gulf of Honduras" in the Annexes).

During the workshops, it was decided that it would not be feasible to include the whole area of the watersheds of the Gulf, because the extent of some (Motagua, Ulúa, Dulce-Polochic, and Chamelecón) is ample. So, it was decided to include only the lower part of the watersheds, up to 500 m above sea level (Cerro San Gil, Sierra Caral, Sierra de las Minas, and Sierra Santa Cruz in Guatemala; Sierra Meledón in Honduras; Maya Mountains in Belize). In Guatemala, it was decided to extend the Gulf to the western limit of El Golfete, because the seawater of the tides reaches there.

The Gulf covers approximately some 10,000 Km^2, including parts of the Exclusive Economic Zones of the three countries.

The narrow proximity between the environments of riverine estuaries, mangrove swamps, marine grasslands, reefs, and deep ocean waters contribute to the high marine productivity and the high biodiversity found within the Gulf.

The Mesoamerican Barrier Reef System is the largest in the hemisphere, and when the Presidents of Mexico, Belize, Guatemala, and Honduras signed the Tulum Agreements of 1997 in Mexico, they committed to collaborate to achieve its conservation.

The coastal-marine system of the Gulf is influenced by three main oceanographic and hydrologic processes, the most important one being the forking of the Cayman current coming from the north, which induces the spin of a countercurrent, resulting in a south current of 2 to 4 Km/h west of the Belize barrier reef and within the Gulf. The second phenomenon is precipitation, which surpasses 3,000 mm in the Gulf, and the presence of 15 rivers, including 3 big ones (Motagua, Chamelecón, and Ulúa), which contribute a large discharge of freshwater and sediments. The third, and occasional, phenomenon is the entry of nutrient-rich oceanic waters into Gulf, in the opposite direction to the prevailing surface current (ICSED, volume I, 2000).

The coastal zone of southern Belize is characterized by lowland habitats that include great areas of freshwater wetlands, tropical hardwood forests, pine forests, open savannas, and vast mangrove swamps that have been formed as a result of changes in the sea level, which rises and floods the coastal lowlands (see the "Ecoregions" map and the "Life Zones, according to Holdridge" map in the Annexes). The coast of Belize also has an area of cayes dominated by mangrove forests inland and submerged banks with marine grasses – an extensive habitat for marine and estuarine, benthic and pelagic fish and invertebrates. The Sapodilla Cayes form the southwest end of the Belize Barrier Reef, and are found within the Gulf of Honduras.

The coast of Guatemala is, in general, a more abrupt littoral, with high, forested areas looking out on the coast. Amatique Bay is a complex ecosystem, composed of coastal lagoons, mangrove forests, herbaceous wetlands, flood forests, and marine grasslands, all influenced by marine currents, riverine systems (Río Dulce-El Golfete, Río Sarstún, and Motagua River), and canals. According to Yañez-Arancibia *et al.* (1999), Amatique Bay is the most important estuarine ecosystem of Guatemala, due to its size, state of conservation, ecologic and socio-economic value, and great ecotourism potential. The benthic communities within Amatique Bay are controlled by an influx of much sediment and freshwater, and are less diverse and productive than the benthic communities farther north. Exceptions to this are the Río Sarstún mouth, which sustains the largest shrimp production in the Gulf, and Río Dulce, which once was one of the most productive rivers in the region.

Marine productivity within the Gulf is maintained in great measure by the contributions of the most important rivers, their estuaries, and the humid coastlands bathed by tides, populated mostly by mangroves. The mangrove forests of the Sarstún-Temash system and the Port Honduras-Payne's Creek system together constitute the largest mangrove forest area in all Belize and the Caribbean coast of Guatemala; they provide critical habitat for most of the marine vertebrate and invertebrate species within the Gulf and beyond. The cayes within Port Honduras are the only mangrove cayes in this humid tropical climate, and shelter a significant diversity of scale fish. Marine grasslands are abundant in the coast of Guatemala, close to Punta de Manabique, as well as within Port Honduras.

The Gulf has commercially exploited populations of shrimp, lobster, conch, and scale fish (*e.g.*, snapper, jack, mackerel, snook, and grouper), and important populations of sport fish (tarpon, permit, snook). Also, the Gulf provides habitat for several endangered species, including the West Indies manatee (*Trichecus manatus manatus*), bottlenose and Atlantic spotted dolphins (*Tursiops truncatus* and *Stenella frontalis*), whale shark (*Rhincodon typus*), American crocodile (*Crocodylus acutus*), yellow-headed parrot (*Amazona oratrix*), and the following sea turtles: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*).

The Gulf has half a million inhabitants, mainly concentrated in the port cities of Santo Tomás de Castilla and Puerto Barrios (100,000+), and Puerto Cortés (100,000). Livingston (40,000) and Tela are smaller cities, and on the south of Belize, Punta Gorda has a population of only 4,000 inhabitants (Heyman and Graham, 2000 and PROLANSATE, 1999). The highest population density is found in Guatemala (95 persons / Km^2); it is lower in Honduras (49 persons / Km^2), and lowest in Belize (9 persons / Km^2). This uneven distribution is reflected in the use of natural resources. For example, when fisheries resources in Guatemala and Honduras are depleted, fishermen from these countries fish illegally in Belizean waters (Heyman and Björn, 1999).

II. ELEMENTS OF CONSERVATION AND THREATS

All the selected conservation elements are coastal-marine ecosystems: coral reefs, mangrove forests, marine grasslands, beach systems, estuaries and coastal lagoons, and herbaceous wetlands (which include flood forests). There was a long discussion on how to include endangered and commercial species. Instead of including them as conservation elements, apart from ecosystems, it was decided to incorporate each species in the ecosystems in which it is found. For example, sea turtles are found within the "beach systems" element, where they nest, and within marine grasslands, where they feed. This means that when analyzing the viability of each element, the viability of the populations of these species was taken into account. For example, when defining threats faced by beaches, illegal extraction of sea turtle eggs was included.

Laughing Bird Key. Photo: FUNDARY

2.1 Coral Reefs

Reefs are ecosystems characterized by their high biodiversity. Marine grassland–mangrove forest–coral reef complexes are important as reproduction areas for marine fauna species (TIDE, 1998). In the Gulf, examples of these ecosystems include the south part of the Belize barrier reef, a complex labyrinth of reef patches over a wide and relatively deep reef lagoon (TIDE, 1998); and some isolated reef patches in Guatemala and Honduras.

The reef ecosystems of Belize are important in the western hemisphere due to their size and diversity, as well as for the remarkable development of some corals in pristine conditions. As shown in the "Conservation Elements" map, most of the reefs in the Gulf are found in Belize. The Belize coral barrier stands out: some 220 linear kilometers where atolls and other formations, almost unique in the Caribbean Sea, are found (Windevoxhel, 1997). Patches of coral can be found in great surfaces off Placencia, Punta Gorda, and the Snake Cayes (see the "Conservation Elements" map in the Annexes).

In Guatemala there are small patches of coral reef, located in Amatique Bay and the north side of Punta de Manabique, including some patches near the mouth of Motagua River. According to the participants of the SCP workshops, in Honduras there are coral patches off Omoa, Puerto Cortés, and Tela Bay. In Tela Bay, corals are less than 6 kilometers from the coast, at a depth of less than 27 m. The participants said that there are reef patches in Cincuentón and Cuarentón, off Río Quehueche, off La Guaira, Tirana Gú Los Altares (near Bajo de Heredia), in El Pulpo, Langua, Faro Blanco, and Faro Rojo. They also said that there are corals at approximately 72 kilometers off the coast, at depths between 36 and 90 m.

Participants of the first workshop emphasized the importance of reefs where spawning aggregations take place, because these sites sustain the fisheries of several places. For example, Gladden Spit is a site in the south of Belize where several snapper and grouper species spawn, and where whale sharks feed.

Endangered species associated to the reefs include the whale shark (*Rhincodon typus*), the bottlenose dolphin (*Tursiops truncatus*), the Atlantic spotted dolphin (*Stenella frontalis*), and the following sea turtles: green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and loggerhead (*Caretta caretta*). Commercial species include: lobster (*Panulirus argus*), queen conch (*Strombus gigas*), crabs (*Calianactus* sp.), tarpon (*Megelops atlantica*), grouper (*Epinephelus* sp.), jack (family Carangidae), snapper (family Lutjanidae), dolphinfish (*Coryphaina hippurus*), mackerel (family Scombridae), and bonefish (*Albula vulpes*). Snapper and cubera snapper (family Lutjanidae) are fished in the rocky corals of Guatemala.

Viability (Global Value: good)

- **Size:** Good. The largest coral reef areas are in Belize, with some in Guatemala and some off the Honduran coast.

- **Condition:** Good, in general. In Guatemala and Honduras the condition of the reefs is poor, but they are represented in the whole area. In Belize, the reef system is big and its condition good, and these reefs represent almost the whole reef cover of the Gulf.

  Due to the natural effect of hurricanes, added to the increase in seawater temperature, coral bleaching is present in a high percentage of the corals in the Belizean continental platform, between 2 and 4 meters deep; its recuperative capacity is unknown. Also, algae cover is greater than it used to be. In general, the corals most resistant to bleaching are the ones in the greatest depths, on walls, and close to outcroppings, where there is less direct sunlight and temperatures are low. A natural reef quality gradient exists: from best in the Belizean part of the Gulf, to worst in Guatemala and Honduras. Therefore, a good condition is based both on health and distribution.

- **Landscape context:** Good. There is great representation of non-fragmented reefs in the south of Belize. The rest of reefs are naturally separate, and their connection is for the most part by means of marine currents. The corals to the south are product of the large area in Belize, so all corals in the Gulf of Honduras are recognized as a single system.

Stresses (Global Value: high)

- **Habitat destruction and conversion:** Medium. High severity, low extent. In the Sapodilla Cayes there is physical damage, and even destruction, of coral reefs by anchors dropped on the reefs and by tourists collecting pieces as souvenirs. Also, constructions in the Belize Cayes have caused coral reef destruction and conversion.

- **Sedimentation:** Medium. High severity, medium extent.

There is much sedimentation at the mouths of the Motagua River in Guatemala and the Ulúa and Chamelecón rivers in Honduras, caused in large part by intensive agriculture in the Motagua and Sula valleys. Sediments transported by Río Ulúa travel all the way to the reef off Tela Bay and the Punta Sal reefs. There is less sedimentation in Belize than in the other two countries.

- **Habitat perturbation:** High. High severity, very high extent. Tourism is a source of physical perturbation of the coral reefs. In Placencia, Belize, remains of corals can be seen. There are places where black coral is looted to make tourist artifacts.

- **Altered composition and structure:** High. Very high severity, high extent. Natural events like hurricanes and climate change (which causes coral bleaching in shallow areas) affect the coral reefs. The elimination of some predators (such as groupers) affects the whole system.

Sources of stress (Global Value: high)

- **Tourism development:** High. Tourists and tour operators drop anchors on the reef, ripping pieces off, and they build in sensitive areas such as the Belize Cayes.

- **Climate change:** High. The effect of climate change is seen in the bleaching of corals, which has happened throughout the whole distribution of reefs, especially affecting corals in shallow waters. The recuperative capacity of corals is yet unknown.

- **Inappropriate agricultural and animal farming practices:** Medium. These include banana, African palm, sugarcane, and melon plantations in the Sula valley (Honduras) and the Motagua valley (Guatemala). In the department of Izabal, Guatemala, cattle raisers dig drainage ditches to dry swamps, which cause sedimentation. Also, shrimp and citric fruit farms in Placencia contribute to the contamination and sedimentation of waters.

- **Inappropriate fishing practices:** High. Includes the use of illegal fishing methods (such as harpoons), use of gill nets and dragnets, uncontrolled industrial fishing, indiscriminate capture of accompanying fauna, fishing during no take seasons and in no-take areas, illegal cross-border fishing, and fishing in spawning aggregations.

Table 1. Hierarchical values for viability, stresses, and sources of stress for coral reefs

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Good	Habitat destruction	Medium	Tourism development	High
Condition	Good	Sedimentation	Medium	Climate change	High
Landscape context	Good	Habitat perturbation	High	Inappropriate agricultural and animal farming practices	Medium
		Altered composition and structure	High	Inappropriate fishing practices	High
Global Value	**Good**	**Global Value**	**High**	**Global Value**	**High**

2.2 Mangrove Forests

Mangrove forests constitute very particular forest ecosystems, because mangroves are facultative halophyte plants that grow in environments under the influence of continuous tide fluctuation. They possess adaptations that make them highly competitive in environments where other plants cannot subsist.

Mangroves are particularly important in ecologic terms, because they provide habitats or banks for crustaceans, mollusks, and fish; wintering habitat for migratory birds; and habitat for resident birds, reptiles, and mammals.

Along the Gulf, in the islands, estuaries, and coastal lagoons that are under the influence of tidal fluctuation, mangrove forests can be seen growing, with relative abundance of different genera.

The dominant species is red mangrove (*Rhizophora mangle*); there is a smaller proportion of black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood mangrove (*Conocarpus erectus*). The mangrove forests of the Gulf can be classified as riverine, littoral, and insular mangrove forests.

As the "Conservation Elements" map shows (see the Annexes), there are mangrove forests in almost the whole south coast of Belize, especially in Placencia, Port Honduras, and the banks of the main rivers: Deep, Sarstoon, and Temash.

According to Yáñez-Arancibia *et al.* (1999), an analysis of aerial photographs and satellite images has shown that mangrove forests colonize 91.9 Km of the Caribbean coast of Guatemala (which is some 185 Km long).

Laguna de Los Micos, Jeannette Kawas National Park
Photo: FUNDARY

There are approximately 707 Ha of mangrove forests in La Graciosa Bay, Canal Inglés, Cocolías, Sarstún, Punta de Palma, and Amatique Bay. In Honduras, mangrove forests surround all the coastal lagoons, being more abundant in De Alvarado Lagoon, De Los Micos Lagoon in the Jeannette Kawas National Park, Laguna Negra in Tela, and the Punta Izopo National Park. The largest mangrove forest region in the Gulf is the Sarstún-Temash bi-national (Belize-Guatemala) area.

Endangered species associated to mangrove forests include West Indies manatee (*Trichechus manatus*), American crocodile (*Crocodylus acutus*), ducks (*Dendrocygna automnalis* and *Anas discor*), great curassow (*Crax rubra*), and capuchin, howler, and spider monkeys (*Cebus capucinus, Allouatta pigra*, and *Ateles geoffroyi*).

The main commercial species include queen conch (*Strombus gigas*), crown conch (*Melongena* sp.), shrimp (*Penaeus* spp.), crabs (*Calianactus* sp.), tarpon (*Megelops atlantica*), grouper (*Epinephilas* sp.) and snapper (family Lutjanidae).

Viability (Global Value: good)

- **Size:** Good. The size is considered good, because there are mangrove forests in all the places mentioned above, but there is fragmentation in some sites caused by human activities. Guatemala has less mangrove forest cover than Belize and Honduras.

- **Condition:** Good. The condition of the mangrove is good, since there is representation in all the area.

- **Landscape context:** Fair. There exist stresses (such as fragmentation and habitat conversion) on the mangrove forests and coastal forests that diminish connectiveness.

Stresses (Global Value: high)

- **Habitat destruction and conversion:** High. High severity, high extent. Higher in Guatemala and Honduras than in Belize. For example, in Honduras the development of infrastructure and agricultural plantations have caused destruction and conversion of the mangrove forests.

- **Habitat fragmentation:** High. High severity and high extent. Mangrove forests have been fragmented in the coastline of Guatemala in Sarstún and Punta de Palma, because of the building of chalets and the expansion of coastal communities. In Río Dulce and El Golfete there are patches of mangrove forest, but very fragmented by constructions. In Honduras, there is fragmentation because of the construction of the road that connects Guatemala with Puerto Cortés. In Belize there is fragmentation because of the construction of the south road.

- **Habitat perturbation:** Medium. Medium severity, high extent. Perturbation is related to the ecosystem function of mangrove forests. They are not highly perturbed – they still function as ecologic niches for the feeding and reproduction of certain species, but some species stop behaving in a natural manner. Human activities such as fishing, hunting, and boat traffic can displace certain species, or change their behavior.

- **Altered composition and structure:** Medium. Medium severity, medium extent. The horizontal and vertical structure of mangrove forests has been altered by the extraction of firewood (roots and branches), and by the construction of infrastructure and the expansion of agricultural areas. The fragmentation alters the structure of mangrove forests, and that degrades niches for bird, mammal, and other species.

- **Nutrient overload:** Medium. Medium severity, high extent. Caused by agricultural practices, such as the use of fertilizers in rice crops in Honduras; wastewater; and solid wastes, especially in the cities of Puerto Barrios and Puerto Cortés.

Sources of stress (Global Value: high)

- **Inappropriate agricultural and animal farming practices:** High. These forest ecosystems are being threatened by tree cutting for firewood, construction, and by the change of land use (Espinal, 1994). The latter is caused by productive activities, such as intensive and subsistence agriculture, cattle raising, and aquaculture.

- **Pollution by wastewater and solid wastes:** Medium. Includes the lack of management of wastewater and solid wastes in coastal cities and communities.

- **Urban development and access roads:** High. Expansion of coastal cities and communities, and construction of the south road in Toledo, Belize, and the road between Puerto Cortés and Izabal, Guatemala.

- **Development of industrial infrastructure:** High. Expansion of the ports.

- **Tourism development:** High. The development of tourism infrastructure (hotels, restaurants, country houses, marinas, and private piers) affects the mangrove forests systems.

- **Selective extraction of timber and firewood:** Medium. In El Triunfo and in Laguna Negra, Honduras, community people extract mangrove to make charcoal.

- **Wildlife poaching:** Medium. West Indies manatee, great curassow, and other species are illegally hunted.

- **Maritime transportation:** Low. The frequent passage of ships and boats along the maritime transportation routes contributes to habitat perturbation.

Table 2. Hierarchical values for viability, stresses, and sources of stress for mangrove forests

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Good	Habitat destruction	High	Inappropriate agricultural and animal farming practices	High
Condition	Good	Habitat fragmentation	High	Contamination by solid wastes	Medium
Landscape context	Fair	Habitat perturbation	Medium	Urban development and access roads	High
		Altered composition and structure	Medium	Development of industrial infrastructure	High
		Nutrient overload	Medium	Tourism development	High
				Selective extraction of timber and firewood	Medium
				Wildlife poaching	Medium
				Maritime transportation	Low
Global Value	**Good**	**Global Value**	**High**	**Global Value**	**High**

2.3 Marine grasslands

Marine grasslands are marine ecosystems composed of aquatic plants of the *Syringodium* and *Thalassia* genera (FUNDARY, 2001 and TIDE, 1998), colonized by stable and tranquil (without much wave motion) sediments in shallow waters, with high transparency and intermediate salinity. Marine grasslands are frequently associated to coral reefs. They constitute biotic systems with a high relevance as producers in the trophic chain. They serve as important breeding areas for many fish and invertebrate species, and they provide important feeding habitat for the sea turtles of the Gulf.

In the Gulf, the dominant species is *Thalassia testudinum*, but patches of *Halodule wrigthii* and *Syringodium filiforme* can also be found. There are approximately 15 Ha of *Vallisneria americana* in El Golfete (Yáñez-Arancibia et al., 1999).

Bahía La Graciosa, APE Punta de Manabique. Photo: FUNDARY

According to the "Conservation Elements" map (see the Annexes), the largest marine grasslands are found off the coast of Belize and around the barrier reefs and reef patches, to a depth of approximately 5 meters. In Guatemala, there are approximately 3,750 Ha of marine grasslands in the central and eastern parts of Amatique Bay and La Graciosa Bay (*ibid.*).

There are also patches in Laguna Grande in Sarstún, to the south of the mouth of Río Sarstún, in El Golfete, Bahía Santo Tomás, the mouth of Río San Carlos and Punta de Palma, and the north side of Punta de Manabique. In the north coast of Honduras, there are marine grasslands between Omoa and Chachaguala, in the Jeannette Kawas National Park and in Tela Bay.

Endangered species associated with marine grasslands include West Indies manatee (*Trichechus manatus*), bottlenose and Atlantic spotted dolphins (*Tursiops truncatus, Stenella frontalis*), and the following sea turtles: green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and loggerhead (*Caretta caretta*).

Commercial species include lobster (*Panulirus argus*), queen conch (*Strombus gigas*), crown conch (*Melongena* sp.), shrimp (*Penaeus* spp.), crabs (*Calianactus* sp.), anchovy (*Anchoa* sp.), tarpon (*Megelops atlantica*), and bonefish (*Albula vulpes*).

Viability (Global Value: good)

- **Size:** Good. Marine grasslands are represented in all the Gulf of Honduras, and they have areas large enough to ensure their recuperation.

- **Condition:** Good. In Honduras, specifically in Omoa, marine grasses are suffering a disease that begins at the tips of the leaves and extends towards the stems. Sedimentation is also affecting the grasslands. It is a factor that inhibits connectiveness.

- **Landscape context:** Fair. The disease that affects the grasses is fragmenting and inhibiting the connectiveness, and can constitute a threat.

Stresses (Global Value: medium)

- **Sedimentation:** Low. Low severity, very high extent. It diminishes photosynthesis of the marine grasses and causes deposition. In Guatemala, severity is moderate, because the marine grasslands are within Amatique Bay, while the greatest sources of sedimentation are the rivers, especially Motagua River. Anyhow, sediment deposits from dredging are high. In Belize, the effect of sediments in the river mouths is low. The marine grassland sites that are affected by sedimentation are Manabique and Río Dulce. In conclusion, the effect of sedimentation is low, because sediments disperse before reaching the marine grasslands.

- **Habitat perturbation:** High. High severity, high extent. The speed of marine grassland restoration is unknown. Grasses are destroyed by dragnets used by shrimp boats, mainly in Amatique Bay and in the Belize Cayes, off Placencia. The severity of habitat perturbation is high because the nets completely pull out some grasses.

  Currently there is not as much fishing in the coast as before, because there are no white shrimp. Therefore, fishing occurs in deeper waters, and grasslands are not very degraded.

- **Contamination by toxic substances:** Medium. High severity, medium extent. It is a current and also a potential stress. Contamination occurs when ships empty their tanks, when ships are painted, when small spills take place, and by inappropriate disposal of used oil and other toxic substances in the ports of the Gulf.

  As a potential stress, it is speculated that the effect of a possible oil (or other toxic substance) spill could have a high extent, depending on the location and size of the spill and the strength of the marine currents.

- **Altered composition and structure:** High. High severity, very high extent.

  There is a change in the structure of the marine grasslands, due to the overfishing of conch, sea turtles (green, especially), West Indies manatee, fish, mollusks, and crustaceans that spend part of their lives in the grasslands. The extent is very high because there are no sites in the Gulf that have not been affected by this stress.

Sources of stress (Global Value: high)

- **Inappropriate agricultural and animal farming practices:** Low.

  This source of stress is a combination of intensive and subsistence agriculture, and cattle raising practices. Intensive agriculture is responsible for contamination by toxic substances.

- **Tourism development:** Low. Many owners remove marine grass and substitute it with sand, to create artificial beaches or to extend existing beaches.

- **Inappropriate fishing practices:** High. The overexploitation of conch and other species alters the structure and composition of associated species populations.

- **Maritime transportation:** Medium. Includes development of marinas and contamination from spills. The risk of spills from the toxic material transportation is high.

- **Petroleum exploration and exploitation:** Low. This is a potential threat.

- **Wildlife poaching:** High. Contributes to altered composition and structure. Includes manatee poaching and the capture of sea turtles in fishing nets.

Table 3. Hierarchical values for viability, stresses, and sources of stress for marine grasslands

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Good	Sedimentation	Low	Inappropriate agricultural and animal farming	Low
Condition	Good	Habitat perturbation	High	Tourism development	Low
Landscape context	Fair	Contamination by toxic substances	Medium	Inappropriate fishing practices	High
		Altered composition and structure	High	Maritime transportation	Medium
				Petroleum exploration and exploitation	Low
				Wildlife poaching	High
Global Value	**Good**	**Global Value**	**Medium**	**Global Value**	**High**

2.4 Beach Systems

Beaches constitute dynamic areas. The shape of a beach changes continually, due to the transportation of sand by waves, currents, tides, and the wind. In the Caribbean, the sand is composed of coral and conch remains.

Ecologically, beaches provide nesting, feeding, and resting areas for sea turtles, birds, crustaceans, and others species. Beach systems include not only the strip of sand and rock and the wave action zone, but also the vegetation behind the beach and the shallow marine waters off the beach, both areas being ecologically associated to the beach.

The "Conservation Elements" map (see the Annexes) shows the location of beaches in the Gulf. Beach systems are located in Port Honduras, Placencia, and the Sapodilla Cayes in Belize (approximately 220 Km); Punta de Manabique, Punta de Palma, and Siete Altares in Guatemala (approximately 185 Km); and Punta Sal, Masca, Omoa, Puerto Cortés, and Tela Bay in Honduras (approximately 200 Km).

Associated endangered species include yellow-headed parrot (*Amazona oratrix*); iguana (*Iguana iguana*); jaguar (*Panthera onca*); and capuchin, howler, and spider monkeys (*Cebus capucinus, Allouatta pigra*, and *Ateles geoffroyi*). Commercial species include lobster (*Panulirus argus*), queen conch (*Strombus gigas*), crown conch (*Melongena* sp.), shrimp (*Penaeus* spp.), crabs (*Calianactus* sp.), anchovy (*Achoa* sp.), snook (*Centropomus undecimalis*), tarpon (*Megelops atlantica*), and the following sea turtles: green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and loggerhead (*Caretta caretta*).

Miami community, Jeannette Kawas National Park. Photo: FUNDARY

Viability (Global Value: good)

- **Size:** Very good. There is a good extension of rocky and sandy beaches.

- **Condition:** Good. The condition of the beaches is basically being altered by contamination, tourism, and extraction of associated species. In Guatemala, for example in Punta de Manabique, the solid and liquid wastes that come from Motagua River affect the beach systems. Other threats are the lethal yellowing of coconut palms, cattle ranches, and the extraction of sea turtles and iguanas. In Belize, hotels and tourism complexes are transforming the ecosystem. There is also extraction of iguanas, natural and anthropogenic erosion, and water is misused. In Honduras, there is lethal yellowing of coconut palms, tourism development problems, and wastewater discharge.

- **Landscape context:** Good. The oceanographic connectiveness and continental connectiveness are good in the Gulf of Honduras.

There exists connectiveness between the beaches and other ecosystems by means of marine currents and the transportation of river sand. However, the continental connectiveness is being threatened by the cultivation of African palm and by tourism development.

Stresses (Global Value: high)

- **Beach erosion:** Medium. High severity, medium extent. Drainage ditches, dikes, sea walls, and breakwaters have been built. Hurricanes have contributed highly to erosion, which is irreversible. There is beach erosion in Cortés, Monkey River, the Sapodilla Cayes, the south of Manabique, between Punta de Palma and Santa María, and in Bajamar (in the Chamelecón River sandbar) in Honduras.

- **Habitat fragmentation:** High. High severity, very high extent. It is due mainly to urban development, tourism development, and inappropriate agricultural and animal farming practices. For example, the construction of houses (country houses and the expansion of rural communities) has eliminated the vegetation behind the beaches in Tela (Triunfo de la Cruz, Ensenada, Tela, Tornabé, and San Juan), between Puerto Cortés and Tulián, from Omoa to the Guatemalan border, in Punta de Manabique, and in Placencia.

- **Altered composition and structure:** High. High severity, very high extent. Poaching iguanas, sea turtle eggs, parrots, and other species associated to beaches has had a negative impact on their populations. Iguanas are hunted in the beaches of Tela, Omoa, and Punta de Manabique. Toucans are hunted in Tela, Omoa, and Manabique.

  There is poaching of monkeys in Bajamar and Cerro Cardona (to the east of Puerto Cortés). Parrots are hunted in Omoa and Manabique. Shrimp and lobster are overfished off the beaches of Tela, as are crabs in Puerto Cortés. In Guatemala, the overfishing of anchovy (*Achoa* sp.) occurs between San Francisco del Mar and Cabo Tres Puntas, and in Estero Lagarto, Pichilingo, Punta de Palma, and Santa María. Sea turtle eggs are illegally collected between Quetzalito and San Francisco del Mar.

- **Nutrient overload:** High. High severity, high extent. It is due mainly to urban development, with a high and irreversible contribution, due to the high cost of reversion. It occurs in Cortés, Tela, and Manabique, through the mouths of the Ulúa, Chamelecón, and Motagua rivers and the Canal Martínez.

- **Hydrologic alteration:** High. High severity, very high extent. There exists hydrologic alteration caused by sand extraction. Also, the degradation of watersheds affects the speed, direction, and salinity of marine water streams and that affects the beaches. For example, there are strong discharges of fresh water after the rains, and no watershed recuperation has been observed after Hurricane Mitch. In hydrologic alteration, the contribution is medium, and the irreversibility is also medium. There is hydrologic alteration in the rivers Tinto, Ulúa, Chamelecón, Tulián, Omoa, Masca, Motagua, Chachaguala, and Cuyamel.

- **Contamination by toxic substances:** High. High severity, high extent. Includes contamination by agrochemicals, solid wastes, and ship wastes.

Sources of stress (Global Value: very high)

- **Urban development and access roads:** Very high. Causes the elimination or fragmentation of vegetation behind the beaches.

- **Maritime transportation:** High. The construction of breakwaters and sea walls has a reduced contribution to the stress of erosion, because it is not a highly generalized practice and is reversible, using legislation. For habitat fragmentation, it provides a medium contribution and medium irreversibility. For composition and structure, the sea walls alter the currents where they are placed, but the impact is low throughout the Gulf.

- **Climate change:** High. The sea level increase due to climate change is contributing highly to the erosion of beaches. In the case of Belize, beaches have almost been lost. The sea level is expected to increase between 2 and 6 millimeters each year, equivalent of up to 6 centimeters in 10 years.

- **Tourism development:** High. Tourism infrastructure (hotels, country houses, and / or piers) has been built in almost all the beaches of the Gulf. In habitat fragmentation, the contribution of tourism development is very high. As it affects habitat fragmentation, structure, and composition, associated populations are reduced. The establishment of marinas is more frequent, but in general terms their contribution is medium. Tourism development contributes to erosion in a very low way, because it is not very generalized.
Another problem is the use of beach sand for construction.

- **Inappropriate agricultural and animal farming practices:** Medium. Cattle raising and the cultivation of corn and fodder cause fragmentation of the ecosystems by using up resources such as mangrove and beach resources.

- **Wildlife poaching:** High. It changes the composition and structure of associated populations.

- **Pollution by wastewater and solid wastes:** Medium. In Guatemala, the nutrient overload is high because of wastewater discharge. Two sewage treatment plants have been built in Puerto Barrios. Punta de Manabique receives all the garbage of the Motagua River watershed. Solid wastes affect the composition and structure of the populations of associated species. For example, plastic bags affect sea turtles (specifically leatherbacks), which confuse them with medusas.

Table 4. Hierarchical values for viability, stresses, and sources of stress for beach systems

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Very Good	Beach erosion	Medium	Urban development and access roads	Very High
Condition	Good	Habitat fragmentation	High	Maritime transportation	High
Landscape context	Good	Altered composition and structure	High	Climate change	High
		Nutrient overload	High	Tourism development	High
		Hydrologic alteration	High	Inappropriate agricultural and animal farming practices	Medium
		Contamination by toxic substances	High	Wildlife poaching	High
				Contamination by solid wastes	Medium
Global Value	**Good**	**Global Value**	**High**	**Global Value**	**Very High**

2.5 Estuaries and Coastal Lagoons

Estuaries are complex aquatic systems where seawater and freshwater mix. They are directly influenced by tidal fluctuation: the extension of brackish water varies during the rainy and dry seasons. They are high biodiversity ecosystems, which receive nutrients from the watersheds. Lankford (1977) defines a coastal lagoon as a "depression of the coastal zone, below the average of the highest tides, having a permanent or ephemeral communication with the sea, but protected from the sea by some type of barrier."

The "Conservation Elements" map (see Annexes) shows the location of the estuaries and coastal lagoons in the Gulf. The estuaries are found in the mouths of the principal rivers, such as Monkey River, Deep River, Río Temash, Sarstún, Río Dulce, Bahía Santo Tomás, Río Pichilingo, La Graciosa Bay and Canal Inglés, and the rivers San Francisco, Motagua, Ulúa, Chamelecón, Coto, Frío, Tulián, and Cuyamel. The number and size of coastal lagoons is larger in Belize, then Honduras, followed last by Guatemala. In Belize there are coastal lagoons in Placencia, Monkey River, and Punta Ycacos.

Bahía de la Graciosa, APE Punta de Manabique. Photo: FUNDARY

In Honduras lagoons include De Alvarado, De los Micos, De Chachaguala, De los Diamantes, Verde, Negra, Río Tinto, De Cintino, and De Jaloa. Finally, in Guatemala, the lagoons are Laguna Grande in Sarstún, Verde in Punta de Palma, Santa Isabel, Escondida, Estero Lagarto, Quetzalito, Chocón Machacas, Cocolí, San Francisco, and Jabalí.

It is important to mention the presence of West Indies manatee (*Trichechus manatus)* in these systems: it has been seen in Port Honduras, Río Sarstún, El Golfete, La Graciosa Bay, the mouth of Motagua River, and in various coastal lagoons of Honduras.

Also to be found here are the American crocodile (*Crocodylus acutus),* bottlenose and Atlantic spotted dolphins (*Tursiops truncatus* and *Stenella frontalis*), and ducks (*Dendrocygna automnalis* and *Anas discor*). Commercial species associated with these ecosystems include crown conch (*Melongena* sp.), shrimp (*Penaeus* spp.), crabs (*Calianactus* sp.), anchovy (*Anchoa* sp.), snook (*Centropomus undecimalis*), tarpon (*Megelops atlantica*), jacks (family Carangidae), snappers (family Lutjanidae), dolphinfish (*Coryphaena hippurus*), and mojarra (*Cichlasoma* sp.).

Viability (Global Value: good)

- **Size:** Very good. There are extensive areas of estuaries and coastal lagoons in the Gulf.

- **Condition:** Good. In general, the condition of the estuaries and coastal lagoons is considered good. In Belize, the estuaries and coastal lagoons are in a good state, because the water quality is good, and because there are many species present. In Guatemala, there are healthy areas and degraded areas. Sarstún, Santa Isabel Lagoon, and Quetzalito have little contamination and low resource extraction. However, Amatique Bay and Motagua River are highly polluted, and the lagoons of Chocón Machacas suffer vegetation extraction. In Honduras, contamination harms De Alvarado Lagoon, and there is sedimentation caused by deforestation. De Los Micos Lagoon has medium contamination, but the rest of small lagoons are in good conditions. The estuaries are in good condition: they are not very contaminated.

- **Landscape context:** Good. The degradation of watersheds causes the degradation and disappearance of some estuaries and coastal lagoons. In Belize, there is only one estuary (Agua Caliente) where degradation of the watershed affects the connectiveness between the estuary and the watershed. In Guatemala, the landscape context is fair, because of the watershed degradation and the lack of integrated management of the Motagua, Polochic, and Sarstún watersheds. In Honduras, the landscape context is good, except for De Alvarado Lagoon, which is highly affected by the degradation of Chamelecón River.

Stresses (Global Value: high)

- **Habitat perturbation:** Medium. Medium severity, high extent. Several activities contribute to the degradation of estuarine habitats: use of improper fishing methods, dredging in the ports and maritime transportation routes, deposition of dredge residue in estuarine areas (La Graciosa Bay), and water pollution.

- **Sedimentation:** High. High severity, high extent. Sedimentation is high due to the change in land use, especially in the watersheds of Guatemala and Honduras. The main rivers (Motagua, Ulúa, and Chamelecón) produce large plumes of sediments that strongly affect the areas close to their mouths. De Alvarado Lagoon receives sediments from Chamelecón River. Dredging has increased the amount of sediments to the south of Placencia; in Guatemala there are many sediments in the mouths of the rivers Motagua, Sarstún, and Dulce, and in Santo Tomás Bay.

- **Nutrient overload:** Medium. High severity, medium extent. The nutrient overload includes nitrates and phosphates carried by the rivers. It comes from wastewater from the cities (Puerto Barrios, Santo Tomás, Puerto Cortés, Tela), and from the fertilizers and wastes of agricultural and industrial companies. Fertilizers and wastewater pollute Río Dulce, while a butter factory pollutes De Los Micos Lagoon.

- **Hydrologic alteration:** Medium. Medium severity, medium extent. The degradation of watersheds affects the distribution of freshwater over time, producing higher peaks in the rainy season (less salinity) and less flow in the dry season (higher salinity). In Honduras, the dam constructed in Río Ulúa affects the direction of flow towards the lagoon and wetlands in Tela Bay.

- **Habitat conversion:** Low. Medium severity, low extent. Mangrove is extracted for firewood in the lagoons. For example, in Honduras much of the mangrove forests around De Los Micos Lagoon and De los Diamantes Bay have been destroyed.

Sources of stress (Global Value: high)

- **Inappropriate agricultural and animal farming practices:** High. In the banana, African palm, cattle, vegetable, and shrimp farms, the change of land use increases the sedimentation, and the indiscriminate use of agrochemicals causes contamination. The water discharge by shrimp farms alters the freshwater.

- **Tourism development:** Medium. The impact of tourism development is greater on mangrove forests and beaches than on coastal lagoons. However, the channeling of rivers and streams affects the hydrological system.

- **Inappropriate fishing practices:** Medium. The practices that contribute to habitat perturbation and conversion include the use of gill nets with very fine mesh, the use of dragnets, fishing of species during their spawning season, and anchovy fishing from Río Dulce to San Felipe and in Amatique Bay ("mosquito netting" captures juveniles of commercial species). Also, the incidental capture of hawksbill sea turtles in shrimp boat nets has been reported in Tela Bay.

- **Urban development and access roads:** High. Even though roads bring development to the zone, they have great sedimentation impacts. For example, the south Belize road and the road from Puerto Cortés, Honduras, to the border with Guatemala cause sedimentation. The growth of cities and rural communities also causes sedimentation and nutrient overload.

- **Contamination by solid wastes:** Medium. Its major contribution is the discharge of nutrients in the coastal lagoon systems. Lagoons eutrophicate quicker, because they are semi-closed systems (especially De Alvarado Lagoon and Santo Tomás Bay).

- **Industrial waste discharge:** Low. The discharges of agro-industrial companies pollute the lagoons. There are African palm plantations on the edge of Lake Izabal, and an African palm oil processing plant will be built in Punta Chapín River. De Los Micos Lagoon receives wastes from a butter factory. In Valle de Sula and Choloma there are factories and clothes assembly shops.

- **Maritime transportation:** Low. The port operations contribute to nutrient overload, sedimentation, and contamination by toxic substances, because they have pipelines for petroleum, agrochemicals, and other toxic products. Fuels are stored in Puerto de Santo Tomás, Puerto Cortés, and Tela. Also, sailboats in Río Dulce discharge their wastewater and garbage into the sea.

Table 5. Hierarchical values for viability, stresses, and sources of stress for estuaries and coastal lagoons

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Very good	Habitat perturbation	Medium	Inappropriate agricultural and animal farming practices	High
Condition	Good	Sedimentation	High	Tourism development	Medium
Landscape context	Good	Nutrient overload	Medium	Inappropriate fishing practices	Medium
		Hydrologic alteration	Medium	Urban development and access roads	High
		Habitat conversion	Low	Contamination by solid wastes	Medium
				Industrial waste discharge	Low
				Maritime transportation	Low
Global Value	**Good**	**Global Value**	**High**	**Global Value**	**High**

2.6 Herbaceous Wetlands, Flood forests, and their supporting Aquatic Systems

As the "Conservation Elements" map shows (see the Annexes), there are herbaceous wetlands and / or flood forests in Punta de Manabique, Puerto Cortés, the western part of Santo Tomás Bay (San Carlos), and on the eastern part of Punta Izopo. In Guatemala, Yañez-Arancibia *et al.* (1999) estimate that herbaceous wetlands and flood forests cover approximately 9,261 Ha of the Caribbean coast of Guatemala, both being covered by water for the greater part of each year. The endangered species associated with the herbaceous wetlands include yellow-headed parrot (*Amazona oratrix*); American crocodile (*Crocodylus acutus*); iguana (*Iguana iguana*); freshwater turtles; ducks (*Dendrocygna automnalis, Anas discor);* jaguar (*Panthera onca*); capuchin, howler, and spider monkeys (*Cebus capucinus*, *Allouatta pigra* and *Ateles geoffroyi*); tapir (*Tapirus bardii*); peccary (*Tayassu tajacu*); and great curassow (*Crax rubra*). The commercial species include snook (*Centropomus undecimalis*) and tarpon (*Megelops atlantica*).

Viability (Global Value: good)

- **Size:** Good. The herbaceous wetlands and flood forests have greater extensions than the mangrove forests. In Belize they are very good, in Guatemala good, and in Honduras fair.

- **Condition:** Good. The flooded condition of wetlands makes access difficult, helping to conserve them. However, in Honduras the wetlands are highly deteriorated; their condition is fair. In Guatemala, there is wood extraction for charcoal, and roads have altered the secondary forest.

Polochic River Natural Wildlife Refuge
Photo: FUNDARY

- **Landscape context:** Fair. Many wetlands connected to the tropical forests in Izabal, Guatemala, and the north coast of Honduras, but many of these forests have been converted to agricultural areas.

Stresses (Global Value: high)

- **Habitat conversion:** High. High severity, high extent. The herbaceous wetlands and flood forests are highly stressed by habitat conversion, since most of them are not protected. Healthy examples are found only in patches with little agricultural and cattle-raising interest, since their soils are not fit for these activities.

- **Habitat fragmentation:** High. High severity, high extent. Much of the low tropical forest that used to be behind the wetlands, between 25 and 500 m above sea level, has been destroyed. There is also wood extraction in the flood forests, for firewood, charcoal, and construction, for example in Manabique and Sarstún.

- **Hydrologic alteration:** Medium. High severity, medium extent.

Hydrologic alteration affects wetlands, because the amount of freshwater and its distribution over time have changed in some watersheds. The severity is high and the extent is medium because it is relatively localized. In Deep River, the strong rains brought by Hurricane Mitch (October 1998) changed the salinity, killing much of the vegetation in the wetlands. Other affected areas include the watersheds of Río Frío and San Idelfonso, Canal Martínez, and Río Ulúa (Honduras); Estero Lagarto (Guatemala); and Monkey River (Belize).

- **Altered composition and structure:** High. High severity, high extent. Excessive fishing and hunting alters the structure of species populations, including yellow-headed parrot, American crocodile, iguana, great curassow, snook, and tarpon.

Sources of stress (Global Value: high)

- **Urban development and access roads:** High. The unplanned expansion of cities and rural communities and the construction of access roads fragment the wetlands. For example, in Honduras, human settlements in the zone of De Alvarado Lagoon and El Faro have modified the wetlands close to Cortés. In Manabique, the threat of a future road exists.

- **Inappropriate agricultural and animal farming practices:** High. Principally includes the conversion of herbaceous wetlands and flood forests into grasslands and agricultural areas. In Río Chiquito and Cuyamel (Honduras), rice plantations have fragmented the wetlands. In the watershed of Río Ulúa, the Chamelecón bar, and Canal Martínez there are African palm plantations where wetlands used to be. In Placencia, wetlands have been converted to shrimp farms. Peasants have planted crops in the wetlands of Sarstún, Sarstoon-Temash, Manabique, and Río Ulúa.

- **Channeling rivers and streams:** Medium. In Punta de Manabique, cattle raisers and farmers have dried wetlands to convert them to cattle raising and agricultural areas.

- **Contamination by solid wastes:** Low. There are solid wastes in the rivers Motagua, Chamelecón, Ulúa, and Dulce.

- **Timber and firewood extraction:** Medium. For example, cahue is cut in Manabique and Santa María in Sarstún. In the Canal Martínez forests, the following wood types are exploited: mahogany, San Juan, laurel, and cedar.

- **Wildlife poaching:** Medium. Includes poaching great curassow, deer, and peccary in Quetzalito and Cabo Tres Puntas (Manabique), hunting iguanas and poaching in the wetlands of Chocón-Machacas and Sarstoon-Temash.

- **Industrial waste discharge:** Medium.

Table 6. Hierarchical values for viability, stresses, and sources of stress for herbaceous wetlands

Viability	Value	Stresses	Value	Sources of stress	Value
Size	Good	Habitat conversion	High	Urban development and access roads	High
Condition	Good	Habitat fragmentation	High	Inappropriate agricultural and animal farming practices	High
Landscape context	Fair	Hydrologic alteration	Medium	Channeling rivers and streams	Medium
		Altered composition and structure	High	Contamination by solid wastes	Low
				Timber and firewood extraction	Medium
				Wildlife poaching	Medium
				Industrial waste discharge	Medium
Global Value	**Good**	**Global Value**	**High**	**Global Value**	**High**

III. CONSERVATION STRATEGIES AND ACTIONS

Strategies to diminish threats and increase the viability of the conservation elements were defined during the workshops. For each conservation element, strategies were prioritized according to their potential to mitigate the threats. Using the Excel spreadsheet for Site Conservation Planning, an analysis was made of the capability of each strategy to reduce the stress on each conservation element. The following table presents the conservation strategies that would be most effective in reducing the threats that the Gulf faces. The most effective strategy would be to complete the tri-national protected areas system in the Gulf. This strategy would provide a very high benefit to the mangrove forests and marine grasslands, a high benefit for coral reefs and herbaceous wetlands, and a medium benefit for estuaries and coastal lagoons.

OBJECTIVES	STRATEGIES	VALUE OF THE STRATEGY FOR EACH SYSTEM						GLOBAL STRATEGY VALUE
		Coral Reefs	Mangrove Forests	Marine Grass-lands	Beach Systems	Estuaries and Coastal Lagoons	Herba-ceous wetlands	
1. Develop a tri-national coastal-marine protected areas system, all areas having management plans, long-term financial plans, and adequate resources	Complete the Gulf of Honduras protected areas system, and improve the management and protection of the areas	High	Very High	Very High	Medium	Medium	High	Very High
	Create mechanisms for the financial sustainability of protected area management	Medium	High	Medium	High	High	High	High
2. Promote the development of a legislative, regulatory, and institutional framework compatible among the three countries	Develop and implement Land Use Regulation Plans and Sector Plans	High	Very High	Medium	High	Medium	Very High	Very High
	Make and execute protection plans for endangered, and economically important, species	High	High	High	High	Medium	Medium	High
	Support the regulation of fisheries and sustainable fishing	High	Medium	High	Low	High	Low	High
	Revise, develop, and enforce, in a participative manner, norms and mechanisms to regulate the sustainable use of natural resources	Medium	High	Medium	High	Medium	High	High
3. Consolidate economic activities that are compatible with the conservation of nature, with high participation and leading roles by local inhabitants	Promote alternate economic activities in the local communities	Medium	High	High	High	High	Medium	High
4. Develop a communications system, periodic meetings, publications, capacity building, and inter-institutional exchanges and coordination	Implement education, sensitizing, awareness-raising, and divulgation programs about the environmental problems and their solutions with inhabitants, resource users, and governments	Medium	Medium	Medium	Medium	Medium	Medium	Medium
	Implement institutional strengthening programs, and coordination and citizen participation mechanisms, for the protection of natural systems	Medium	Medium	Medium	Medium	Medium	Medium	Medium

Following is each strategy, with its action plan and a list of the threats it mitigates

Objective 1.

Strategy # 1: Complete the protected areas system, and improve protected area management and protection

Threats mitigated: **Urban development and access roads, tourism development, wildlife poaching, inappropriate fishing practices, development of industrial infrastructure, timber and firewood extraction, channeling rivers and streams, petroleum exploration and exploitation.** Total cost: **$ 1,170,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Promote the declaration of Punta de Manabique as a new protected area in the Gulf	Guatemala	Congress of the Republic of Guatemala FUNDARY, TRIGOH, MARN, CONAP, Environment Commission of Congress, Ministry of the Interior, congressmen	Communities, tourists	$ 5,000	Began first semester of 2004
Promote the declaration of Sierra Caral as a new protected area in the Gulf	Guatemala	Congress of the Republic of Guatemala FUNDAECO, TRIGOH, MARN, CONAP, Environment Commission of Congress, Ministry of the Interior, congressmen	Communities, tourists	$ 5,000	Began first semester of 2004
Promote the declaration of Río Sarstún as a new protected area in the Gulf	Guatemala	Congress of the Republic of Guatemala FUNDAECO, TRIGOH, MARN, CONAP, Environment Commission of Congress, Ministry of the Interior, congressmen	Communities, tourists	$ 5,000	Began first semester of 2004
Promote the declaration of Omoa Baracoa as a new protected area in the Gulf	Honduras	Congress of the Republic of Honduras CCO, TRIGOH, COHDEFOR, Ministry of the Interior, congressmen	Communities, tourists	$ 5,000	Began first semester of 2004
Conduct annual monitoring of the effectiveness of PA management with MBRS, WB, PROARCA, and TNC tools	The whole Gulf	PA managers TRIGOH, MBRS, MBC, PROARCA/APM	PA system administrators	$ 50,000/ year	Continuously
Strengthen mechanisms (advisory councils) to involve community members in PA management	The whole Gulf	PA managers Local PDOs, local projects, civil society, UN, MINUGUA, UNDP	PDOs, committees, cooperatives, fishermen groups	$ 50,000/ year	Continuously
Formalize an exchange forum among PA managers in border zones	The whole Gulf	PA managers Protected Areas Commission of TRIGOH	PA system	$ 10,000/ year	Every 6 months, in all 5 years
Design a model for corridors between the PAs, including marine elements within the MBC agenda	The whole Gulf	Ministry of Environment Local PDOs, MBC, municipal governments, private enterprise	Committees, cooperatives, municipal govt.s	$100,000	2 years
Establish cross-border co-management agreements between Sarstún and Sarstoon-Temash, and between Punta de Manabique and Omoa-Baracoa	Belize, Guatemala, Honduras	Ministries of Environment and Foreign Relations, CONAP, COHDEFOR Local PDOs, MBC, TRIGOH, MBRS	Communities, tourists, PA system	$ 50,000	2 years
Promote the creation or enlargement of private protected areas	The whole Gulf	Ministries of Environment, CONAP, COHDEFOR, Belizean authorities Local PDOs, local projects	Tourists, PA system	$ 50,000/ year	3 years
Attend to invader species problems, particularly *Hydrilla* and the lethal yellowing of coconut palms	The whole Gulf	Ministries of Environment, CONAP, COHDEFOR, Belizean authorities Local PDOs, local projects	PA system	$100,000 / year	3 years

Strategy # 2: Create mechanisms for the financial sustainability of protected area management

Threats mitigated: All. Total cost: **$ 350,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Establish systems to charge entry fees to PAs in each country, especially for cruise ships	Each country	Government units, PDOs, Congresses Local projects	PA system, community members, users	$ 80,000	2 years
Lobby in governments so that PA fees will be re-invested in management of the PAs where the fees were charged	Each country	CCAD, TRIGOH, Government units, PDOs, Congresses Local projects, PDOs	PA system, community members, users	$ 40,000	3 years
Analyze and create technical and economic incentives (payment for environmental services) to promote conservation	Each country	CCAD, Congresses, Government units PDOs managing PAs, universities, private sector, Ministries of Economy and Finance	PA system, landowners, community, municipal governments, private sector	$ 50,000	2 years
Conduct studies on the economic value of the ecosystems	The whole Gulf	Universities PDOs managing PAs	PA system	$ 100,000	2 years
Implement a long-term financial plan for the Gulf PA system	The whole Gulf	Government units, PDOs Local projects	PA system	$ 80,000	2 years

Objective 2

Strategy # 3: Develop and implement Land Use Regulation Plans and Sector Plans

Threats mitigated: **Urban development and access roads, inappropriate agricultural and animal farming practices, tourism development, development of industrial infrastructure, channeling rivers and streams, petroleum exploration and exploitation.**

Total cost: **$460,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Develop 3 Land Use Regulation Plans, for Izabal, Toledo, and Cortés and Atlántida	Toledo, Izabal, Cortés, Atlántida (4 departments of the Gulf)	TRIGOH, MBC Fishing institutions, community, local authorities, territorial management institutions	Communities, municipal governments	$ 200,000	3 years
Incorporate environmental elements into port development plans (diagnosis, audits, and environmental impact assessments) and into contingency plans	Santo Tomás, Puerto Barrios, Puerto Cortés	TRIGOH ENP Puerto Barrios, EMPORNAC	Maritime transportation companies, customs, port company	?	3 to 5 years
Support municipal planning units in land use regulation courses	Toledo, Izabal, Cortés, Atlántida (4 departments of the Gulf)	TRIGOH Local authorities, territorial management institutions	Municipal governments	$ 100,000	2 years
Systematize and share land tenure and land use information by means of a GIS	Toledo, Izabal, Cortés, Atlántida (4 departments of the Gulf)	TRIGOH Governments, territorial management institutions, municipal governments, private businesses	Communities, municipal governments	$ 100,000	2 years
Obtain participation of organizations that manage protected areas in sharing opinions for coastal development	Toledo, Izabal, Cortés, Atlántida (4 departments of the Gulf)	Local PDOs, with support from TRIGOH Governments, territorial management institutions, municipal governments, private businesses	Communities, municipal governments	$ 30,000/ year	2 years

Strategy # 4: Make and execute protection plans for endangered, and economically important, species
Threats mitigated: **Wildlife poaching, inappropriate fishing practices, timber and firewood extraction.** Total cost**: $ 540,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Identify the most important areas for West Indies manatees, iguanas, parrots, and sea turtles, and develop conservation plans and long-term monitoring	Coastal areas, including wetlands	TRIGOH, UNIPESCA, CONAP, DIGEPESCA, COHDEFOR, Belizean authorities PDOs, universities, volunteers	Decision makers, hunters	$ 5,000/ year	5 years
Mangrove forest monitoring program with remote sensors	Gulf of Honduras (continental and insular mangrove forest areas)	GOs responsible for protected areas, co-manager PDOs TRIGOH, organizations with technical capabilities, universities, PDOs, MBC	Decision makers, administrators	$ 3,000/ year	1 year, continuously
Conduct research on hunting and a forest inventory, and propose long-term monitoring	The whole Gulf	GOs responsible for protected areas, co-manager PDOs TRIGOH, organizations with technical capabilities, universities, PDOs, MBRS, MBC	Decision makers, administrators	$ 20,000/ year	2 years, continuously
Teach courses for customs and police about CITES, national laws, and control and management of endangered species	The whole Gulf, particularly border zones	CONAP, COHDEFOR Co-manager PDOs, universities	Customs, police	$ 5,000/ year	2 years
Create 3 national inter-governmental forums on endangered species, to improve law enforcement, especially regarding commercialization	Belize, Guatemala, Honduras	Government units, PDOs MBRS, MBC, hunters, forest users, TRIGOH, universities	Decision makers, users	$ 50,000/ year	Continuously
Make a tri-national endangered species database	Belize, Guatemala, Honduras	Government units, PDOs TRIGOH, universities	Decision makers, users	$ 20,000/ year	Continuously
Establish tri-national protection strategies, including education, monitoring, and control and surveillance	Belize, Guatemala, Honduras	Government units, PDOs MBC, hunters, forest users, MBRS, TRIGOH, universities	Decision makers, users	$ 50,000	2 years
Conduct a tri-national divulgation and awareness-raising campaign (radio spots, school materials, posters)	Belize, Guatemala, Honduras	Government units, PDOs MBRS, MBC, hunters, forest users, TRIGOH, universities	Users	$ 50,000	Continuously

Strategy # 5: Support the regulation of fisheries and sustainable fishing

Threats mitigated: **Inappropriate fishing practices.** Total cost: **$ 1,050,000**

Actions	Geographical area	Entities responsible / Collaborators	Beneficiaries	Cost	Period
Create 3 national inter-governmental forums on fishing, which shall meet periodically	Belize, Guatemala, Honduras	Government units, PDOs MBRS, MBC, fishermen, TRIGOH, universities	Decision makers, users	$ 50,000/ year	Continuously
Create 1 tri-national inter-governmental forum on fishing, with the participation of authorities and users from the three countries, which shall meet periodically for coordination in legislation and law enforcement	Gulf of Honduras	Government units, PDOs MBRS, MBC, fishermen, TRIGOH, universities	Decision makers, users	$ 50,000/ year	Continuously
Conduct studies on "fair" and "black" anchovies, to understand their life cycles and migrations, to implement no-take seasons and propose long-term monitoring	Guatemalan coast on the Gulf	UNIPESCA Fishermen, CEMA, TRIGOH	Legislators	$ 50,000	2 years, continuously
Conduct studies of conch and lobster, to improve their management and propose long-term monitoring	Reef areas, marine grasslands, deep bottoms	Government units, PDOs with technical capability MBRS, MBC, fishermen, TRIGOH, universities, forum on fishing	Decision makers, users	$ 100,000/ year	2 years, continuously
Identify and conduct monitoring of spawning aggregations by species, such as snapper and grouper, in reef bottoms	Spawning banks in the Gulf	Fishing authorities, MBRS, TRIGOH Universities, fishermen, volunteers	Decision makers, fishermen	Year 1 $ 50,000, Year 2 $ 40,000	2 years
Promote the management of key spawning sites for marine species in the 3 countries	Spawning banks in the Gulf	Fishing authorities, MBRS, TRIGOH, congresses Universities, fishermen	Decision makers, fishermen	$ 50,000	2 years
Revise the fishing laws and regulations of Guatemala, Belize, and Honduras, to update fines and establish mechanisms for the co-management of fisheries	Belize, Guatemala, and Honduras	Fishing Commission of TRIGOH Fishing entities, congresses, IDEADS, local government, Chambers of Commerce	Fishermen, businesspeople, consumers, municipal governments, authorities	$ 110,000	3 years
Establish regional agreements to harmonize laws that protect economically important species (sardines, shrimp, lobster, conch)	Nationally, in each of the 3 countries	Fishing Commission of TRIGOH, Fishing Directorates Fishermen associations, Ministries of Environment, communities	Fishermen, consumers	$ 50,000	3 years

Strategy # 6: Revise, develop, and enforce, in a participative manner, norms and mechanisms to regulate the sustainable use of natural resources

Threats mitigated: **Urban development and access roads, inappropriate agricultural and animal farming practices, tourism development, pollution by wastewater and solid wastes, maritime transportation, development of industrial infrastructure, industrial waste discharge, channeling rivers and streams.** Total cost**: $300,000**

Actions	Geographical area	Entity responsible Collaborators	Beneficiaries	Cost	Period
Support the ratification and enforcement of international treaties (MARPOL, SOLAS, *etc.*) on the management of wastes transported by ships	Nationally, in each of the 3 countries	SERNA, municipal governments, Port Safety Committee Merchant Marine, port companies (ENP), Ministries of Foreign Relations, national congresses	Tourism, fishing, and private (industry) sectors; ports	$10,000	1 year
Promote environmental security with contingency plans, for port operations and commercial and recreational maritime transportation	Nationally, in each of the 3 countries	TRIGOH, local PDOs SERNA, MARN, Belizean authorities	Tourism, fishing, and private (industry) sectors; ports	$ 50,000	2 years
Lobby so that the Gulf of Honduras will be declared a "Particularly Sensitive Maritime Zone" by IMO	Nationally, in each of the 3 countries	TRIGOH, SERNA, MARN, local PDOs Ministries of Foreign Relations	Tourism, fishing, and private (industry) sectors; ports	$ 20,000	2 years
Revise and update the list of prohibited / allowed agrochemicals in each country, and establish mechanisms to verify and enforce these norms	Nationally, in each of the 3 countries	TRIGOH, SERNA, MARN Ministries of Agriculture and Health	Agrochemical distributors, farmers	$ 10,000	6 months
Promote the regulation and application of existing environmental laws related to infrastructure	Nationally, in each of the 3 countries	TRIGOH, local PDOs Municipal governments	Investors, communities	$ 20,000	1 year
Make the existing norms on waste disposal into bodies of water be widely known	Gulf of Honduras	TRIGOH, local PDOs Ministries of Environment, municipal governments, Ministries of Health	Private real estate businesses, population	$ 10,000	2 years
Develop and enforce use regulations, and sustainable tourism infrastructure standards	Gulf of Honduras	TRIGOH, local PDOs Municipal governments, INGUAT, FOPECO, INTECAP, UVG, BTB (Belize), IHT (Honduras)	Investors, communities	$ 50,000	1 year
Use tools such as conservation easements to promote conservation in private lands	Gulf of Honduras	TRIGOH, local PDOs Municipality associations, municipal governments, congresses, Ministries of Environment	Landowners, communities, municipal governments, private sector	$ 60,000	2 years
Strengthen municipality associations regarding conservation and management of private lands	Gulf of Honduras	TRIGOH, local PDOs Municipality associations, municipal governments, congresses, Ministries of Environment	Landowners, communities, municipal governments, private sector	$ 80,000	2 years

Objective 3

Strategy # 7: Promote alternate economic activities in the local communities

Threats mitigated: **Inappropriate agricultural and animal farming practices, tourism development, wildlife poaching, inappropriate fishing practices, timber and firewood extraction.** Total cost: **$ 815,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Conduct studies on species, seasons, and places that are important to sport fishing	Gulf of Honduras	PDOs Local fishermen	Communities, fishermen	$ 15,000 / country	6 months
Conduct courses on sport fishing and tourism service	Gulf of Honduras	PDOs TRIGOH	Local fishermen	$ 20,000 / country	2 courses per year
Equip boats of interested fishermen for sport fishing	Gulf of Honduras	PDOs, Tourism Commission of TRIGOH Fishermen associations	Fishermen	$ 25,000	6 months
Identify agricultural, fishing, and tourism products in the Gulf of Honduras that meet certification conditions	Watersheds next to the coast	Farmer and fishermen groups, hotel and restaurant owners, PDOs, certifiers Guilds, exporter associations	Producers, guilds, consumers	$ 25,000	6 months
Achieve certification of forest (wood and non-wood) and fishing products	Watersheds next to the coast	Producers, PDOs, certifiers Government, guilds, exporter associations	Producers, guilds, consumers	?	1 to 3 years
Verify measures in certified product markets	Watersheds next to the coast	Producers, PDOs, certifiers Government, guilds, exporter associations	Producers, guilds, consumers	?	2 years
Certify tourism activities	Coastal zone and riverbanks	Businesses complying with the program, Ecotourism Committee of TRIGOH Tourism GOs, PDOs	Tourism companies	$ 40,000 / year	3 to 4 years, continuous process
Train fishermen and peasants as nature guides	Sites associated to PAs	Protected area managers, PDOs GOs, municipal governments, PDOs	Fishermen, peasants	$ 50,000	2 to 3 years
Develop the tri-national community ecotourism route	Sites associated to PAs	TRIGOH, protected area managers Tourism GOs, PDOs	Fishermen, peasants	$ 50,000	1 year
Develop a regional market for products and services compatible with conservation	Belize, Izabal, Honduras	TRIGOH Chambers of Commerce, PDOs, communications media	Tour operators, consumers	$ 30,000 / year	5 years
Train communities in the processing of smoked fish, fish sausages, fresh fish, dry salted fish	Sites associated to PAs	GOs, associated PDOs Fishermen groups	Informed consumers, fishermen	$ 50,000	2 to 3 years
Conduct exchanges among producers, to replicate successful experiences	Sites associated to PAs	Protected area managers, PDOs, Government Guilds, exporter associations	Fishermen, peasants	$ 50,000	2 to 3 years
Implement the breeding of synergetic species (fish, conch, shrimp, lobster, paca, *etc.*)	Belize, Izabal, Honduras	Protected area managers, PDOs Universities, local projects	Fishermen, peasants	$ 150,000	3 years

Objective 4

Strategy # 8: Implement education, sensitizing, awareness-raising, and divulgation programs about the environmental problems and their solutions with inhabitants, resource users, and governments

Threats mitigated: All. Total cost: **$ 650,000**

Actions	Geographical area	Entities responsible / Collaborators	Beneficiaries	Cost	Period
Establish a public information and awareness-raising program targeting users, authorities, and the general public, supporting the initiatives established by civil society	Gulf of Honduras	TRIGOH Local (municipal) governments, Ministries of Education, press and other communications media, community based organizations, universities, local private development and conservation organizations	Civilian and military authorities, organized groups, private sector, local communities, communications media	$ 50,000	1 year
Establish a program to train government and PDO extensionists	Gulf of Honduras	TRIGOH, local PDOs Regional projects, local organizations, GOs, international cooperation agencies	Extensionists, assistant technicians, producers, community leaders, rangers	$ 150,000	5 years
Foment awareness in affected parties, by informing and training, to demand environmental impact and exploitation licenses	Gulf of Honduras	Local PDOs, TRIGOH, municipal governments Ministries of Environment, Department of the Environment (Belize), SERNA, COHDEFOR	Private sector, local communities	$ 100,000	5 years
Foment a culture of local tourism, aiming for conservation and eco-development, by means of workshops, exchange tours, and radio and television programs	Gulf of Honduras	TRIGOH, local PDOs Tri-National Ecotourism Commission, INGUAT, FOPECO, INTECAP, UVG, tour operators, Mundo Maya, BTB (Belize), IHT (Honduras)	Local communities (restaurants, hotels, taxi drivers, boat captains), university extension centers, local schools	$ 50,000/ year	First to third years
Incorporate sustainable development into the formal education (educational institutions) curriculum	Gulf of Honduras	TRIGOH, local PDOs Ministries of Education, PROECO (Honduras), MoES (Belize), local teachers, CONAP, MBRS	Elementary School students	$ 30,000 / year	5 years
Develop an environmental education plan on contamination in the Gulf of Honduras (industrial and solid wastes, wastewater, visual contamination, sedimentation), including training in sanitary landfills for the municipal governments, and latrinization for coastal and riverine communities	Gulf of Honduras	TRIGOH, local PDOs Solid Waste Management Authority (Belize), municipal governments, PDOs, community trusts, water committees, ports, Ministries of Environment, Port Safety Committee, environmental educators of each PDO, communications media	Municipal governments, agro-industrial businesspeople, hotel owners, traders, port activities	$ 50,000	First year

Strategy # 9: Implement institutional strengthening programs, and coordination and citizen participation mechanisms, for the protection of natural systems

Threats mitigated: **inappropriate agricultural and animal farming practices, wildlife poaching, inappropriate fishing practices, pollution by wastewater and solid wastes, timber and firewood extraction.** Total cost: **$ 365,000**

Actions	Geographical area	Entities responsible Collaborators	Beneficiaries	Cost	Period
Make known the results of the national initiatives on public / social participation, to make regional adaptations (for example, advisory councils in Guatemala)	Gulf of Honduras	TRIGOH, local PDOs Human rights organizations, projects, Ministries of Health, social workers	Local PDOs, GOs, authorities, users, directors of natural resource managing organizations, organized groups	$ 100,000	2 years
Strengthen the capacity of municipal governments for environmental management, by creating an association of the municipalities involved in the area of action in the Gulf of Honduras, by training, by informing, and by visits to the Municipal Government of Cortés as an example for the region	Gulf of Honduras	TRIGOH, local PDOs MBRS, MBC, PROARCA, universities	Municipal governments, village councils, COCODES (Guatemala)	$ 110,000	5 years
Create fishermen and resource user organizations, accompanied by: Training in management, project designs, accounting, organization Obtaining legal registration for the local organizations National and tri-national exchanges, and educational tours	Gulf of Honduras	TRIGOH, local PDOs Fishing authorities, fishermen associations, COCODES, other resource user associations	Fishermen (sports, industrial, and non-industrial), resource users, COCODES (Guatemala)	$ 155,000	5 years

IV. MEASURES OF SUCCESS

The Nature Conservancy has defined success in conservation as substantial progress towards (1) the durable mitigation of critical threats, and (2) the sustained maintenance or improvement of the viability of the conservation targets in the sites identified for taking conservation actions. However, there frequently exists a delay between the implementation of strategies and the mitigation of critical threats and persistent stresses, and an even longer delay between the implementation of strategies and the evidence of change in biodiversity health. Therefore it is necessary to also develop short-term indicators to reflect the capability to implement the effective strategies proposed in the Site Conservation Plan (TNC, 2000).

Currently, the viability of all the conservation elements in the Gulf is considered good, but the threat to focal objects and the site as a whole is very high.

A monitoring and evaluation system (MES) is necessary to learn the impact of the proposed strategies such as planning instruments and policies, to evaluate the current situation in a given socio-economic context, to discover trends, to prevent irreversible damage, and, in general, to improve the different types of management. The objectives, structure, fields, and themes of the SCP are detailed in Volume II of the Site Conservation Plan for the Gulf of Honduras (FUNDARY, 2004), which describes the measures of success and their monitoring in greater detail.

Following are health measurements for the site's biodiversity, with the purpose of evaluating the effectiveness of the conservation strategies to improve or maintain the viability of the conservation elements, using for a baseline the viability evaluation (size, condition, and landscape context) for each of the six conservation elements.

Coral Reefs

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
Size and condition	Live coral cover, diversity, health, algae cover, *etc.*	Aronson's video method	Once a year	Required in the outer and inner faces of the barrier, and in the patches or inner islets in Belize; in the Jeanette Kawas area, Honduras; and off Punta de Manabique in Guatemala	5 person team for 11 field days: 7 days in Belize, 2 in Guatemala, and 2 in Honduras
Condition	Diversity index for fish populations	Direct sampling of fish, by transects	Once a year	The same sites of the previous study	2 person team for 11 field days: 7 days in Belize, 2 in Guatemala, and 2 in Honduras
Condition	Reference of seasonal changes in the structure, and in the quality of the catch	Sampling of fish in ports or storage sites	Two samplings monthly	Punta Gorda and Placencia in Belize; Puerto Barrios and Livingston in Guatemala; Omoa, Cortés, and El Triunfo in Honduras	Personnel from the fisheries departments

Mangrove Forests

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
Size	Area covered	Remote sensors (GIS)	Once a year	Gulf of Honduras	1 GIS analyst
Condition	Changes in the diversity indices of benthoids	Samplings with Ekmann dredges, laboratory analysis	One monthly sampling for the first two years; once the mangrove forest has been characterized, twice a year	Channels in each country where the mangrove forest is widest	Biology student, Biology Departments of local universities
Condition and landscape context	Habitat diversity and availability	Bird, reptile, and mammal counts	Once a year	For reptiles, sampling by diurnal and nocturnal transects in the main channels of the mangrove forests in the three countries. For birds, diurnal samplings (dawn and dusk) in transects in the three countries.	2 persons for a week, every 3 months
Condition	Productivity	Production, accumulation of duff	Monthly for two years to characterize, then twice a year (during rainy and dry season)	Sarstún, La Graciosa Bay, Amatique, Port Honduras, Jeannette Kawas National Park, Punta Izopo	3 persons for one day, for each protected area in the Gulf

Marine Grasslands

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
West Indies manatee population	Number of individuals (adults + juveniles)	Overflights	Once a year, in March or April	The whole Gulf	TRIGOH, CZMA/I
West Indies manatee population	Number of individuals (adults + juveniles)	Counts from a boat, community member surveys	Thrice a year	In the priority habitats of the Gulf (Port Honduras, Sarstún, Lake Izabal, La Graciosa Bay, Punta Sal, and Punta Izopo)	TRIGOH
Marine grass abundance	Density (number / m^2)	Parcels and sub-aquatic photography	Twice a year (in the dry and rainy seasons)	Coast of Toledo, La Graciosa, Punta Sal	TRIGOH + CZMA/I + CEMA
Condition: sedimentation	Turbidity, depth	Secchi disk, rod	Thrice a year	River mouths and lagoon outlets	15 man days / year

Beach Systems

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
Cover and current use	Natural and perturbed Ha	Remote sensor (Spot)	Dry season, every 2 years	The whole Gulf	1 GIS analyst
Biodiversity in the area	Biodiversity index	Sampling	Dry season, every 2 years	Sampling sites in the whole Gulf	TRIGOH + Universities

Estuaries and Coastal Lagoons

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
Size: area and number of water surfaces	Water surface hectares	Satellite photographs, remote sensors	Twice a year, once each in the dry and rainy seasons	Coastal-marine zone	PDOs, two persons per country
Condition: heavy metals	Mercury, cadmium, lead, copper, and organochlorates	Chemical determination	Once a year	River mouths and lagoon outlets	Laboratory
Condition: sedimentation	Turbidity, depth	Secchi disk, rod	Thrice a year	River mouths and lagoon outlets	15 man days / year
Condition: presence of species	Number of individuals	Samplings	Once a year / one month of research	River mouths and lagoon outlets	
Landscape: increase in tourism infrastructure	Number of marinas, rooms, and hotels	Inventories, samplings, surveys	Once a year / one month of research	Coastal-marine zone	Tourism Commission of TRIGOH
Landscape: increase in roads and urban infrastructure	Number, quality, and length (in Km) of roads	Remote sensors, routes, trails	Once a year		Rangers

Herbaceous Wetlands

Indicator	Attribute to be measured	Methods	Time and frequency	Location	Personnel
Size: habitat conversion	Hectares of forest and wetland cover	Maps, aerial photographs, remote sensors	Once a year	Coastal-marine zone	GIS personnel of PDOs
Landscape: urban growth	Number of roads, houses, canals, and inhabitants	Remote sensors, censuses, routes, population censuses	Once a year		GIS personnel of PDOs, Statistics Institutes, Ministries of Health and Education
Condition: water flow	Depths, canals, seasonality of the water surface, yearly precipitation	Rod, volumetric methods, satellite images, sampling points at depth	Twice a year, once each in the dry and rainy seasons	Selected forests of the Gulf	Internship students, graduation research students, universities, rangers

V. BIBLIOGRAPHY

AUIL, N. 1998. Sustainable development and management of biologically diverse coastal resources management project. Belize City, Belize.

BROWN, M. 1998. Minicasos sobre asuntos clave de manejo y grupos de interesados relacionados con el Golfo de Honduras. PROARCA/Costas and PROARCA/CAPAS, Guatemala, Guatemala.

CEDEX. 1999. Plan director para el saneamiento integral y la gestión de residuos sólidos de los apartamentos poblacionales del Parque Nacional "Río Dulce" y de la Amatique Bay, Informe final, Tomos I, II, III y IV, informe técnico para Ministerio de Asuntos Exteriores, Secretaría de Estado de Cooperación Internacional y para Ibero América, Agencia Española de Cooperación Internacional (AECI), convenio para realización de trabajos y actividades de cooperación técnica en materia de medio ambiente e infraestructuras, con los países de Centroamérica afectados por el Huracán Mitch. II informes de los Proyectos del convenio, Proyecto Guatemala 2 Centro de Estudios Hidrográficos, clave CEDEX 45-499-7-001. Madrid, Spain.

CENTRAL STATISTICAL OFFICE, MINISTRY OF FINANCE. 2000. Environmental Statistics For Belize 2000. Belmopan, Belize.

CHACON & GERSON. 1998. Comercialización de la manjúa *Anchoa iyolepsis* y análisis de la Asociación de Pescadores. Punta de Manabique, Puerto Barrios, Izabal, Guatemala.

COASTAL MANAGEMENT ZONE. 1999. Coastal Water Quality, Belize. Belize City, Belize.

COMITÉ DE RESPUESTA A CRISIS DEL MEDIO AMBIENTE MARINO–COSTERO IZABAL, 1998. Plan de 1998. Contingencias contra derrames de hidrocarburos / químicos. Diálogos de políticas ambientales. Puerto Barrios Izabal, Guatemala.

CONAMA. 1997. Anteproyecto "Reglamento especial para la navegación en el Parque Nacional Río Dulce". Guatemala, Guatemala.

CONAMA. 1998. Proyecto de reglamento de navegación de las aguas del Parque Nacional Río Dulce.   Guatemala, Guatemala.

DITEPESCA. Plan de Ordenamiento Pesquero. Guatemala.

ENVIRONMENTAL & SOCIAL TECHNICAL ASISTANCE PROJECT. 1999. Regional Development Plan For Southern Belize – Draft. Belize City, Belize.

ESPINAL, M. 1994. Diagnóstico de los recursos costeros en la zona del Golfo de Honduras (Parte Hondureña). Honduras.

FISHERIES DEPARTMENT, MINISTRY OF AGRICULTURE AND FISHERIES & TOLEDO INSTITUTE ON DEVELOPMENT AND ENVIRONMENT. 1998. Port Honduras Marine Reserve (Draft Management Plan). Belize.

FUNDARY. 2001. Evaluación Ecológica Rápida del Refugio de Vida Silvestre Punta de Manabique, Izabal, Guatemala, C. A. Guatemala. 240 p. + maps.

GÁLVEZ J. J. 2001. Sistema de monitoreo y evaluación de la biodiversidad del proyecto MIRNA. Sección 2: Recomendaciones para el sistema de seguimiento y evaluación del proyecto MIRNA.   MAGA / MARN / CONAP / INAB, Guatemala. 30 p.

HEYMAN, W. D. 1996. Integrated coastal zone management and sustainable development for tropical estuarine ecosystems: A case study of Port Honduras, Belize. Belize.

HEYMAN, W. & R. GRAHAM. 2000. La voz de los pescadores de la Costa Atlántica de Guatemala.

HEYMAN, W. & T. HYAT. 1996. An analysis of commercial and sport fishing in the proposed Port Honduras Marine Reserve, Belize. Belize Centre for Environmental Studies, Belize.

HEYMAN, W. & B. KJERFVE. 1999. Hydrological and oceanographic considerations for integrated coastal zone management in Southern Belize.

ICSED. 2000. Desarrollo de herramientas económicas para la preparación de políticas sostenibles en el sector pesquero del Golfo de Honduras. Tomo I. PROARCA/CAPAS, Guatemala, Guatemala.

ICSED. 2000. Desarrollo de herramientas económicas para la preparación de políticas sostenibles en el sector pesquero del Golfo de Honduras. Tomo II. PROARCA/CAPAS, Guatemala, Guatemala.
JICA. 1993. Informe de la investigación sobre recursos pesqueros en la República de Honduras. Honduras.
LANKFORD, R.R. 1977. Coastal lagoons of Mexico: Their origin and classification, p. 182-215. In: Wiley, M. (Ed.) Estuarine Processes. Academic Press, Inc., New York, 2: 428 pp.
MONGE, L. 1998. Memoria del taller regional sobre manejo de pesquerías en el Sistema Arrecifal del Caribe Mesoamericano, organizado y financiado por PROARCA/Costas y PROARCA/CAPAS, con apoyo de la Alianza Trinacional de ONGs del Golfo de Honduras - TRIGOH. PROARCA/CAPAS, Guatemala.
MUNICIPALIDAD DE LIVINGSTON. "Información general sobre Livinsgston y la comunidad Garífuna".
PELTIER, N. 1997. El transporte de productos peligrosos en el Golfo de Honduras: Evaluación del riesgo, políticas de prevención y plan de contingencia, Guatemala.
PROARCA/APM. 2003. Perfil del sitio de trabajo: Golfo de Honduras, borrador. PROARCA/APM, Guatemala. 70 p.
PROARCA/Costas. 2001. Perfil del sitio Golfo de Honduras (borrador). PROARCA/Costas, Guatemala.
PROARCA/Costas, PROARCA/CAPAS. 1999. Memoria del taller regional sobre conservación del manatí en el Golfo de Honduras, Guatemala. PROARCA/CAPAS, Guatemala.
PROGRAM FOR BELIZE, BID. 1995. National protected areas system plan for Belize. Synthesis report. Belize.
PROLANSATE. 1999. La voz de los pescadores de Honduras, Honduras.
PROLANSATE. 2000. Ayuda de memoria de la IX Reunión de la TRIGOH, Punta Gorda, Belice.
PROMACO/ORCA. 1992. Memorias, Consulta Nacional en Guatemala.
RODA. 1999. Marco legal e institucional para la protección de manatí en el Golfo de Honduras / Centroamérica. Informe comparado trinacional.
RODRÍGUEZ, J. 1996. Muestreo biológico de pesca artesanal de la langosta común (*Panulirus argus*) en la Bahía de Omoa, Cortés, Honduras.
RODRIGUEZ, J. 1998. Informe, V campaña de los monitoreos biológicos de pesca artesanal de la langosta común (*Panulirus argus*) en la Bahía de Omoa, Cortés, Tegucigalpa, Honduras.
TNC. 2000. Esquema de las cinco S para la conservación de sitios: Un manual de planificación para la conservación de sitios y medición del éxito en conservación. 62 p.
TOLEDO INSTITUTE FOR DEVELOPMENT AND ENVIRONMENT (TIDE). 1998. Draft management plan for Paynes Creek National Park. Belize.
TRIGOH, LA ALIANZA TRINACIONAL PARA LA CONSERVACION DEL GOLFO DE HONDURAS. 1998. Plan estratégico y operacional.
TRIGOH, LA ALIANZA TRINACIONAL PARA LA CONSERVACION DEL GOLFO DE HONDURAS. 2003. Plan estratégico y operacional.
URQUIZÚ, S. M. 1993. Reconocimiento arqueológico de la costa atlántica periférica al Área de Protección Especial Cerro San Gil, Departamento de Izabal, Guatemala. USAC, Guatemala.
Yañez-Arancibia, A. D. 1999. The ecosystem framework for planning and management of the Atlantic Coast of Guatemala. In: Ocean and Coastal Management 42 (1999), pp. 283-317.
Yañez-Arancibia, A. D., Zárate Lomelí, and A. Terán Cuevas. 1995. Evaluation of the coastal and marine resources of the Atlantic Coast of Guatemala. EPOMEX: CEP Technical Report No. 34. UNEP Caribbean Environment Programme, Kingston, Jamaica. 64 p.
ZISMAN, S. 1996. (Compilation) The Directory of Belizean Protected Areas and Sites of Nature Conservation Interest, Second Edition. Belize.

VI. ANEXES

The Site Conservation Planning method

Maps

Map 1. Base map of the Gulf of Honduras
Map 2. Ecoregions
Map 3. Life Zones, according to Holdridge
Map 4. Conservation elements
Map 5. Stresses
Map 6. Sources of stress

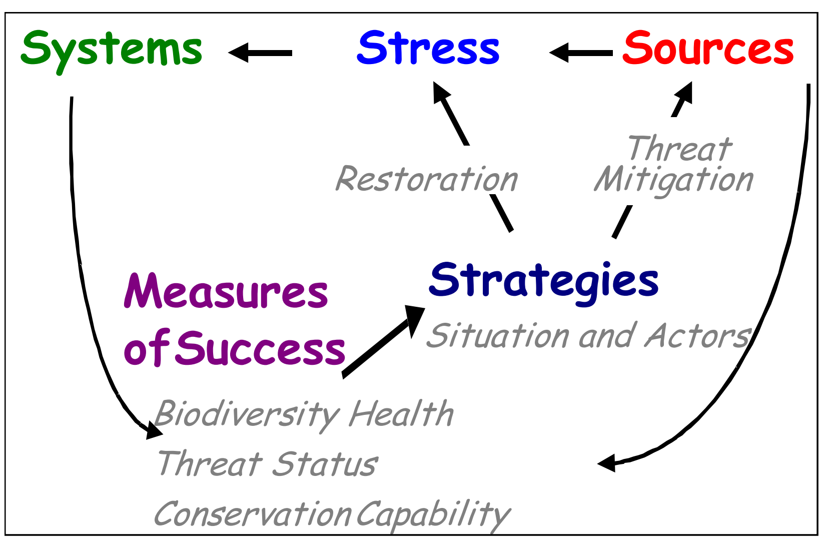
The Site Conservation Planning method

Site Conservation Planning (SCP) is a methodological framework developed by The Nature Conservancy (TNC, 2000) and its partners to analyze information about a site and plan activities focused on the conservation priorities of the site, including the protection or improvement of biodiversity health (viability) and the reduction and elimination of critical threats damaging a site. By identifying priorities, this method allows protected area planners and managers to achieve a better allocation of limited human and financial resources for the conservation of a site.

SCP is five-stage iterative method that results in two specific products:

Priority conservation strategies **to mitigate and / or eliminate the critical stresses damaging the site (threat mitigation), to restore or improve biodiversity viability in the site (by means of restoration and management), and to strengthen the conservation capabilities in the site.**
A conservation monitoring system, **to measure the impact of conservation actions in the site (measures of success) and to provide feedback for revising the conservation strategies when it becomes necessary.**

The Site Conservation Planning methodological framework has five steps, summarized in the following figure:



Component 1: Systems and Conservation Elements

Systems and Conservation elements:

The important species, ecologic communities, and ecologic systems — including the natural processes that maintain them— that justify the selection of a site for conservation actions. Once the key elements to ensure the long-term viability of each system have been identified—including species, communities, and processes—, three characteristics of the systems must be analyzed:

- **Size:** measurement of the area or abundance of the occurrence of the conservation element
- **Condition:** integrated measurement of the composition, structure, and the biotic interactions that characterize the occurrence
- **Landscape context:** integrated measurement of two factors: the dominant environmental regimes and processes that establish and maintain the occurrence of the conservation element, and connectiveness

A category evaluation (Very Good, Good, Fair, Poor) of the current state of these three factors allows a characterization of the viable occurrences of the systems within the site.

Component 2: Stresses

Stresses:

The types of degradation and damage to the size, condition, and / or landscape context of a system or conservation element that result in the reduction of the viability and health of the system. The analysis of stresses in this step and the analysis of the sources of stress in the next step are key to learn what the problems of the site are, and to focus the conservation strategies on the priority threats from an ecologic perspective. The following important points must be considered when identifying the stresses acting on the systems and their associated conservation elements:

- Only the destruction or degradation of systems and their associated conservation elements resulting from human (non-natural) causes must be considered as a stress.
- To be considered, the stress must be happening at the present, or have a high probability of happening in the near future.
- Stresses damaging each system must be identified.
- It is important to be as precise as possible when identifying stresses; this will help identify sources of stress.

A hierarchical value (Very High, High, Medium or Low) is assigned to the stresses acting on each conservation element. Even though all the stresses acting on the biodiversity are documented, it is critical to prioritize these stresses based on the severity and extent of each stress. The conservation strategies must reduce or eliminate those stresses that have a high severity combined with an ample extent.

Component 3: Sources of stress

Sources of stress:

The actions, processes, or agents, of human or natural origin, that generate or cause stress. Together, the sources of stress and the stresses they exert on the systems constitute the threats to the ecosystems.

Most of the sources of stress are associated to the environmentally unsound use of soil, water, and natural resources by humans, which are taking place or have taken place in the past, yet continue having an impact. Several points must be considered when identifying sources of stress for conservation elements:

- When multiple sources of stress contribute to a single stress, threat mitigation strategies must be focused on the sources that have the most impact on that stress.
- Focus must be placed on those sources of stress that would have a long-term impact, like urban development.
- To be considered, the sources of stress must be happening at the present, or have a high probability of happening in the near future.
- The sources of stress closest to the conservation elements must be identified, rather than the most distant sources, to ensure the development of direct and feasible conservation strategies.

On the basis of the best knowledge and expert judgment available, each source of stress must be evaluated according to the criteria of contribution and irreversibility:

It is critical that investments made to implement site conservation strategies be focused on the mitigation of the most critical threats, instead of less destructive and easier to confront threats.

The final step in the evaluation of stresses and sources of stress is to make a synthesis of the individual analyses of each stress and source of stress, which identifies the critical threats over the systems or conservation elements in a site, and allows the definition of priorities.

Component 4: Conservation strategies

Conservation strategies:
The conservation actions developed and implemented to:

- Mitigate and / or eliminate the critical stresses that are damaging the site
- Restore or improve the viability of biodiversity in the site
- Strengthen the conservation capabilities in the site

The ultimate objective of the conservation strategies is to reduce the stresses that act on the systems or conservation elements, reducing their viability. To develop conservation strategies, the following points must be taken into account:

- Conduct an analysis of the situation and the actors in the whole site linked to each threat
- Make a list of the proposed conservation strategies
- Evaluate the proposed conservation strategies according to the following criteria: the benefits acquired by implementing them; the feasibility of their being successful; and the costs
- Prioritize the conservation strategies for the whole site, to determine the lines of action

Making the Situation and Key Actors Diagram generates a graphic representation of the cause and effect relations between the sources of stress, human activities, key actors, and their main motivations.

Component 5: Measures of conservation success

Measures of conservation success:
The measurements of conservation impact consist of monitoring biodiversity health and the state of critical threats, to provide feedback for the adaptive management of the site, and for the revision of the conservation strategies when necessary. Also, measuring conservation capability monitors the institutional support for the

implementation of the conservation strategies. The measures of conservation success are sets of monitoring indicators classified in the following manner:

- Biodiversity health: Evaluates the effectiveness of conservation strategies to improve or maintain the viability of the conservation elements (size, condition, and landscape context).

- State of critical threats: Evaluates the effectiveness of conservation strategies to diminish or eliminate critical threats over time.

- Conservation capability: Provides a way to monitor the following factors, key to the success of a site project:

- Project leadership and support: Responsible and experienced personnel, support equipment

- Strategic method: Understanding and application of the Site Conservation Planning methodological framework, an iterative and adaptive method to develop and implement key conservation strategies

- Project financing and sustainability: Initial or short-term financing, sustainable support

Development of the Site Conservation Planning process for the Gulf of Honduras

In the year 2001, with the support of PROARCA/Costas, the basis for the Site Conservation Plan (SCP) for the Gulf of Honduras was formulated. To this effect, a site profile was developed, and jointly with tri-national key actors, including the members of the Tri-National Alliance for the Conservation of the Gulf of Honduras (TRIGOH), three workshops were held to identify conservation elements, stresses, sources of stress, work strategies, and measures of success for the conservation of the site. Thematic maps of the Gulf were also produced, to support the analysis and the formulation of the SCP.

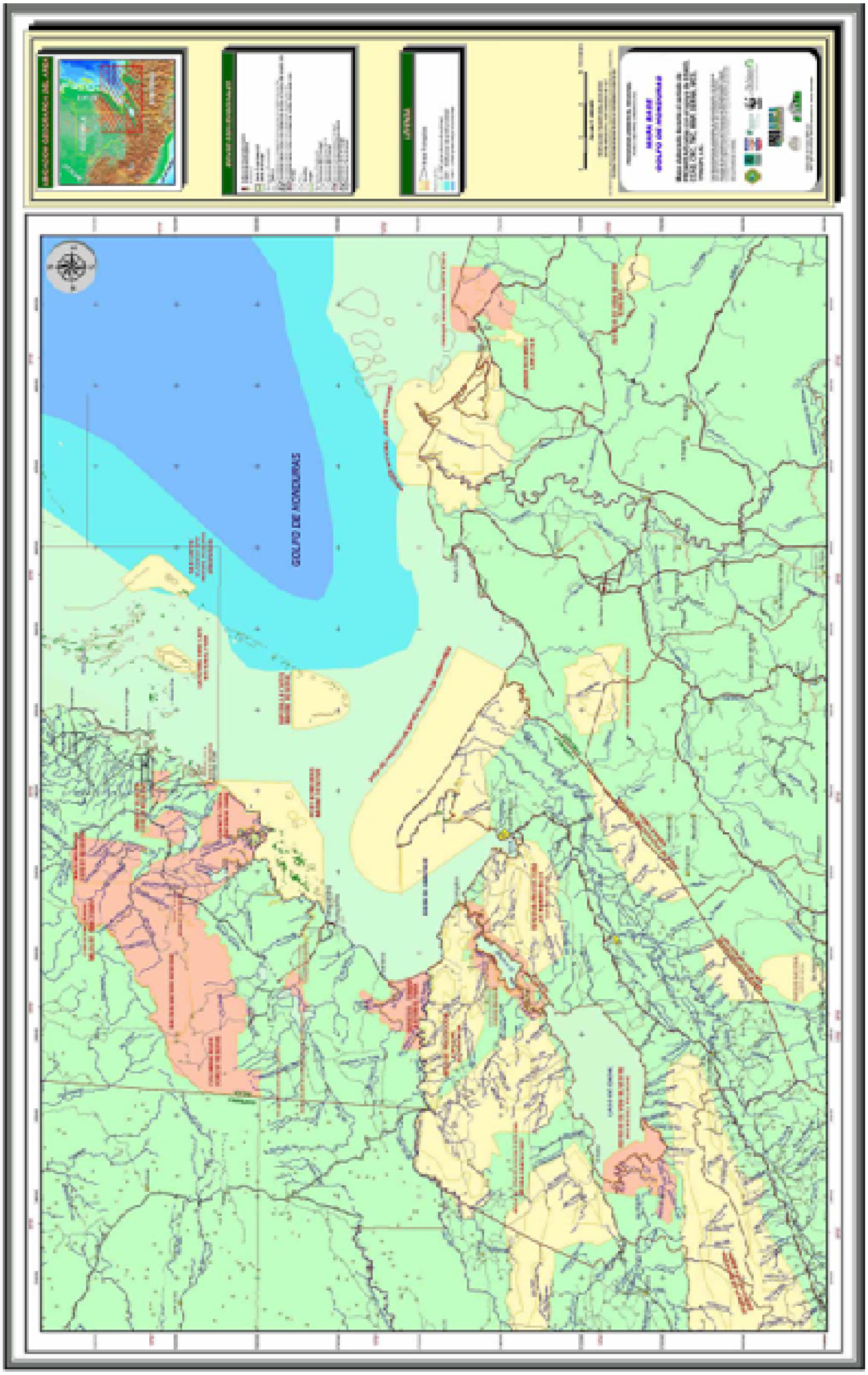
The first workshop was held in Guatemala City, from 2 to 4 May 2001. The objectives were to identify, in a participative manner, the conservation elements and the principal threats to the tri-national area of the Gulf of Honduras, and to define the indicators to monitor those conservation elements and threats. There were 42 participants. The second workshop was held in Guatemala City, from 24 to 26 July 2001. The objectives were to map the threats (stresses and sources of stress) that are degrading the target elements, to identify in a participative way the strategies to conserve the target elements, and to conduct an analysis of actors to involve in the implementation of the strategies. There were 35 participants. The process was finalized with a third workshop, held in Antigua Guatemala on 30 and 31 August 2001. The objectives were to validate and refine the strategies and action plans generated by the analyses in the previous activities, to ensure an effective conservation of the biodiversity of the site. There were 19 participants. Besides all the members of TRIGOH, universities, Ministries of the Environment and Agriculture, municipal governments of the three countries, MBC, PROARCA, and TNC all participated in these workshops.

However, the original process was not completed; the systematization of the information produced in the workshops was lacking.

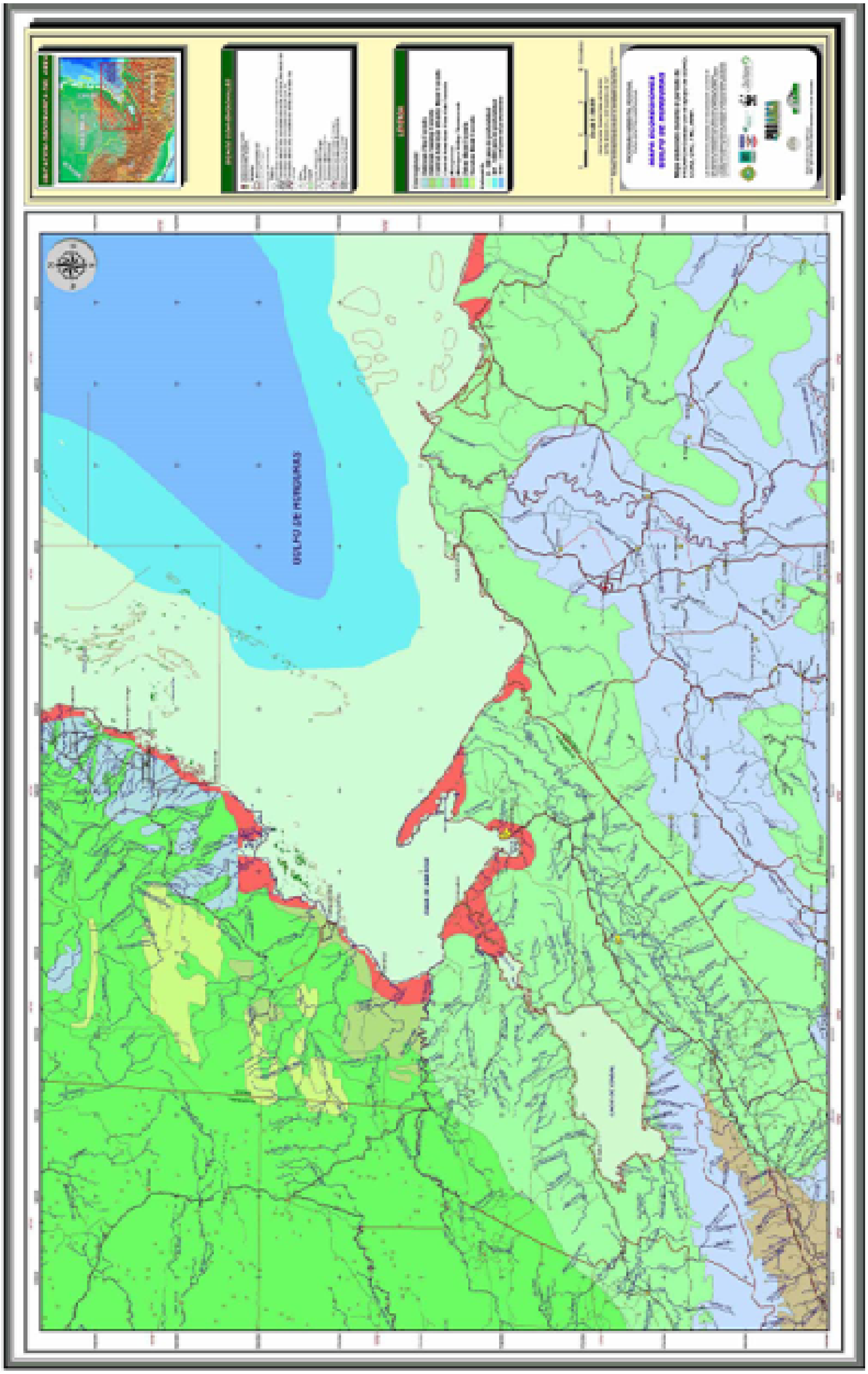
When the new vision of PROARCA/APM was manifested, it became necessary to include some terrestrial regions, in order to complete the information of the "from the watershed to the reef" proposal, and to validate the results with a new workshop. It was held from 4 to 6 December 2003, in Puerto Barrios.

The objectives of the workshop were to validate the strategies and the measures of success. Participants from Guatemala were 3 persons from FUNDARY, 4 persons from FUNDAECO, and 1 representative from Defensores de la Naturaleza; from Belize, 1 representative from TASTE, 1 representative from TIDE, 1 representative from NGC/TDC, 1 representative from Friends Of Nature, and 2 representatives from CISP/Proyecto GOH, for a total of 14 participants.

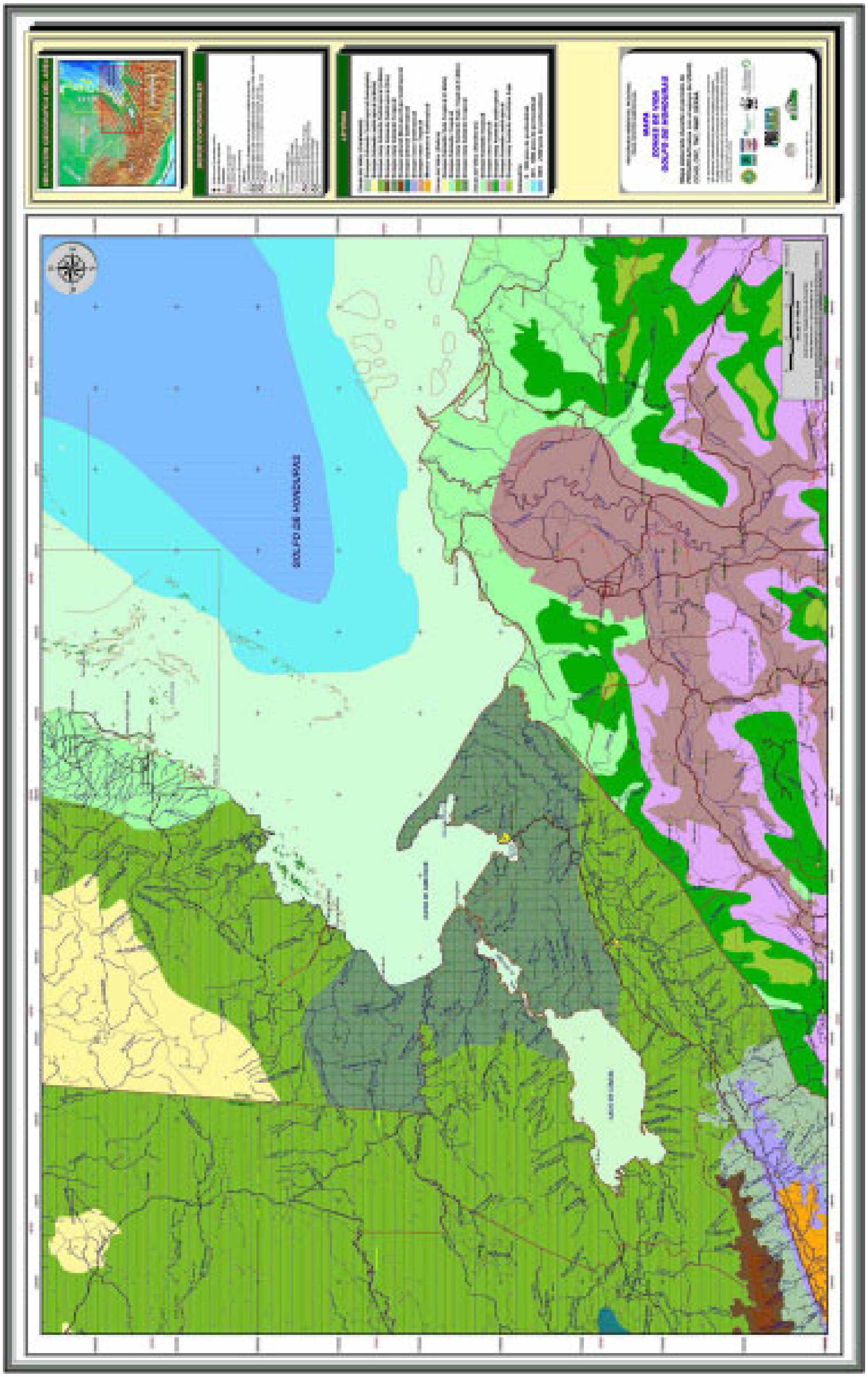
Before the workshop, suggestions from Fundación Fasquelle and PROLANSATE (Honduras), and TIDE and NGC/TDC (Belize) were taken into account, by means of visits to Honduras and Belize.



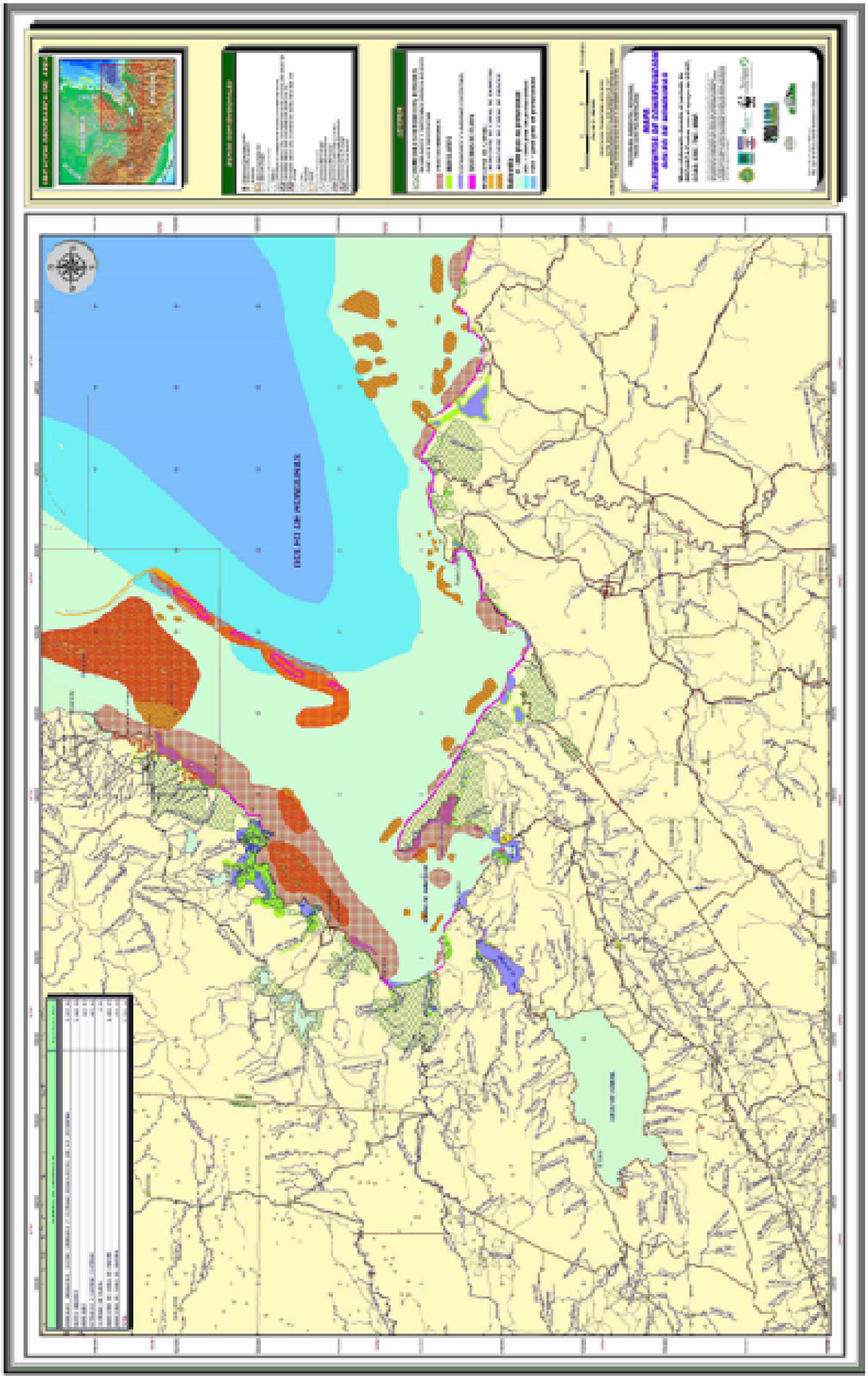
Map 1. Base map of the Gulf of Honduras



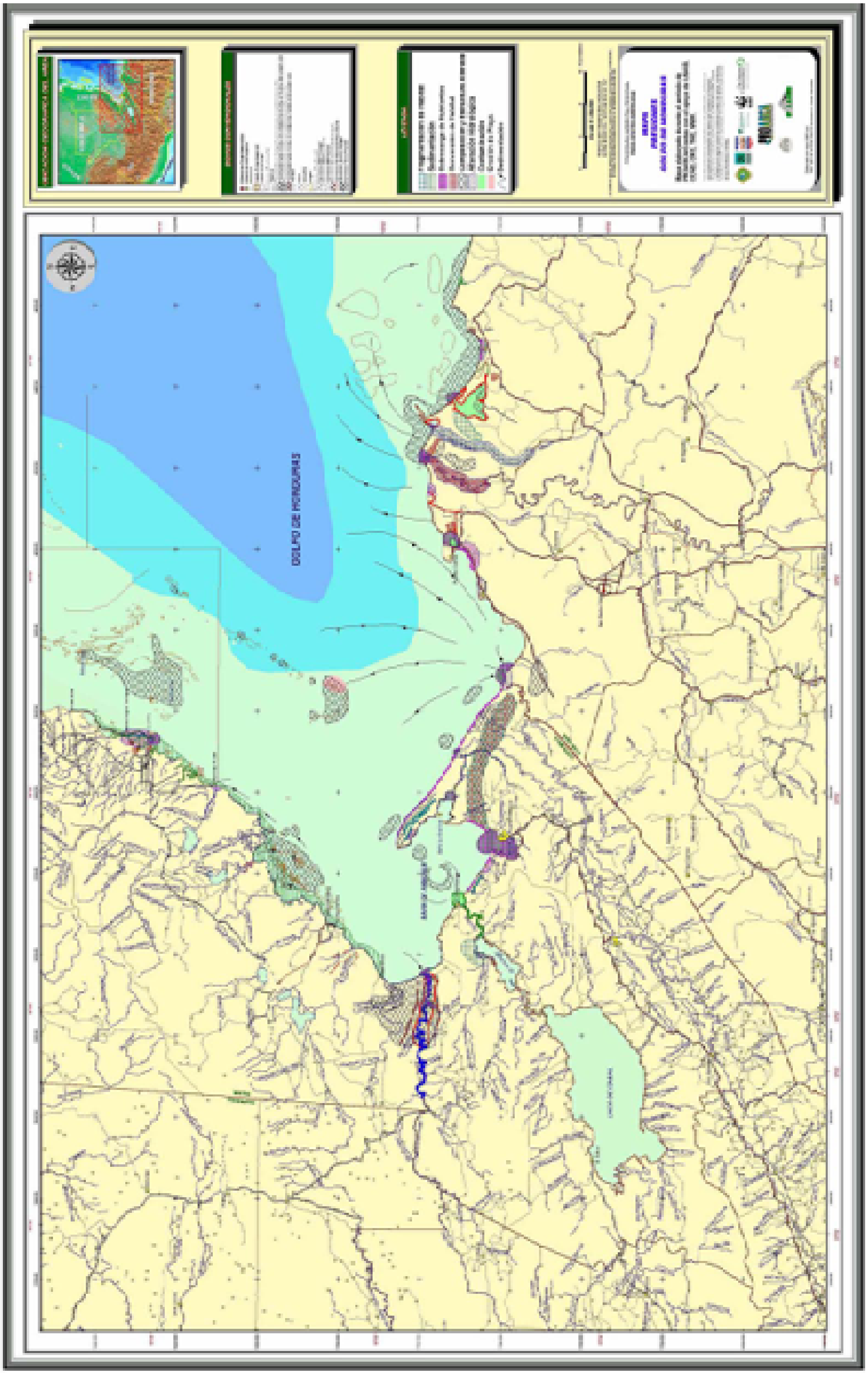
Map 2. Ecoregions



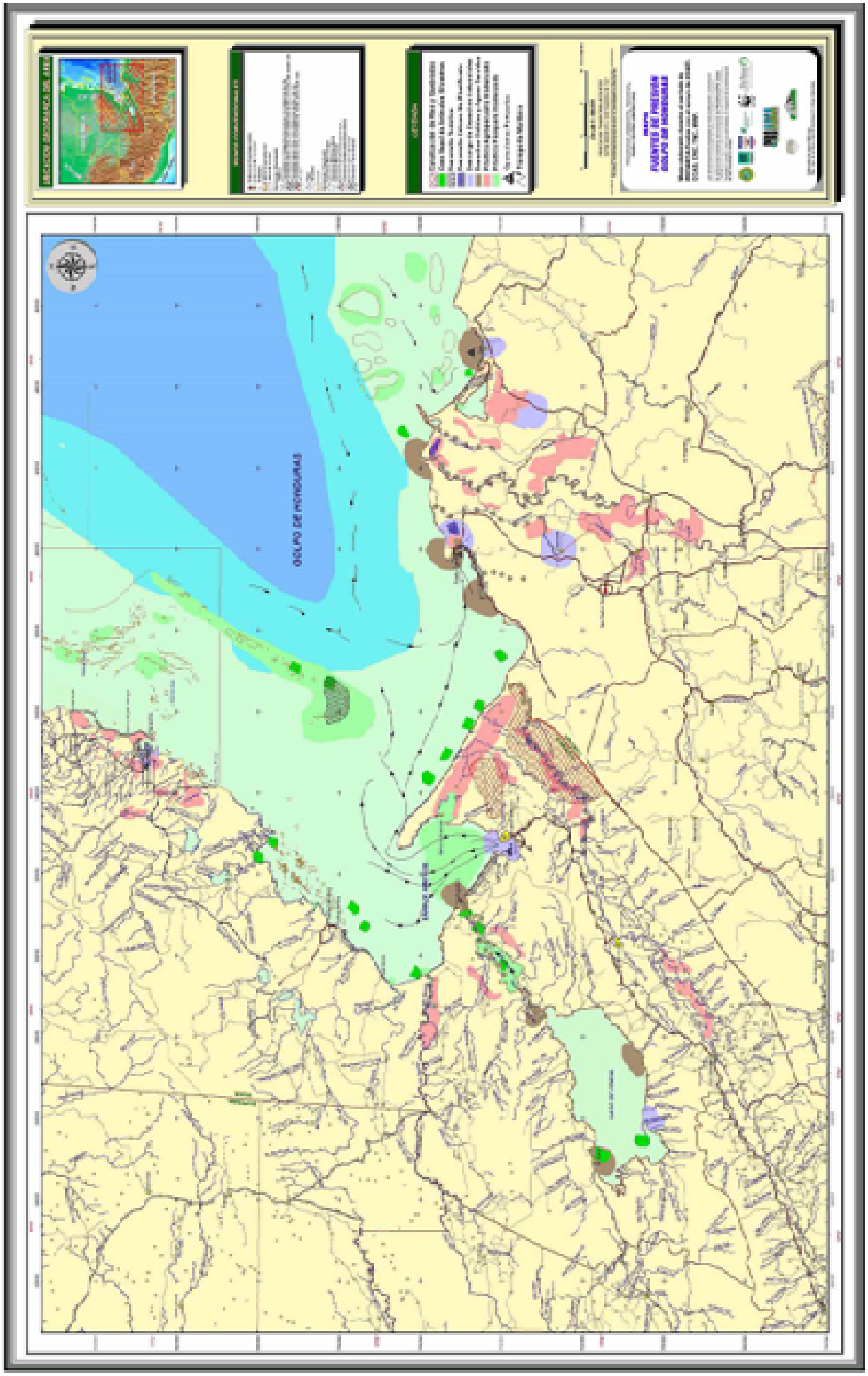
Map 3. Life Zones, according to Holdridge



Map 4. Conservation Elements



Map 5. Stresses



Map 6. Sources of stress

Organizaciones que forman parte del Consorcio de Ejecución de PROARCA/APM

In the Presidential Summit of 1989, the Chiefs of State signed the Central American Agreement for the Protection of the Environment, thus forming the Central American Commission on the Environment and Development (CCAD), as part of the Central American Integration System (SICA). The principles that provide the basis for the objectives of CCAD are:

To value and protect the heritage of the region, which is characterized by a diverse biology and diverse ecosystems. CCAD is called to be the link that establishes collaboration between the countries of the region in jointly seeking the adoption of sustainable development styles and the participation of all entities concerned with development. Meanwhile, it should promote coordinated actions between governmental and international entities to use the natural resources of the area in an optimal and rational way, and in the same manner seek actions destined to control contamination and seek efforts to re-establish the ecologic equilibrium. Another of its objectives is to negotiate the obtaining of regional and international financial resources to fulfill its conservation and development goals.

United States Agency for International Development

Since its founding by President John F. Kennedy in 1961 as an independent federal agency, the US Agency for International Development – USAID – has helped developing countries to provide opportunities to their people and to combat hunger, poverty, sickness, and environmental degradation. The international assistance programs of the United States have a long and distinguished history of achievements attained with half of one percent of the federal budget. Throughout more than 40 years, the programs of USAID have significantly contributed to democratic government, the facilitation of economic growth, natural resource and protected area management, biodiversity conservation, conflict reduction and management, and the provision of humanitarian aid in more than 200 countries in the world.

The Nature Conservancy was established in 1951 as a non-profit organization. Currently, it is the largest private organization dedicated to conservation in the United States. Its mission is:

To preserve the plants, animals, and natural communities that represent the diversity of life in the world, by protecting the lands and waters that these need to survive. Since 1980, the Latin American and Caribbean Division of The Nature Conservancy has worked with associates in 20 countries to protect over 22 million hectares of critical habitats.

The basic goals of The Nature Conservancy are:

- Conserve, with a scientific basis. The organization was created by a group of ecologists; therefore science has always been the basis for its actions.

- Obtain on site results. TNC concentrates its efforts on *in situ* conservation, from the acquisition of lands to marking borders and patrolling protected areas, and training and equipping rangers.

CCAD

USAID
FROM THE AMERICAN PEOPLE

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH