PORT HONDURAS MARINE RESERVE

(Preliminary Draft Management Plan)

PREPARED FOR
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BY
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BACKGROUND INFORMATION

1 INTRODUCTION

1.1 History of Proposed Port Honduras Marine Reserve

Coastal areas are transition zones between the upland terrestrial environment and a marine environment offshore. Coastal areas are normally in constant flux and frequently considered harsh, because of the fluctuations in physical and environmental conditions (salinity, nutrients, tides, etc.) that prevail in these areas. Only species equipped to withstand these conditions can thrive in coastal environments. Certain coastal areas, nonetheless, such as estuaries and lagoons, as those existing in Belize, are very productive in fishery resources. The coastal areas of Belize filter and utilize nutrients from runoffs thus improving water quality. These functions are vital to the health and survival of the offshore coral reefs. Coastal vegetation along with the Barrier Reef retard wind and storm surge thereby protecting, to some extent, development from storm damage.

Throughout the developing world, coastal areas are coming under increased pressure by competing and conflicting activities that negatively impact natural ecosystems. Five proximal threats to marine biological diversity have been described (Nurse, 1993): over-exploitation, physical ecosystem alteration, pollution, introduction of alien species, and global climate change. These threats, however, are essentially symptoms of more fundamental forces that are driving environmental degradation worldwide. Among these major forces are overpopulation, excessive consumption and inequitable distribution of resources.

In an attempt to retard coastal environmental degradation, and to protect and preserve vital coastal ecosystem functions, integrated coastal zone management (ICZM) programs are being developed in many countries, including Belize. ICZM is a process in which a coordinated strategy is developed and implemented for the allocation of environmental, socio-cultural and institutional resources to achieve conservation and sustainable multiple use of the coastal zone (Sorensen, 1993). Normally, within such plan is a system of coastal/marine protected areas to help maintain ecosystem productivity and safeguard essential ecological processes by controlling activities that disrupt them.

In Belize, the Coastal Zone Management Unit (CZMU) of the Fisheries Department assisted by UNDP/Coastal Zone Management Project (CZMP), recently legislated as the Coastal Zone Authority, is preparing an ICZM program for Belize. In meeting the need for marine protected areas, the Marine Protected Areas Working Group drafted a set of guidelines for the preparation

of management plans and zoning schemes to be used in the establishment of marine protected areas. Port Honduras is specifically targeted to test these guideline.

The general location of the proposed Port Honduras Marine Reserve is defined as starting from the coast from the northern bar of the Monkey River, southward to Punta Ycacos Lagoon, Deep River Estuary, Golden Stream, Middle River and Rio Grande, and eastward to include the Snake Cayes. The Port Honduras coastal basin itself, which functions ecologically as a lagoon (Sullivan et al., 1995) is defined within the area from Punta Ycacos to Rio Grande along the coast and includes the three rows of near shore cayes, including the Snake Cayes.

The Port Honduras area is still largely in a pristine condition possibly with the exception of fish stocks and manatee population. The area is unique along the coast of Central America in lagoon system size and the number of and proximity of mangrove islands to the coast. This ecological system includes three related components: coastal and tidal wetlands, the marine lagoons itself, and the mangrove islands with their associated shallow banks. While some of the vegetation on the cayes has been cleared, most of the mangroves are still intact.

Over the past few decades, the Port Honduras area saw only few human settlements. The predominant use had been fishing, including fishing by foreign nationals from neighboring Honduras and Guatemala. Many of the Belizean fishers who work in the Port Honduras area complain of illegal fishing activities by foreign nationals, and attribute the apparent reduction in certain fish stocks to such activities. Recently, the Punta Ycacos Lagoon has been used as a tourist attraction primarily for fly-fishing. New Haven, a natural harbor, is witnessing increased use by sailboats. Also a number of proposals are being prepared for resort development in the area including the Snake Cayes, Frenchman's and others cayes.

Even though the Port Honduras is only sparsely inhabited, about 25% of the mainland area is private property, and another 5% is in lease holdings. A number of cayes are also privately owned or leased. Another third of the land is classified as National Lands. Most of the other lands of Port Honduras are under some form of protection including a forest reserve, a national park and a nature reserve. The Seven Hills Range at the southern end of Port Honduras is utilized by the military as a shooting range.

The uniqueness of the Port Honduras area, ecologically, was first recognized in 1990 from a Critical Habitat Study (BCES, 1990). Actually, this study identified the area from the Bladen Nature Reserve to Port Honduras as the area where a corridor could be established from the Maya Mountains to the sea. This corridor would have great potential for the conservation of biological diversity. Subsequently, the Port Honduras area was the subject of two rapid ecological assessments (REAs) funded under the PACA (Environmental Project for Central America) Project.

Basically, the REAs revealed that Port Honduras serves extremely important ecological functions probably of regional significance. Compared with the water quality beyond the Snake Cayes, the Port Honduras area was found to be quite turbid. This indicates that much of the sediment from runoffs is confined within the coastal basin allowing for appropriate water quality for coral

growth offshore. The area was also found to be rather high in juvenile fish including most of the commercial species.

Thus, to preserve this vital area Port Honduras was designated by the Fisheries Department as a proposed marine reserve. This designation began the formal steps towards the establishment of a marine reserve. Since the Belize Center for Environmental Studies (BCES) is no longer in existence, the Fisheries Department has mandated the Toledo Institute for Development and Environment (TIDE) to prepare a draft management plan for the proposed marine reserve. TIDE is a grass roots non-governmental organization that involves community participation in the planning process.

In February 1998, TIDE invited twenty-four fishers to visit several existing national marine protected areas to witness firsthand management strategies.

In May 1998, Tide staff completed a series of community meetings in Monkey River, Punta Negra and Punta Gorda. An overwhelming majority of those in attendance support the idea of establishing a marine reserve (TIDE Newsletter, Vol. 1, Issue 1, May 1, 1998.)

1.2 Purpose and Scope of Plan

The Port Honduras Management Plan will serve as a working document to provide a framework for the development and refinement of rational management policies in maintaining coastal ecosystem functions and natural resource values, including water quality and nursery habitats of the area. The ultimate aim is the preservation and sustainable use of biological resources. Because of the need for improvement in living standards, it is necessary that the plan accommodate traditional fishing practices of the fringing communities, while facilitating and promoting income-generating activities. The plan also aims to allow for the identification and development of other economic activities that could be compatible with the overall goals of the reserve.

While this management plan is specifically for the Port Honduras coastal basin, it should be adopted in concert with the plans for the adjacent Paynes Creek National Park and the offshore Sapodilla Cayes Marine Reserve.

Section 1 of this plan includes a full bibliography of all existing scientific and socio-economic information on the area as well as the identification of existing gaps. It identifies conservation priorities for the area, nevertheless, the Fisheries Department's technical staff, Toledo Institute for Development and Environment, and the Port Honduras Advisory Committee will play important roles in prioritizing goals and objectives for the proposed protected area.

Section 2 provides general information on the location, accessibility to the area and the availability of maps, charts and images. Section 3 looks at the physical environmental information available whole section 4 looks at the biological data. Section 5 provides cultural and socio-economic uses of the resources.

Section 6 covers constraints and potential management problems while 7 deals with the actual management of the area. Section 8 looks at surveillance and enforcement, 9 at research and monitoring, and sections 10 deals with interpretation, education and community development. Section 11 deal with tourism and recreational development potential. Sections 12 and 13 deals with the administration and finances respectively. The last section 14, looks at plan implementation.

1.3 Legislative Authority

Under the Fisheries Amendment Act of 1983, the Fisheries Department is *ultimately* responsible for the establishment and implementation of marine reserves. Similarly, under the National Parks System Act of 1981, the Forest Department is responsible for the establishment and management of protected areas declared under this act. Since the Port Honduras Marine Reserve (proposed) is contiguous with the Payne Creek National Park it is recommended that both areas have close cooperation within the managing agencies.

Within the last decade, non-governmental organizations (NGO's) have played a major role in protected areas development and management in Belize. Recently, the Forest Department entered into a formal agreement with the Belize Audubon Society for the preparation of management plans for selected protected areas and for institutional management of these areas. The Forest Department has even secured powers of arrest to the Belize Audubon Society Guards in the agreement. This was established through the Special Constabulary Program with the Belize Police Force.

The Fisheries Department is also beginning to forge linkages with NGOs and to take advantage of opportunities and capabilities within the Belizean NGO community. Such partnership appears to be not only useful but also necessary in the wake of downsizing government departments.

The Fisheries Administrator will be responsible for the final approval of the advisory committee and non-governmental organization that will assist with the management of the marine reserve. In this case the Fisheries Department will enter into formal agreement for co-management with the Toledo Institute of Development and Environment.

1.4 The Advisory Committee

General Terms of Reference **(Port Honduras Marine Reserve Advisory Committee)**

The purpose of the committee, which is comprised of representatives of the major stakeholders, is to advise the Fisheries Administrator on the management of the marine reserve through participation in the following activities:

a) Ensure regular revision and review of the management plan.

b) Comment on and recommend legislation and regulations.

c) Maintain an overview of and, where necessary, provide advice on applications for permits relating to the reserve and subdivisions and development on private land adjacent and within the reserve.

d) Report on matters impacting the reserve and dialogue with government enforcement agencies.

e) Assist with enforcement activities.

f) Assist in the development of sustainable financing mechanisms for the reserve.

g) Advise on and, where appropriate, assist with administrative matters, publicity, educational and interpretative programs, and decisions relating to research to be conducted in the reserve.

2. GENERAL INFORMATION

2.1 Location

The proposed Port Honduras Marine Reserve is located in southern Belize near the coast just off Punta Gorda Town between Rio Grande Bar and Monkey River Village (Figure 2.1, Location Map on page 8). It comprises all the coastal wetlands, sea, seabed, and National Lands within the area known as Port Honduras with general boundaries being Rio Grande in the South, Monkey River in the North, the Snake Cayes in the East and the coastal wetlands along the coast.

2.2 Access

The easiest, and probably the safest, access to the proposed Port Honduras Marine Reserve is by boat. The closest access point by road from Dangriga Town or from further North terminates at northern side of Monkey River Bar from where boat access is easy. Boats can also be taken from Punta Gorda Town, the southern terminus of the Southern Highway.

A couple footpath and logging trials exist around mile 50-60 along the Southern Highway that leads eventually into Port Honduras. However, these are only passable during the dry season. Also, river trips taken from Swasey, Bladen, Deep River, Golden Stream, or Rio Grande along the Southern Highway can lead directly into Port Honduras.

2.3 Land and Sea Tenure

The coastal area of Belize is predominantly in the hands of private owners. A 1939 Law reserved one-chain (20m) of water frontage as public land. However, much of the land along the coast was privately titled before the law was passed. The land area of the watersheds bordering Port Honduras (Figure 2.2 on page 9) is estimated to be approximately 270 square kilometers. About 25% of this area is designated as private property, and more than 6% is claimed in lease holdings. About 50% of the area is in protected status and another 13% as National Lands. More than 6% is of unknown tenure status.

Most of the 138 cayes within the Port Honduras are National Lands. The marine continental shelf is public property.

Table 2.1

DISTRIBUTION OF TENURE STATUS IN THE STUDY AREA

TENURE	ACRES	Km2	%
Lease Lands	9,331.20	14,58	5.39
Property	43,624.34	68.16	25.19
National Lands	22,622	35.35	13.05

Protected Land	86,857.4	135.7	50.14
Unknown	10,801.53	16.86	6.23

The protected lands within the land tenure study area are the Deep River Forest Reserve and the Payne Creek National Park. Along with the proposed Port Honduras Marine Reserve, these two protected areas and the Bladen Nature Reserve are the basis upon which the concept of a corridor of protected areas from the Maya Mountain Divide down to the sea conceptualize.

2.4 Maps, Photographic and Satellite Imagery Coverage

Maps

The 1:50,000 map series printed in 1973 covering the entire country have been digitized and used to produce geo-referenced maps of Port Honduras. This is available in hard copy and digital format at the Land Information Center (LIC).

Aerial Photography and Satellite Imagery

Presently TIDE is trying to acquire a copy of the digital imagery of the Port Honduras, Paynes Creek and Sapodilla Cayes which the defunct BCES has in its possession. The images are Landsat ™ taken from February 11 to May 18, 1995 on bands one through seven (1 - 7). This data is on CD_ROM and can be mounted on any PC, Macintosh or Unix Platform System.

2.5 Previous Research

A number of studies have been conducted in and around the Port Honduras area since the 1960's (Stoddart, 1960; High, 1966; Wetland & Pukey 1971; Perkins, 1983; Zisman, 1992). However, studies focusing directly on Port Honduras only began in 1990 with the Critical Habitat Survey. This study essentially highlighted the existence of an area of unique bio-geographical occurrence in Southern Belize. Actually, this survey promoted the affiliates to PACA to choose Toledo District as a project site.

Under the PACA Project the Port Honduras area was the subject of two “rapid ecological assessments” (REAs) lead by The Nature Conservancy’s (TNC) Florida and Caribbean Marine and Conservation Science Center and included the Government of Belize, NGOs, and Community Based Organizations (CBOs) participation. The first REA was conducted in May 1993, and focused on the mangrove communities and tidal wetlands of the areas around the Punta Ycacos (or Still Water) Lagoon which drains into Port Honduras but is actually within the Paynes Creek National Park. This work was conducted by ground truthing a SPOT Satellite imagery of the area.

In 1994, a second REA was conducted within the Port Honduras itself but this time with a wider focus. Conducted by basically the same team, this REA addressed, to varying extent, the areas of oceanography and coastal hydrology, fisheries, benthic community ecology, and some further mangrove studies. The assessment of Honduras benthos was assisted by Coral Caye Conservation (CCC) who lead the expedition for the Snake Caye area. The results of both REAs, including the assessment of the Snake Cayes area, are documented in the report "Ecology, Oceanography, and Geography of Port Honduras, Belize - A proposed marine protected area" (Sullivan et al. 1996). The description of the environment of Port Honduras in this plan is essentially a summary of the results of the two REAs.

Other research conducted in the Port Honduras include: a number of papers drafted by William D. Heyman of TNC on seagrass and mangrove productivity studies (Heyman, 1996); an assessment of climate and hydrology of Port Honduras (Heyman and Kjerfve, 1996), and a survey of the perceptions of fishers who use Port Honduras (Heyman and Hyatt, 1996). Wil Maheia of TIDE assessed the needs and desires of residents of Toledo for eco-tourism developed (Maheia, 1995); and Sharon Franklin from TIDE interpreted the land tenure situation of Port Honduras (Franklin, 1995). Dr. Heather Mckillop has done more than a decade worth of research on the archeology of Port Honduras.

William D. Heyman produced a dissertation as partial fulfillment of the requirements for the Degree of Doctor of Philosophy in the Marine Science Program at the University of South Carolina. The document is entitled "Integrated Coastal Zone Management and Sustainable Development for Tropical Estuarine Ecosystems: A case study of Port Honduras, Belize."

3 PHYSICAL ENVIRONMENTAL INFORMATION

Environmental data exists from previous research conducted in the area. As the data is compiled it will be incorporated into this document.

3.1 Bathymetry and Turbidity

Port Honduras can be characterized as a relatively deep and turbid embayment (Sullivan, et al., 1996). There are a series of terraces or drop-offs that proceed seaward to a channel 25 - 30 meters in depth offshore running between Port Honduras and the southern extent of the barrier reef at Sapodilla Cayes. Two parallel lines of shallow banks, 1 - 2 meters deep, and mangrove islands occur in mid and outer Port Honduras, breaking the deep areas of the embayment into restricted basins. The Snake Cayes are in the deep offshore channel outside of Port Honduras proper, and are sitting on as well as surrounded by a series of shallow banks.

Most of the area of Port Honduras is deeper than 5 meters (Figure 3.1 on page 12). These deeper basins are somewhat protected from vertical mixing by shallow banks, and retain the inertia of the tropical surface water circulated in from the Gulf of Honduras. It is this volume of oceanic water that maintains oceanic salinities and the marine nature of the embayment.

Turbidity, measured using standard 20cm secchi disk, (Sullivan, et al., 1996) indicated that most of Port Honduras is extremely turbid (Figure 3.2 on page 13). In general, turbidity was highest close to shore. Turbidity decreased over deeper areas of the bay and in mangrove enclosed lagoons.

3.2 Tides, Water Movement & Vertical Structure via Temperature and Salinity Profiles

The vertical structuring of water masses in the lagoon is critical in understanding the mechanisms influencing salinity. Vertical temperature and salinity profiles of Port Honduras were obtained using a SEACAT CTD (Conductivity-Temperature-Depth device) (Sullivan, et al., 1996). The CTD records temperature, salinity, turbidity, and depths as it is lowered in the water column. The combination of temperature and salinity data allows oceanographers to track water masses.

The vertical profile of the Deep River Transect is illustrated in Figure 3.3 on page 14. This can be seen in more detail by examining the casts from individual stations. A saltwater wedge appears as a dense water mass under a less saline surface layer. This layering between water masses can be very abrupt in places, especially near river mouths. Figure 3.4 on page 15 shows the location of five different transect that illustrate the vertical structure of Port Honduras contrasted to the area offshore Monkey River.

Figure 3.5 on page 17 illustrates the transition in water mass characteristics from upper Deep River to Port Honduras; CTD temperature salinity profiles from Station UR1-1 located in a creek 2.1 meters deep and 8.8 kilometers from the river mouth has a well mixed uniform water column with a salinity between 8 and 9 ppt and temperatures under 28C. Moving down the river, a sharp halocline occurs about 1.3 meters in depth, regardless of bottom depth, with brackish water on the surface and saline water (30ppt) at the bottom; temperature changes as well, being slightly cooler at the surface and warmer at the bottom. Station UR1-3, located in the main channel 3.7 meters deep and 7.1 kn. from the river mouth, illustrates the salt wedge.

Monkey River provides a contrasting estuarine system. This river has a much smaller associated coastal wetland area and near-freshwater flow at the river mouth than Deep River. The CTD temperature and salinity profiles from Station MR2-1 located at the mouth of the Monkey River inside the sand bar at 1.2-meter depth, shows a surface freshwater layer of 2ppt. Bottom salinities are 6ppt thus suggesting only slight mixing. Station MR2-2 was located 0.52km from the river mouth, in 7.6m of water; at this station, only a thin brackish water lens occurs at the surface. The bulk of the freshwater plume flow south along the shore. Station MR2-4 located offshore, 1.3km from the river mouth, and Station MR2-5 located offshore, 1.6km from the river mouth, illustrate the uniform well-mixed water column of the coastal shelf.

3.3 Salinity, pH and Water Temperature

Surface temperature readings were taken along six transects within Port Honduras and three transect near Monkey River (Sullivan, et al., 1996). A similar number of salinity measurements were taken along the same transects. Temperature in Port Honduras deep-water habitats is conservative and shows little variability. The largest surface temperature change is from inside of the river mouths (Figure 3.6 on page 18). Temperatures tend to be slightly cooler (28 - 29.5 degree Celsius) inside the river compared to outside. The lagoon proper likely experienced some solar heating.

Salinity in Port Honduras exhibited a pattern similar to temperature (Figure 3.7 on page 19). Within the rivers and extensive coastal wetlands, salinities were highly variable, but estuarine. In the lagoon proper, salinities were over 20ppt, with most areas over 30ppt.

3.4 Geology, Substrate Types and Hydrology

Coastal ecosystems persist throughout the geological record, but the physical location of these systems migrates with changes in the land-sea margin and changes in sea level. Understanding the coastal geology of southern Belize is critical to understanding the history and development leading to the present configuration of coastal ecosystems that occur today as well as change likely to occur in the future with changes in sea level. The geological processes influencing southern Belize can be understood by breaking the continental margin and shelf into three components: the coastal margin, the near-coast shelf and channels, and the offshore reef tract. The continental margin of Belize forms one of the sides of a deep oceanic basin that makes up the northwest Caribbean region of the Tropical Western Atlantic. This basin is surrounded to the

East by the Cayman Ridge and Trough System, the Nicaraguan Rise to the southeast, and by Cuba to the north.

The geology of coastal Belize is complex, and reveals a history of rock strata formed from terrestrial and marine sediments altered by tectonics. Early Paleozoic (meaning "old life;" geological era from 600 - 270 million years ago) basement rocks are believed to underlie northern Guatemala and Belize. Early in the Mesozoic ("middle life"; 220 - 135 million years ago) the organic phase occurred and is characterized by block faulting accompanied by deposition of continental red beds.

In the Cenozoic era ("recent life"; 135 million years to the present), deltaic detritus and carbonates accumulated in restricted marine embayments of eastern Guatemala and southern Belize. The streams of southern Belize drain the Maya Mountains, but they flow across a relatively flat and narrow coastal plain into swamps and small lagoons before entering the sea. The coastal and tidal wetlands serve as an efficient sediment trap, thus, large quantities of terrigenous material probably do not reach the Port Honduras lagoon. The sedimentation regime may have changed little sine the early Cretaceous times when development of the platform began (Dillon and Vedder, 1973).

The proposed stages of the development of the northwest Caribbean, particularly the Gulf of Honduras area of southern Belize, involve two separate sets of plate movements. The proposed model of coastal zone geology is based on a series of rifting and subsidence events, which created Port Honduras and offshore channels that serve as a sink for sediment transported down river from the Maya Mountains and coastal plains. The corals accrete carbonate skeletons that can match sea level rise for a time; therefore, the patterns of coral reefs off the coast of Belize today are products of depth variability and zonation.

3. 5 Climate

Belize receives significant rainfall due to the orographic lifting of air mass as the Easterly Trade Winds converge with continental air masses and thermal convection. Rainfall is further enhanced by tropical storms since Belize is within the hurricane belt (Portig 1976). There is significant variation in precipitation in southern Belize. The wettest months of the year are from June - September with rainfall averaging 400 - 700 millimeters per month. The driest months are from February - April with rainfall averaging 40 - 70 millimeters per month (Heyman 1996).

Temperature variation is minimal due to the strong maritime influence (Nicuwolt 1977). Mean temperatures are degrees centigrade. Temperature during the cooler months, November - March, average 24 degrees centigrade and 28.7 degrees centigrade during the warmer months, July - September.

4 BIOLOGICAL INFORMATION

4.1 Terrestrial

4.1.1 Flora

The dominant vegetation type in the Port Honduras area is mangrove. These salt tolerant species are found on the tidal lands bordering the coastal lagoons and estuaries, as well as on the nearshore cayes of Port Honduras. Littoral vegetation is found only on the beach stretch from Monkey River to Punta Ycacos and on a few of the cayes. Small patches of littoral forest exist between Deep River and Golden Stream.

Mangroves productivity studies were conducted near the mouths of Deep River and Monkey River over a one-year period (Heyman, 1996). The study revealed that the mangrove stands of Deep River are larger, according to diameter at breast height measurement, and taller. Mangrove productivity was measured by litter fall on the Deep River sites. These measurements are comparable with the average estimated measurements for riverine mangroves (Heyman, 1996).

Characterization studies of the mangrove of Port Honduras cayes have not been undertaken as has been done for the Punta Ycacos area. However, it is known that many of the cayes of Port Honduras are overwash mangrove caye without consolidated foundations or upland communities. Cayes with some upland communities are shown in figure 4.1 on page 22. Given difference in salinity regime of Port Honduras from that of Punta Ycacos it is reasonable to assume that the mangrove communities of Port Honduras differ from those of Punta Ycacos.

4.1.2 Fauna

The terrestrial fauna of Port Honduras has not been formally assessed and should be subjected to scientific investigation as early as possible. Seventeen (17) species of crustacean from 11 genera and 7 families of the Order Decapoda, were sampled and identified in the Punta Ycacos mangrove community characterization study. Some of these species are certain to inhabit in the Port Honduras cayes, however, some major differences are expected due to differences in water quality of two adjoining areas.

While no formal assessment was conducted for mammals or other large animals that inhabit the Port Honduras area, manatees are frequently encountered. More than 30 carcasses have been found and 11 butchering sites identified in the Port Honduras area.

A number of bird rookeries, including pelican, frigate bird, cormorants, and anhingahs are noted in the area. Some of these cayes seem to always have nesting frigates, herons, pelican, and brown boobies.

4.2 Marine

4.2.1 Marine Habitats

Marine habitat types found in Port Honduras are sea grass communities, soft bottom communities, and hard bottom communities as shown in Figure 4.2 on page 23 (Sullivan, et al., 1996; Heyman, 1996). Throughout Port Honduras, basins or areas adjacent to low-energy shorelines (often mangrove dominated) with high turbidity are bare clay bottom. Grey clay bottom areas were found to be either homogeneous with flat, featureless topography or had bioturbation areas with mounding infauna.

Sea grass communities are found in areas where the water is not too turbid and photosynthesis is not impeded (Figure 4.3 on page 24). Both the manatee grass (*Syringonium filiforme*) adapted to soft bottom sediment, and the turtle grass (*Thalassia testudinum*) that colonize more stable sediment are found in Port Honduras. The mean standing stock biomass in seagrass beds for the entire Port Honduras as measured via belt quadrants was estimated to be 691.7g dw/m2 +/- 345 (Sullivan, et al., 1996). The area with most standing stock biomass was the mouth of Deep River with a value of 1,392.2g dw/m2 +/- 29.9. The rest of the localities in Port Honduras had values that range from 335 to 804.6g dw/m2. These values are high compared to other areas of the Caribbean. Heyman (1996) estimates mean seagrass productivity value (estimated by leaf mark technique) for Port Honduras to be 2.4g dw/m2/day as compared to 0.97g dw/m2 for Florida Bay.

Reef and hard bottom communities are found around the Snake Cayes area and outer banks associated with the cayes where the water quality is more conducive - salinity, turbidity, and nutrients levels - to coral reef development. However, corals that are tolerant to some levels of sedimentation and freshwater influence such as *Siderastrea radians* and *Oculina diffusa* are found in the flow influence zone of Deep River.

4.2.2 Fish and Fisheries

About seventy (70) fish species were caught in the coastal zone of Port Honduras (Sullivan, et al., 1996). Of these, fifty-nine (59) were identified to the species level and eight more to the genus. In addition, several specimen were identified just to the family level. In total, 32 families were identified. The fish species composition is similar to those reported in other mangrove areas of Cuba (Valdes-Munoz et al., 1990), but higher than those recorded in the seagrass beds of Cancun, Qunintana Roo (Alvarez-Guillen et al., 1986).

Of the more than 70 fish species caught with trawl and channel nets, almost 40 species had commercial value. These fish belonged to mostly the snapper (*Lutjanidae*), grunt (*Haemulidae*), parrotfish (*Scaridae*), and mojarra (*Gerreidae*) families. The rest are small or non-palatable species that are usually common in seagrass habitats. These are anchovies (*Engraulidae*), pipefishes (*Synhnathidae*), filefishes (*Sciaenidae*), small wrasses (*Labridae*), gobies (*Gobiidae*), and puffers (*Tetraodontidae*).

Table 4.1 on pages 27 & 28 shows abundance and diversity as well as the physical conditions (salinity, visibility, depth, and bottom type) of the trawl sampling sites. A total number of 571 individuals belonging to 58 species were caught with the otter trawl. Fish biomass, number of fish per tow, and diversity, varied greatly in the Port Honduras region. Fish biomass per trawl ranged from 1 fish less than 1g (at stations DR1-1- and PY2-12) through 56 individuals and 1443.6g (at Stations UPY1-1). Fish density, biomass, and species number were notably higher in shallow waters and in dense seagrass than in other bottom types located in deeper waters.

Species composition of downstream channel samples at Monkey River (Stations MR2-1 with 0 ppt salinity) shows that a larger amount of fish move downstream at nighttime (net placed from18:00h through 07:00h) than during daytime (net placed from o6:00 through different times in the afternoon). Most of the fishes were striped anchovy (*Anchoa hepsetus*) which is a typical euryhaline fish. As schooling cluepeid fish, these anchovy form large schools that move out the sheltered shores at night to feed on zooplankton. The rest of the fish captured by the channel net belong to the euryhaline families such as croakers (*Sciaenidae*), mojarras (*Gerreidae*), ladyfishes (*Elopidae*), basses (*Percicgthydae*), and gobies (*Gobidae*).

4.2.3 Zooplankton

Figure 4.4 on page 29 shows the distribution of plankton in the study are (Sullivan, et. al., 1996). Plankton samples were sorted; samples were divided into two general taxa groups: fish larvae and early juveniles, and other taxa, which consisted primarily of crustaceans (shrimp, crabs, and copepods). Most of the commercial species of finfish and shellfish in Belize were represented in the plankton tow. The circulation patterns and hydrographic features of the water mass will impact the type of plankton community as well as the distribution of fish larvae to potential recruitment sites.

The results from plankton and otter trawl data show that Port Honduras is an important fish nursery ground, and provides habitat for many species inhabiting seagrass-mangrove-coral reef complexes (Sullivan, et al., 1996). Fish density and biomass are similar to those reported on seagrass beds and mangrove areas by Garcia-Artega et al. (1990) and Valdes-Munoz et al. (1990) in the southwest region of the Cuba shelf, and higher than those recorded by Claro and Garcia-Artega (1993) in the fish assemblages associated with mangroves in the Archipelago Sabana-Camaguey, located on the north-central coast of Cuba. These characteristics supported by Port Honduras' habitats - sheltered areas, abundant seagrass beds, and mangrove cayes provide food and refuge for small fish. The high turbidity prevailing in this area may also favor juvenile fish survival, as visibility may reduce predator ability to catch their prey.

Table 4.1 Data from otter trawl fish sampling station at Port Honduras. (H: Shannon-Weaver index).

Station	No. Fish	No. Of species	Species diversity H'	Fish biomass (G)	Salinity (%)	Vertical visibility (m)	Depth (m)	Bottom type
DR1-1	8	3	0.90	13.3	17	1.2	2.0	Sandy shoal
DR1-2	58	9	1.61	631.7	20	1.2	1.2	Sandy shoal
DR1-4	9	2	0.32	64.6	30	1.5	2.5	Seagrass sparse
DR1-7	7	3	0.69	305.5	34	2.8	4.5	Grey clay-homogeneous
DR1-15	11	6	1.67	211.5	35	3.8	7.5	Grey clay bioturbation
DR2-1	6	6	1.63	1.4	23	0.8	0.8	Sea grass dense
DR2-3	3	1	0.00	1.0	25	1.0	1.9	Sandmud biotrubation
DR2-10	1	1	0.00	3.4	32	2.8	3.5	Sandy shoal
DR3-1	2	2	0.69	21.5	28	1.5	2.0	Muddy homogeneous
DR3-2	13	4	0.79	2.8	28	4.0	5.0	Seagrass sparse
DR3-6	14	8	1.90	393.9	30	4.8	8.0	Mud bioturbation
DR3-8	5	4	1.35	128.0	29	5.5	8.5	Mud-bioturbation
MR1-1	11	7	1.79	47.9	34	1.3	1.3	Seagrass sparse
MR1-3	19	2	0.57	0.5	34	2.4	6.2	Matrix hard bottom
MR1-5	23	4	0.94	704.2		2.2	2.6	Seagrass-sparse
MR2-1	3	3	1.09	2.7	0	0.4	1.4	Sandy shoal riverbed
MR2-2	12	7	1.76	146.5	24	1.3	6.1	Sandy shoal river bed
MR2-3	2	1	0.00	47.0	34	1.8	10.6	Mud bioturbation
MR3-8	2	2	0.69	1.4	32	0.8	0.8	Seagrass-sparse
PY1-1	30	14	2.37	170.8	33	1.5	1.5	Seagrass-dense

PY1-2	16	3	0.82	77.7	30	3.3	3.5	Mud-bioturbation
PY1-6	5	4	1.33	8.9	32	2.8	7.3	Mud-bioturbation
PY1-7	34	7	1.21	183.5	31	4.0	6.8	Mud-bioturbation
PY1-10	18	8	1.95	483.1	32	3.8	6.5	Grey clay-homogeneous
PY1-15	1	1	0.00	0.0	30	4.0	5.0	Mud-bioturbation
PY2-1	18	9	2.06	149.0	36	1.7	1.1	Seagrass=dense
PY2-2	2	2	0.69	0.7	37	2.3	4.1	Mud-homogeneous
PY2-4	2	2	0.69	0.1	36	2.3	5.0	Halophila-sparse
PY2-6	2	2	0.69	0.4	37	3.0	5.5	Mud-bioturbation
PY2-7	6	2	0.69	1.4	36	3.2	8.4	Mud-bioturbation
PY2-12	1	1	0.00	0.5	36	3.8	8.3	Mud-bioturbation
PY2-19	38	6	1.03	22.1	35	3.5	3.5	Seagrass-sparse
PY2-20	26	8	0.74	316.0	28	1.1	1.1	Seagrass-sparse
PY3-1	98	14	2.16	567.5	32	1.3	1.3	Seagrass-dense
PY3-2	9	4	1.21	285.7	29	2.5	7.3	Grey clay-bioturbation
UPY1-1	56	13	2.11	1443.6	10	2.0	3.0	Seagrass dense
Total	571	58		6439.7				

5 CULTURAL AND SOCIO-ECONOMIC INFORMATION/ EXISTING USES

5. 1 Archeology

The Port Honduras area has been the subject archeological investigation for more than ten years by Dr. Heather Mckillop. Several archeological sites have been identified and reported in her numerous publications. These include a trading post at Wild Cane Caye, settlements at Frenchman's Caye, salt production ponds at Stingray Lagoon of Punta Ycacos, and under-water sites of Green Vine Snake Caye and Pork-and-Doughboy Point. Currently, these sites are not subjected to much visitation.

5.2 Fishing

Residents of Monkey River, Punta Negra, Punta Gorda and nearby communities, and the Port Honduras cayes use the Port Honduras area for small-scale commercial fisheries, largely for lobster and finfish (Figure 5.1 on page 30). According to Heyman & Hyatt (1996) the most productive fishery in economic terms is for lobster, (caught with nets, traps and by diving) generating an estimated 50,000 pounds (BZ$900,000) per years. These lobsters are caught mainly on the deep-water banks associated with Snake Cayes, but are also captured within Port Honduras. Local residents in Punta Negra and Monkey River do the same when water clarity allows. Approximately 97% of surveyed local fishers believe that populations are declining and blame over fishing, lobster nets, out of season fishing, and illegal aliens fishing as causes for the apparent decline (Heyman & Hyatt, 1996).

Lane snappers are the most abundant fish caught in Port Honduras. Nearly 95,000 pounds are landed annually, largely with hand lines. Lane snapper is the most important local fish food. According to fishermen survey, an estimated 150,000 pounds of mackerel and jack, caught largely with gill nets, are harvested annually from Port Honduras (Heyman & Hyatt, 1996). Since these fish only fetch about $1.70/lb in local markets and shipping costs to Belize City for low-value, large-volume products is high, most of this product is sold illegally in higher valued markets in Guatemala and Honduras as salted fish. This is particularly prevalent during the Lent season when high demand causes the price to triple.

There is also a significant catch of barracuda, snook and jewfish from Port Honduras. Fishers seem to believe that snook have been drastically depleted by gill nets near river mouths and along the coast (Heyman & Hyatt, 1996). Although jewfish are still relatively abundant, their mean size at harvest has fallen sharply in recent years. These fish reach local markets but are also shipped to Belize and often exported illegally depending on quantity and harvest times.

Conch are still targeted by local fishers but catches have declined to a small fraction of their former abundance. Local fishers again site illegal aliens conch harvesting (often out of season and undersized) in Belizean territorial waters.

Several internationally threatened or endangered species are harvested commercially within Port Honduras. Manatee and marine sea turtles are routinely harvested. These species are listed as endangered and serve as an important international symbols for conservation and are tourist attractions.

The over fishing and illegal fishing by foreign nationals may not be surprising given the relative richness of the fisheries resources in Southern Belize compared to those in coastal Guatemala and Honduras. Also, southern Belize has only about 4,500 coastal inhabitants and 125 fishers whereas the Atlantic Coast of Guatemala alone has 130,000 inhabitants and 5,000 coastal fishers.

However, in spite of recent signs of fisheries decline, intact habitats in Port Honduras can continue to support regionally important fisheries resources but management is critical. Port Honduras represents the core of an intact corridor of terrestrial and marine habitats. Because of its role in linking uplands with the sea via rivers, estuaries and coastal lagoons, the area is critical for the reproduction of a great diversity and abundance of commercially important resources. The large mangrove area on the coast, significant seagrass beds, large areas of substrate and reef environments all contribute to the value of Port Honduras as critical habitat for fisheries productivity and diversity.

Clearly, Port Honduras would require active management and enforcement, so as to efficiently gather the benefits of this valuable resource. This would need to include promoting and protecting usage rights of local fishers, better enforcement of Fisheries Laws, and the development of legal fisheries markets to Guatemala and Honduras. The promotion of high value sport fishing and marine related tourism within the marine reserve can also contribute tangible benefits to Belize and the region.

5.3 Tourism

5.3.1 Brief Overview of the Tourism Industry in Belize

The growth of Belize's tourism industry has been phenomenal with tourist arrival increasing from 25,688 in 1981 to 126,000 in 1996 (BTB Statistics). Tourism is now considered the second largest industry in terms of foreign exchange earnings, but is regarded as a preferred alternative form of development to sustain Belize's rich ecological and cultural base. It is Government policy, as stated in Belize's Development Plan for 1994 - 1998, to further expand and promote Belizean style eco-cultural tourism in order to maximize tourism's economic contribution to Belize.

Tourism development in Belize has been spatially biased with primary tourist routes and destination focussed in the environment of southern Ambergris Caye and western Cayo District. Toledo is not traditionally considered a tourist node in Belize and in 1995 only approximately 3,735 tourists visited Toledo (about 3 % of total tourist (BTB).

The current development trend shows sign of dramatic change over the next few years primarily due to improved access to Toledo through the rehabilitation and paving of the Southern

Highway. In addition, there is a growing interest in cultural tourism worldwide. Belize is establishing itself as a leader in ecotourism focussing on the rainforest and reef. Belize's heightened marketing profile in Europe is likely to increase visitation, average length of stay and provide for an increase in multi-destinations within the country. These factors combined suggest new opportunities but added pressure for the Toledo District. The challenge is to balance recreation and tourism in Toledo with the ecological and cultural integrity of the area.

5.3.2 Marketing Profile to Southern Belize

The main markets to southern Belize are reflective of the country with USA, Canada, and Germany as the top three countries of origin as shown below on Table 5.1.

Table 5.1: Country of Origin of visitors to Southern Belize

Country of origin	% of visitors
U.S.A.	50.5
Canada	20.7
Germany	15.3
United Kingdom	5.4
Other Continental Europe	5.4
Belize (domestic)	1.8
Other	0.9

n= 111(Source: TIDE 1996)

A survey of visitors in 1996 (TIDE) showed that southern Belize appealed to a range of different age groups with a fairly even mix of visitors in their twenties, thirties, and forties almost one fifth of the visitors with the 50's and 60's age group (18% total). Annual household income characteristics indicate a significant number of visitors fall with the $61,000 to $150,000 Bze. bracket (50%), and thus can be classified as middle class. 32% of visitors' household income is less than $60,000 Bze. per year, and the remaining 18% fall in the high annual household income bracket of over $151,000 Bze.

5.3.3 Recreation, Tourism, and Existing Use of Port Honduras

In managing the proposed Port Honduras Marine Reserve highest priority will be given to the preservation of biodiversity. Recreation and tourism activity will be promoted as an alternative non-extractive use of the resources for income generation and to promote ecologically sound practices. Local recreation should also be recognized as a critical component to enhance quality of life.

Existing use of Port Honduras area for tourism and recreation is currently minimal and low impact. By contrast the buffer areas of Sapodilla Cayes and the Monkey River are extensively

used for tourist purpose. Concerns over carrying capacity and supporting infrastructure on the Sapodilla Cayes have been stressed by a Government Agency (Fisheries Dept. 1992) and locals (Garbutt, pers. com. 1996). The main concern is poorly planned tourism development on Nicholas and Hunting Caye that has resulted in environmental degradation, specifically the destruction of Hawksbill turtle (*Eretmochyles imbricata*) nesting sites. Effectively planned recreational and tourism development in Port Honduras may assist in relieving intense pressure upon fragile adjacent areas nearby currently threaten by overexploitation.

Present tourism and recreational usage of Port Honduras Proposed Marine Reserve include key site specific activities. A brief overview is provided below.

5.3.3.1 Snorkeling

Seventy-two percent of all visitors to Belize snorkel (CZMU 1995). The primary area for snorkeling activity in Port Honduras is on the fringing reefs around the northern and southern points of West Snake Caye. Other good snorkeling areas can be found on the patch and fringing reefs associated with the outer cayes. Visibility, however is sometimes poor due to the large amount of freshwater input from the watersheds draining into the area and the high rainfall.

5.3.3.2 SCUBA Diving

Although SCUBA diving off the barrier reef and atolls is a popular attraction in Belize the Port Honduras is not utilized regularly for this activity. The best noted dive sites are in the adjacent protected area off the Sapodilla Cayes. Recently there has been some occasional SCUBA activity within the Port Honduras: Coral Caye Conservation have noted that although shallow, the dives are impressive.

5.3.3.3 Kayaking

Five regular kayak operations utilize the Port Honduras and Sapodilla Cayes areas. Four are internationally based. Further information is required on their use of the cayes for overnight camping, fishing activity and the use of local guides from the buffer communities during the expeditions. It is known that one company operates only in the winter season.

5.3.3.4 Sailing

Private sailing activity in the waters of southern Belize is relatively common. The potential for an increase in sailing is high when considering both the general worldwide trend whereby sailing is increasing in popularity. The close proximity of the Port Honduras is popular for sailing destination from Rio Dulce, Guatemala, and marina facilities at Orange Point, Punta Gorda, and Placencia Village. Day sailing activity has high potential but is currently limited.

Protected anchorage can be found to the north of Wilson Caye, inside and to the south of Wild Cane Caye, north west of inside Sheephead, inside Mangrove Cayes (Frenchman's Range), West of Bird Caye (Moho cayes), off Stuart Caye, and within New Haven and Punta Ycacos Lagoons. New Haven offers excellent protection in all but southwest winds. (Rausher, F. 1991).

5.3.3.5 Cruise Ships

Cruise ship tourist arrivals in Belize totaled 8,748 in 1995 (BTB, 1996) and a draft cruise ship policy is currently used as guidelines to regulate the size and number of cruise ship entering Belize. Regulations were recently enacted to license cruise ships and other commercial recreational boat operations (S.I. No.6 of 1996, Cap232A). A commercial recreational boat for this purpose does not include those vessels under twenty feet or those that do not offer overnight accommodation and amenities.

Two cruise ships carrying between 20 to 85 passengers currently visit the Port Honduras cayes on a regular schedule with landings off Monkey River, West Snake Caye and Punta Gorda Town. One Company markets its cruise as an ecotourism tour and offers natural history educational lectures on board.

5.3.3.6 Sport and Recreational Fishing

Sport fishing is defined for the purpose of this document as catch and release or tag and release fishing of target species, whereas recreational fishing is extractive fishing for enjoyment and consumption but not subsistence. The former activity is gaining in popularity in Belize but remains an embryonic industry when compared to other countries in the Caribbean. Sport fishing license are not presently mandatory, but are on the agenda for introduction by the Fisheries Department and the Coastal Zone Management Authority.

Port Honduras is referenced as having great potential for sport fishing. Tour operators visit the Punta Ycacos Lagoon from Placencia for this purpose. Approximately 12 full time sport fishing guides currently using the Port Honduras area (BCES, 1995). Expressed local interest shows sport fishing to be a growing industry. Healthy stocks of targeted species (tarpon, permit, snook, bonefish, barracuda, crevale and horse eyed jack) are prevalent in Port Honduras and also the land lock freshwater lagoons in the buffer area of the Payne Creek National Park.

Recreational fishing occurs by tourists concurrent with kayak tours, sail boats operators, etc. and some organized trips. It is less species specific than sport fishing.

5.3.3.7 Picnicking, relaxation and swimming activity

Swimming, sunbathing and general relaxation are stated as the primary reasons for visiting Belize by 47% of tourist (Boo, 1990). Although somewhat surprising considering Belize's ecotourism marketing edge, this reasoning was highlighted in a 1994 survey when climate and beaches were rated highest as decision making factors for visitors to Belize (BTB, 1994). Additionally, enjoyment of the beach environment is evident as a local recreational activity focusing mainly the cayes.

Fourteen of the cayes in the Port Honduras area have upland communities sustainable for varying levels of on-land visitation. Attractive beach areas are accessible on West Snake Caye, Abalone Caye, South Snake Caye, and Moho Caye. West Snake Caye is the most frequently visited with over 190 feet of shifting beach.

The locals for recreation also utilize areas adjacent to communities along the stretch of sandy beach and bays from the mouth of Monkey River to Punta Ycacos. The remaining areas of beach remain primarily exempt from any activity other than hunting.

5.3.3.8 Wildlife and Nature Observation

Closeness to nature was ranked second as a motivating factor for choosing Belize as a visitor destination (BTB, 1994). The value of the Port Honduras area in terms of its natural abundance of flora and fauna is underestimated at present with limited nature oriented tours available. Specific sites of interest include the mouth of Deep River due to its aesthetic beauty, numerous orchids, bird life, and manatees; the nesting sites of frigates, herons, white ibis, pelican and brown bodies at Bird Caye; and manatee watches within Punta Ycacos lagoon. Trips up the Monkey River, with the buffer area have become well established in the past five years with tours operated out of Placencia and Punta Gorda (Muskins, J. Et al. 1994) The attraction is for a jungle experience focussing on the plants, river life, birds, and Black Howler monkeys. Tours through the mangrove channel are yet to be exploited.

5.3.4 Existing Infrastructure and Ancillary Services.

Limited physical infrastructure or facilities to cater to tourism or recreational activity have been developed in the proposed Port Honduras Marine Reserve, and a limited number of tours are offered from Punta Gorda, Monkey River and Placencia. Within the past year, however, tourism development has begun on Abalone Caye, Bobby's Caye and South Snake Caye with varying levels of intensity.

Bobby's Caye

A low impact thatched shelter has recently been constructed on the southwestern upland area of the caye.

Abalone Caye

A main wooden cabin in the style of a fishing camp, picnic area (one table), well designed composting toilet, and shower facilities have been constructed, with clearance of vegetation in the interior of the caye to allow for camping tent. The littoral forest at the caye's edge remain in tact.

South Snake Caye

A larger scale resort of 6 cabanas accommodating 4 persons each, a staff house, and restaurant facilities is planned with the completion date estimate to be 1998. Vegetation has been cleared in the interior in the north edge of the caye, landscape planning has begun, and a thatched shelter and one cabana constructed. It is recommended that this development is immediately assessed

for its environmental impact, specifically in terms of ecological carrying capacity, and that recommendation for impact mitigation be made.

Buffer Areas

The Sapodilla Cayes are more heavily used for tourism so the urbanizing effect has also begun. Resort development has started on Hunting Caye, Nicholas Caye, Franks Caye, and Lime Caye. An immigration post, piers and (inadequate) sanitary facilities have been established on Hunting Caye.

The villagers of Monkey River have shown an interest in tourism as an alternative income generating activity for village revival since the establishment of the Monkey River Special Development Areas in 1991. Monkey River Village is both a popular tour stop off on Monkey River Trips from Placencia and has begun to develop a tourism destination in its own. A hotel has been constructed and earlier this year the Monkey River Tour Guide Association was formed and operates along with the Association for the Preservation of Monkey River. Plans are under way to develop an iguana-breeding center on the fringe of the village to be operated as a commercial venture providing an alternative to hunting, for stock replenishment and as a tourist attraction.

Punta Negra community has also expressed interest in tourism, specifically sport fishing activities. Currently the village has not developed any form of accommodation, and local meals are available only on a pre-arranged basis with one household.

Punta Gorda Town (P.G.) is the primary tourist hub in the Toledo District, with communication links via land, air, and sea to areas within Belize and regular ferry services to the neighboring country of Guatemala. P.G. lies on the popular back packing route from Cayo to Guatemala although currently a large proportion of visitors via this route are in transit. Three tourist information centers are active in Punta Gorda Town.

It should be noted that the Toledo District has 34 registered hotels, which is a higher number than Corozal District, Orange Walk District or Placenica, These hotels total 239 rooms and 368 beds. However occupancy rates are presently among the lowest in the country. The majority of accommodations can be classified as budget accommodation with average room rate of $40.00 per night (BTB, 1996).

6. CONSTRAINTS AND POTENTIAL MANAGEMENT PROBLEMS

In order to fully address management concerns for Port Honduras the major issues affecting the area were identified through discussions with community groups and stakeholder. For this plan, issues are defined as a problem or opportunity of concern to two or more groups with an interest or stake in the outcome of management decisions. They are a combination of environmental, socio-economic, and institutional issues. Although the Port Honduras is a relatively remote area of southern Belize, five increasing tourism, logging on adjacent lands, increase agriculture and aquaculture activities in the Monkey River watershed, and land-use of all south of Deep River.

6.1 Fishing

As discussed above, fishing is traditional activity of the Port Honduras area. Fishing is conducted normally by local residents on a subsistence as well as commercial basis. The area normally fished commercially by local residents is region of the Snake Cayes, particularly East Snake Caye area. Locals do not usually fish areas along the coast.

The Port Honduras area is also fished commercially by fishermen from neighboring Guatemala and Honduras. Much of the fishing by these foreign nationals is done illegally and include the use of nets near river mouths and the taking of under-size lobster and conch. It has been observed that these fishermen use baited nets that not secured to the bottom which drift and cause damage to benthic communities. It is the perception of local residents that much of the apparent depletion of fish stocks of Port Honduras is due to the fishing pressure and practice of fishermen from across the borders.

Another significant problem is the poaching of manatees in the area. Again, this is an activity conducted by Guatemalan and Honduran nationals who slaughter manatees in the Port Honduras area and sell the meat in their respective countries.

In order to ensure that fish stocks of this area can be sustained, it will be necessary for this management plan to stop illegal fishing and allow for sustainable use of the fisheries resources of this area. Because of the dependence of local residents on fishing, this plan may need to accommodate some fishing; at least for subsistence. There will also be a need to accommodate some fishing if this activity will be curtailed. However, stopping illegal fishing and poaching on manatees by foreign nationals will require management presence and enforcement in the area.

6.2 Tourism

While tourism is a relatively new activity of the Port Honduras area, it is on the increase and is expected to grow. Much of the tourism activities of Port Honduras occur in areas of high biodiversity values and are critical habitats. These include the Punta Ycacos Lagoon within the adjacent Paynes Creek National Park, and the Deep River estuary. Both of these areas have lush mangrove communities and serve as nursery habitats and recruitment grounds for much of the

commercial species found offshore. The Snake Cayes area, with its patch reefs and associated communities, is used for snorkeling and picnicking. Monkey River, an area of abundant wildlife, is also the target by tourists from Placencia.

In order to protect the biological and economic value of these areas within Port Honduras, tourism activities will need to be controlled. It may need to be restricted to wildlife observation, and catch-and-release fishing. Areas suitable for snorkeling and picnicking are to be identified and prepared so as to minimize negative impacts.

6.3 Logging

Timber extraction has been a long-standing activity in the area of the Deep River Forest Reserve. Indeed, the forest reserves are designated for logging and other extractive activities in a controlled manner. Illegal logging has been reported to be occurring near or within the Payne Creek National Park and on nearby National Lands by the resident of Monkey River.

The Forest Department is ultimately responsible for permitting logging and other extractive activities that can occur within forest reserves and other forested areas. Because the impacts of logging can be detrimental to downstream resource, it will be necessary to ensure that such activities in the Deep River Forest Reserve and on National Lands that drain into Port Honduras are conducted according to the Forest Policy of Belize. Specific provisions for the maintenance of canopy cover, and prohibition logging within the riparian zone are key provisions that need to be encouraged.

6.4 Land Use of Monkey River Watershed

It is reported that 76% of the banana plantations in Belize are located along both the Swasey and Baldden branches of the Monkey River (Usher and Pulver, 1994). To increase acreage and probably production, these plantations clear their lands all the way down to the river's edge. These farms also use much agrochemicals - pesticides and fertilizers - that are transported within sediment during periods of rain and runoffs. In 1994, a tilapia farm began operation along the Swasey Branch and has plans for major expansion. Although the water quality of this river is not monitored, the residents of Monkey River have stopped using this river as a source of potable water.

The Monkey River watershed is 1,292 square kilometers and dumps an average of about 25 billion cubic meters of water into the sea annually (Heyman & Kjerfve). The increase sediment loading and the presence of toxic chemicals and nutrients can certainly have detrimental consequences on the integrity of coastal resources including the Port Honduras. The Banana Growers Association and Cherax Ltd. will need to be made aware of the impacts of their respective activities on the Port Honduras marine reserve.

6.5 Land-use of Lands between Deep River and Rio Grande

Almost all of the lands between Deep River and Rio Grande (the southern end of the Port Honduras Reserve) are in private holdings. Fortunately, all of these lands are in their natural states and uses compatible with the maintenance of natural ecosystems function can still be identified. In order to maintain natural ecosystem functions of the Port Honduras basin, it will be necessary to ensure that the uses of these lands and aquatic resources are compatible wit the said function. As such, the development of areas south of Deep River will need to be subjected to a planning scheme that prevents degradation of the natural system. A planning scheme for this area will require the consultation with landowners and personnel of the Lands and Survey Dept. (GOB).

Furthermore, the southern-most section of Port Honduras, i.e. the Seven Hills Range, is used by the military as a firing range. The impacts of this activity have not been assessed, and would not be compatible with tourism activities of the area.

MANAGEMENT PLAN

7. PROTECTED AREA

7.1 Goals and Objectives

The proposed Port Honduras Marine Reserve will maintain coastal ecosystem function and natural resource values, including water quality and nursery habitats of the area. The management plan will allow for the sustainable use of the biological resource and promote the identification and development of integrated conservation as well as development projects compatible with ecosystems functions.

Goal 1

To protect the physical and biological resources of Port Honduras.

Objectives

a) Create a zoning plan for the preservation of coastal habitats and ecosystem function;

Goal 2

To provide education and research

Objectives

a) Develop an educational program to promote conservation through sustainable resource use;
b) Develop a comprehensive interpretative program;
c) Develop protocols for needed research and monitoring of environmental changes;
d) Prioritize research.

Goal 3

To preserve the value of the area for fisheries and other important genetic resources.

Objectives

a) To provide protection to all habitats of commercially important species;
b) To provide areas that will ensure fisheries recruitment.

Goal 4

To develop recreational and tourism services that will enhance the economic and social benefits of the area without causing environmental damage.
Objectives

a) To provide well managed areas for tourism and recreation;
b) To promote uses compatible with conservation and sustainable development practices.

Goal 5

To strive for sustainable financing

Objectives.

a) Generate financial resources necessary to support management activities through user fees, projects, and programs compatible with ecosystems functions;
b) Create a trust fund for the reserve.

While this management plan is specifically for the Port Honduras coastal basin, the institutional management bodies should promote compatibility with plans for Paynes Creek National Park and Sapodilla Cayes Marine Reserve to ensure holistic management of the area.

7.2 Boundaries

The proposed Port Honduras Marine Reserve is the area from Monkey River Village at 16 degrees 20' North Latitude and 88 degree 25' West Longitude, down to Rio Grande at 16 degree 08' North Latitude and 88 degree 45 West Longitude, along the mainland coast of Belize, and include all the near-shore cayes eastward to the Snake Cayes, from the point 16 degree 08'N. Latitude, 88 degree 26'W. Longitude offshore Rio Grande, to 16 degree 20'N. Latitude, 88 degree 26'W. Longitude offshore Monkey River. See appendix 1 for the proposed Statutory Instrument to declare the reserve.

7.3 Zoning Plan and Regulations

A zoning plan for the proposed reserve has not been finalized. The Plan is being developed in consultation with all the stakeholders in the area. More input will be derived from the advisory committee once the members are nominated and confirmed. The following is a tentative zoning plan derived from the Fisheries Department's latest zoning scheme based on the international multi purpose use of marine protected areas.

1. General Use Zone (GUZ)

Objective: *To provide opportunities for established uses and activities (e.g. fishing for conch, lobster and finfish; recreational activities etc.) to be continued in a sustainable manner under a stringent monitoring scheme.*

2. Conservation I Zone (CIZ)

Objectives: *To provide an undisturbed area for recruitment of species to adjacent areas; to provide an area free from all fishing and collecting that will allow research and education; to provide a baseline to monitor the ecological status of unprotected areas; and to provide a representative sample of certain habitats within the protected area.*

3. Conservation II Zone (CIIZ)

Objectives: *To provide an area free from commercial fishing to prevent fishery stocks from overexploitation; and to enhance the value of the area for recreational and tourism activities.*

4. Preservation Zone (PZ)

Objectives: *To provide areas within the reserve that are preserved in an entirely natural state; and to protect areas of particularly fragile habitat or with threatened or rare species.*

5. Special Management Area (SMA)

Objective: *To provide areas for specific purposes not covered by other zones.*

GENERAL RULES OF THE RESERVE

a) No person shall have in his/her possession within the boundaries of the reserve any flora, fauna and archeological artifacts other than in accordance with the regulations.

b) No person shall deposit or extract any material in or on the waters of the reserve, except in cases allowed by special license from the Fisheries Administrator.

c) No person shall mark or tamper with any sign, buoy or notice installed in the reserve.

d) Commercial fishers, resort operators, guides, scientists, residents and visitors shall abide by the permit and entrance fee system as outline in the regulations.

e) Scientific research will be permitted under a licence granted by the Fisheries Administrator.

f) Licences and permits issued are not transferable.

g) No nets are allowed in the reserve.

h) Any accident involving personal injury or damage to property shall be reported to the reserve personnel as soon as possible, but the Reserve Management, TIDE, Fisheries Department or Government of Belize shall not b e liable for such personal injury or damage to property.

i) All fisheries, wildlife, forestry, tourism and archeological laws will apply.

GENERAL USE ZONE (CUZ)

This allows for the sustainable management of existing uses. In these cases the focus is on commercial fishing and recreational activities.

Rationale

This zone lies outside the more critical protection zones. It is fairly accessible to local fishers as the presently use part of the area for commercial fishing. The existence of some fishing banks and nearby replenishment areas make the GUZ valuable and potentially fertile fishing grounds.

Regulations

- Commercial fishing is allowed with special license stipulating specific fishing regulations.
- No destruction of the natural habitat.
- No anchoring on coral reefs.
- No net fishing.
- No spear fishing.

Key Enforcement and Monitoring Needs

Intensive patrols to check for fisher compliance specifically on fishing gear, catch sizes etc. will be needed. These patrols will also deter potential incursions into the other zones.

CONSERVATION I ZONE (CIZ)

This zone encompasses representative habitat of the entire protected area. It is essentially a non-extractive zone, preserved in such a state to provide baseline conditions to allow monitoring , research, education and limited recreational activities.

Rationale

This zone represents from coastal river mouth habitats to coraline islands further out at sea. It includes coastal and tidal wetlands, mangrove islands, fresh, estuarine and marine environs, corals and vegetation types indicative of the entire reserve. CZI serves as replenishing and nursery areas and provides habitats for threatened or endangered species such as the Morelets Crocodile, West Indian manatee, turtles and many bird species.

Regulations

- No extraction except for research purposes with special permits.
- Recreational activities allowed.
- All educational activities require approval and coordination of the managing body.

6 No fishing of any type.
6 No disturbance of the natural habitat.
4 Boat mooring on buoys only.

Key Enforcement and Monitoring Needs

Illegal camps will be disbanded. Illegal fishing will be discontinued especially the night pouching. A base station will be established at the mouth of the Punta Ycacos Lagoon and another at either East or Middle Snake Cayes. Management should coordinate with residents of the nearby cayes for assistance in surveillance.

CONSERVATION II ZONE (CIIZ)

This is a controlled extraction zone to accommodate subsistence fishing, recreation and tourism. This zone will also enhance the fishery through controlled fishing.

Rationale

This zone accommodates for all of the different types of recreational activities accepted in the reserve. It has beach areas for swimming, bird aggregation sites, corals for diving and snorkeling, areas of archeological significance, areas for canoeing and good fishing sites. Additionally, some islands in this zone offers some potential for development of minimal recreation/tourism facilities.

This zone is rich in mature commercial species as they move from the shelters of the mangrove islands into deeper areas.

Regulations

6 No commercial fishing.
4 Subsistence fishing (line and free dive) allowed only for permanent residents who have traditionally used the area.
4 Recreational fishing allowed only with artificial or real baited lines.
4 Sports fishing allowed on a catch and release basis only.
6 No spear or net fishing.
6 No destruction of the natural habitat.
6 No anchoring on coral formations.
4 Non-extractive recreational activities allowed such as snorkeling, diving, kayaking, and sightseeing.
4 All boats must use the mooring buoys where provided.
6 No clearing of mangroves without the approval of the Forest Department.
6 No collection of flora and fauna except with permission from the Fisheries Administrator.
4 All proposed tourism development must go through the EIA process.
4 Visitors/tourists should steer clear of the main boat access routes.

Key Enforcement and Monitoring Needs

The majority of the cayes within this zone are mangrove cayes. This zone has the most cayes with upland communities. All fourteen cayes have undergone some degree of clearing and development mostly to accommodate fishing camps. About 40 % of these have permanent occupation, while others are periodically occupied. The tenure status of these occupations are uncertain but it is estimated that 90% have no legal status. The development trend will continue since the area has high recreational potential.

Recreation and tourism impacts will require monitoring. The EIA process is a tool that can assist in guiding sound development in this zone. The clearing of mangroves will be addressed through the existing permit system from the Forest Department. The reserve's management body will coordinate with DOE and Forest Department in regulating these activities.

Since many of the fishers who use the area for recreational and subsistence fishing, are also commercial fishers, the managing body will have to closely monitor their catches. Restriction of certain gear types for recreational and subsistence fishing will also facilitate the enforcement of the no commercial fishing regulations.

Preservation Zone (PZ)

This constitutes the strictest protection. This area will be closed to visitors, including researchers except under special permission.

Rationale

This area includes tidal wetlands, mangrove coastline and a network of near shore mangrove cayes offering excellent nursery grounds for a variety of species. This zone is directly affected by the nearby rivers (Deep River, Golden Stream, Middle River) which empty into the sea altering the salinity from fresh to estuarine and to oceanic in different location and at different seasons of the year producing diverse spatial and temporal saline conditions. This area is an important habitat and access route for the West Indian Manatee moving into the nearby rivers and Punta Ycacos Lagoon. Human impact in this zone has been minimal thus preserving the area in an almost natural state.

Regulations

4 Access is restricted except to research needed by the park when it cannot be accommodated in the other zones.
6 Strictly no extraction even for research.
6 No habitat disturbance of any kind.
6 No fishing of any type.
6 No recreational or tourism activities.

Key Enforcement and Monitoring Needs

The main potential impact will be from boat traffic due to access into the nearby Deep River area by tourist boats.

SPECIAL MANAGEMENT AREA

This area will accommodate activities not compatible with any of the other zones. The area to date has not been identified but the information will be available before the reserve's legislation is enacted.

Rationale

This area will not include sensitive habitats. The area reserved under this zoning category will be fore human use. This may be in the form of periodic camps to accommodate large-scale research or special projects with community participation.

Regulations

- Low human impact may be permitted.
- Fishing will be permitted under special permission from the Fisheries Administrator.
- The deployment or extraction of materials into the area will be permitted under special permission from the Fisheries Administrator.

Key Enforcement and Monitoring Needs

Any type of activity that will be allowed in this area will have to be properly planned by the managing bodies along with the other related government agencies.

7.4 Permitting Arrangements

← Research

All persons intending to conduct research within the reserve must obtain approval from the managing authority. Permits will be granted based on research priorities of the park. The research permits will stipulate the geographic location within the park where research will be conducted and guidelines such as types and quantities of flora and fauna allowed for extraction, and other pertinent regulations. Regulations and guidelines will be tailored to fit research needs on a case by case basis as described in the *Research and Monitoring* section of this plan.

↑ Tour Operators

All tour guides intending to operate within the reserve must obtain a license from the managing authority. In order to qualify for a license, a person should be a Belizean , age eighteen or older, and must have satisfactorily undergone the tour guides training/screening program offered by the

Belize Tourist Board. First preference will be given to locals of the reserve area especially those who may need to alter their means of earning a living.

License fees will be administered according to intending activities stipulated on the license. Such categories include: Sport Fishing, Recreational Fishing, Subsistence Fishing, General (sightseeing, canoeing, swimming, snorkeling, and SCUBA diving.) Permits will be granted and renewed on an annual basis. Tour guides must have in their possession their licences when conducting tours within the reserve.

→ Commercial Fishing

A license from the managing authority is required for commercial fishing within the GUZ of the reserve. Licenses will only be issued to locals who have traditionally used this area for commercial fishing. A license will be granted on a yearly basis. Users should carry their license at all times when fishing within the reserve.

7.5 Statutory Regulations

The proposed Statutory Instrument to legally declare the proposed Port Honduras Marine Reserve is in Appendix 2.

7.6 Reserve Facilities

λ Buoys and Markers

Buoys will be used to demarcate the reserve boundaries, zoning boundaries, and mooring areas. Buoys will also be used to identify navigational channels, and the various areas designated for various uses. A brochure with the buoy coding system will be made available upon request. The natural harbor of New Haven, in addition to some sites within the C2 zone, will be developed and utilized for yachts and boat moorings. Figure 7.2 on page 49 shows mooring sites in detail.

▣ Administration

The reserve headquarters will be temporarily housed at the TIDE office in Punta Gorda Town while suitable land is identified. There will be two ranger sub-stations within the Port Honduras Reserve; one at Frenchman's Caye and another on West Snake Caye.

▣ Bathrooms

Public bathroom facilities will be developed at the reserve headquarter and two substations. It is anticipated that additional private recreational/tourism facilities of varying scales will develop on some cayes and in CIZ as activities in the reserve increase.

▣ Signs

Signs will be strategically located within the reserve to aid enforcement, give direction and information, and assist in the regulations. The main access routes will be properly marked.

7.7 Planning Guidelines and Recommendations

According to the plan, development is only allowed in the C2 and General Use zones. In terms of development potential, the C2 zone is the zone most capable of supporting any sustainable level of development. Even so however, the types of development that this zone can accommodate is limited. The main limiting factors has to do with their proximity to sensitive and important habitats, and the small size of well drained lands. In the C2 zones the only areas with any upland communities are West and South Snake, Wilson,, Head, Man-o-War, Wild Cane, Abalone, Long, Tarpon, Frenchman, Bobby's, Moho, Cross, and Mcbride Caye, and the narrow beach ridge along the coast adjacent to Paynes Creek National Park, including Punta Ycacos and New Haven. Much of these areas are probably leased or private and may be subjected to some type of development. While these areas support some upland communities, mangrove make up a significant portion of the vegetation on these cayes and coastal areas.

Only private residential and small scale tourism related development should be allowed in these areas and this should be evaluated on a case by case basis within the general zoning scheme so as to provide sound site specific development guidelines. Development on the islands should be limited to the extent possible, with focus being mainly on the larger islands with upland communities. Tourism development on the islands should not include resort or hotel development. Small-scale resort or hotel development should be concentrated on the mainland areas along the coast. Even this however, requires evaluation on a case by case basis.

Structural guidelines should be developed to guide architectural designs for buildings within the reserve so as to blend in with the natural aesthetics of the area.

Management of Buffer Area

Land-Use Plan for Lands between Deep River Forest Reserve and Rio Grande

As discussed in the section Constraints and Potential Management Problems, in order to maintain the various functions of natural ecosystems of the area between Deep River Forest Reserve and Rio Grande, it will be necessary to develop land-use guidelines that allow for uses compatible with maintaining such natural functions. Of key concern is maintaining natural levels of erosion, run-off, and sedimentation. Also of great importance is the maintenance of critical habitats and key species.

Much of the land between Deep River Forest Reserve and Rio Grande is in private holdings and the ownership status is currently changing. The TIDE planning team is discussing with the proponents of Nature Resorts International, a limited liability company with interest in implementing a nature tourism operation in the Golden Stream watershed, in purchasing significant portions of this area. This company is also interested in using some of the area for some agriculture in a manner sensitive to the environment. This company plans to build an eco-lodge that would utilize the surrounding natural environment for site seeing, camping, river trips,

etc. The proposed land use by Nature Resorts International Ltd. can be compatible with maintaining natural ecosystems.

Plans for the use of National Land parcels between Deep River and Rio Grande, however, needs to be drafted. Currently, some of these islands are under license for logging. A significant portion of the Southern section of Port Honduras is used as a firing range by the military. This activity is not compatible with tourism of the area and damages the natural habitat with the creation of craters caused by bomb. Discussions has begun with the military to seek ways to arrest such uses.

Recommendations:

1. The Fisheries Department and TIDE will seek to maintain working relations with developers to guide development and ensure the implementation of plans compatible with the protected area.
2. National Land parcels between Deep River and Rio Grande should be designated buffer areas for the Port Honduras Marine Reserve.
3. Fisheries and Forest Departments should work with TIDE to halt the use of Seven Hills area as a military firing range.

Land Use of Monkey River Watershed

This watershed is currently under heavy agricultural use, particularly for bananas, some mango and citrus. More recently tilapia aquaculture has been introduced along the Swasey Branch of the Monkey River. The Monkey River Village and the area south of the village along the coast are designated as a Special Development Area (SDA). An SDA plan has been drafted and a committee designated to control the development to ensure the protection of species and ecosystems, and to provide development opportunities for locals. There is presently a need to implement this plan.

Recommendations:

1. The reserve should work with the Banana Growers Association (BGA), and the Citrus Growers Association (CGA) to sensitize them of the impacts of banana farms on the natural ecosystems of the areas.

2. The reserve should work with the BGA and CGA to devise a plan to rehabilitate the riparian zone included in banana plantations to employ sound environmental practices.

3. The reserve should sensitize aquacultural operators of the impacts of aquaculture on natural ecosystems and the need to employ best management practices.

4. There is the need to coordinate this plan with the Monkey River Special Development Area.

8. SURVIELLANCE AND ENFORCEMENT

The Fisheries Department will be responsible for the surveillance and enforcement of the management plan for the Port Honduras Marine Reserve. The reserve will have a management staff composed of a reserve manager, secretary, conservation officers and biologists.

Surveillance will be necessary to assure compliance with the reserve's regulations. This will be a prime responsibility of the conservation officers.

Enforcement of the rules for the Port Honduras Marine Reserve will be conducted according to three levels:

a) The first level will be the direct enforcement by the marine reserve staff, particularly the conservation officers. The conservation officers will patrol the entire reserve on a regular basis.

b) The second is the community participation. This will involve radio communications from communities to the reserve authorities. This will be an alert system to inform of suspected illegal activities occurring within the area

c) The third level of enforcement will be the direct involvement of other enforcement agencies, Police and BDF Maritime officials. This approach will be used in the event of a major illegal activity that requires the skills of paramilitary enforcement officers.

In order to minimize infractions occurring within the reserve, conservation officers and personnel responsible for interpretation, including licensed tour guides, will provide environmental education and regulations awareness. The reserve staff will work closely with the resource users especially the tour guides who are an excellent source of information dissemination.

9. RESEARCH AND MONITORI NG

9.1 Goals for Research and Monitoring of Port Honduras

- To provide the information necessary to make informed decisions about managing and protecting the ecosystem processes and critical uses of the reserve.
- To gather simple, indispensable data, that is meaningful, and easily communicable to a wide audience.
- Disseminate results of the research and monitoring to relevant persons (managers, local stakeholders, students, governments, and local international researchers).
- Efficiently use personnel and economic resources for monitoring to ensure that critical parameters are always monitored.
- Support research and monitoring of appropriate integrated conservation and development projects for the reserve and adjacent areas.

9.2 Objectives for Research and Monitoring of Port Honduras

The objectives of a research and monitoring program for Port Honduras and adjoining areas are to:

- Conduct a threats analysis to identify major threats to the sustainable function of the reserve and direct monitoring efforts to address those threats;
- Prepare a research and monitoring program necessary to fill information gaps vital for management of the reserve;
- Monitor ecosystems status and sustainable functions of critical habitats within and adjacent the reserve;
- Better understand the biotic and abiotic linkages between marine, intertidal, and terrestrial habitats within and outside of the reserve;
- Monitor the use of the reserve for social, economic and ecological impacts;
- Support and participate in national, regional, and global research and monitoring initiatives; and
- Provide comprehensive multi-disciplinary information for management of the reserve.

9.3 Research and Monitoring Strategy

The primary goal of the research and monitoring program is to provide information necessary for management and sustainable use of the area. A comprehensive threat analysis will be conducted to identify the major threats to the biodiversity. A compilation of the existing information and gaps will be the first step in the research and monitoring strategy. A strategy will be developed whereby key monitoring parameters are ranked in order of priority (1 the highest, 2 - medium, and 3 low priority). With a prioritized list of research and monitoring needs, international researchers, students, and non-governmental organizations can participate in completing a comprehensive database. Presently, some information has been collected and an informal threat analysis has been conducted. An initial list of research and monitoring needs will be categorized according to the following:

* Oceanography -Physical
  -Chemical
  -Geological
  -Biological

* Terrestrial Ecology -Flora
  -Fauna
  -Soils
  -Geology
  -Land use

* Cultural and Archeological Resources
* Social and Economic Impacts

The reserve staff will revise the list after a more thorough threat analysis has been conducted.

9.3.1 Research Implementation Strategy

The reserve scientific staff will conduct basic research and monitoring. Collaboration and participation from school groups, local resource users, community members, and interested researchers from local and international colleges and universities are encouraged. TIDE will formalize partnerships with academia and other research-oriented institutions to help implement this research plan.

Research Permits

Only non-destructive research will be allowed in the reserve and will be subjected to a research fee. Tide will help in drafting a research priority list and will encourage and facilitate research that will take place within the reserve.

Dissemination of Results

Research conducted by the reserve staff will be analyzed and reported on a systematic basis to the Fisheries Department, stored at TIDE's library, and will be made available to the wider public through CEDS to responsible GOB agencies.

For non-staff research the existing dissemination protocol will be an agreement made by the researcher and the permitting agency. Dissemination will include a combination of publications, technical reports, and local public outreach. In some cases researchers will be asked to participate with the reserve's education and outreach program by providing research findings, public slide shows, booklets, or talks to local schools and by allowing locals to participate in conducting research as an educational activity. The reserve staff and TIDE will facilitate and assist the researcher in conducting this public outreach service.

9.3.2 Research and Monitoring Priorities

9.3.2.1 Oceanography

1. Physical and Chemical Studies

Physical measurements of water quality discharged by the various rivers into Port Honduras are largely lacking, especially turbidity measurements. Riverine dispersion monitoring should be of high priority because of the massive influence of the water flow from the uplands. Tracking certain pollutants such as agrochemicals in certain watersheds is also necessary. This will allow subsequent monitoring to indicate any changers due to change in land use.

Water quality monitoring should include permanent stations to monitor various parameters. Random water quality sampling can also be justified. All water quality research or monitoring should be coordinated with the Coastal Zone Institute and the Hydrology Department.

Research and Monitoring Needs

* Monitor water quality parameters including temperature, salinity, pH, turbidity, and other relevant hydrological parameters that impact the reserve.

* Conduct studies in coastal and estuarine areas to determine levels of suspected pollutants such as pesticides and herbicides used in the agriculture industry along the Bladden and Swasey branches of the Monkey River and Rio Grande.

* Conduct studies on coastal oceanographic processes, such as the relationship among seasonal currents, bathymetry; river dispersion; estuarine dynamics; sediment transport;

and tidal dynamics necessary to understand the nature of Port Honduras coastal basin and nearby marine area.

2. Biological Studies

Mangrove, Sea grass, Coral and Critical Habitat Studies

As primary producers for coastal and marine ecosystems, productivity studies of mangrove and Sea grass can provide useful information on food web linkages. This should be of high priority. The reserve staff along with TIDE will continue to use the CARICOMP mangrove and Sea grass productivity methods and the permanent plots already established for these studies. CARICOMP coral productivity plots will also be developed. Other crucial food web linkages studies that should be conducted include plankton types and distribution, the role of dissolved and particulate organic matter and bacteria; and productivity of intermediate food web organisms (e.g.. Detrital feeders such as mullet, shrimp, and schooling baitfish such as anchovies).

Port Honduras contains several critical habitats, which should be monitored as their status and interactions are indicators of the health of the system. Critical habitats include the mangroves of the shoreline and the cayes, the sea grass beds, the hardbottom communities (general associated with the cayes and banks), soft-bottom or mud bottom communities, and the coral reefs surrounding the Snake Cayes.

The extensive mangrove system requires careful monitoring due to their roles of the sediment traps, contributors to marine productivity, and nursery areas.

Research on the ecological role of these systems is a priority. Much of the bottom of Port Honduras is soft mud and provides habitat for a variety of important finfish including the most common species, lane snapper *(Lutjanus syngaris*) within the reserve.

Research and Monitoring Needs

* Conduct inventory of biodiversity of Port Honduras.

* Map the spatial distribution of Sea grass beds, coral reef and other benthos in the reserve and adjacent areas.

* Characterize the mangrove communities of the Port Honduras Cayes.

* Conduct studies to model energy flows among the various ecosystems of Port Honduras and adjacent areas. These studies will include productivity, decomposition, and organic contribution of the mangroves and sea grass to coastal ecosystems.

* Continue monitoring of sea grass and mangrove productivity using CARICOMP methodologies.

* Develop permanent coral reef monitoring transects around the Snake Cayes.

* Determine factors limiting growth and composition of mangrove forests.

Health, development and use status of commercial species (including sportfishing species*)*

The Port Honduras and adjoining coastal areas have been determined to be very rich nursery and recruitment ground for many of the commercial finfish and shellfish species caught in Belize (Sullivan, et al. 1995). Protecting these functions is an explicit goal of this management plan. In order to tract annual fish landings surveys should be conducted.

Research and Monitoring Needs

* Compile exciting information on the life history of all commercially harvested species and research to fill in the gaps.

* Research and monitor the role of Port Honduras as a larval, nursery, and spawning habitat for commercially important species (e.g. lobster, conch, snook, lane and mutton snapper, jewfish, tarpon, permit, shrimp, etc.)

* Monitor size frequency of reef fishes and commercially harvested species (jewfish, barracuda, snook, lane snapper, mutton snapper, crevalle jack, cero, and king mackerel.)

* Monitor lobster harvested from the GUZ within the reserve.

* Conduct lobster larvae and juvenile surveys to determine population distribution.

* Study the conch populations to determine migrations, breeding grounds and feeding grounds.

* Monitor the sports fishery to determine numbers of guides, numbers of anglers, size and weights of fish caught and released.

Status of endangered species

Port Honduras provides feeding grounds for the West Indian Manatee (Trichechus manatus) which is listed by IUCN as an endangered species. Belize harbors the largest population of manatee in the Caribbean Region between 200 - 700 individuals (O'Shea and Slisbury, 1991). The manatee is under tremendous pressure as they are hunted illegally within Port Honduras.

American saltwater crocodile, *Corcodylus acutus*, and the Morelet's crocodiles, *Corcodylus Moreleti*, inhabit the coastal portions of the reserve. The former is listed by IUCN as a vulnerable species. Port Honduras also provides feeding habitats for three marine sea turtles: Loggerhead

turtle (*Carretta Carretta*), Green turtle (*Chelonia mydas*) and Hawksbill turtle (*Eretmochyles imbricata*). The area is nesting grounds for the Hawksbill turtle.

Unconfirmed reports suggest the presence of the Riverine "Tucuxi" Dolphin, *Satalia fluviatiles* in Port Honduras. The proposed reserve definitely provides habitat for the Atlantic Bottlenose Dolphin, *Tersiops truncatus*, which is a common and charismatic species. Studies on these charismatic and endangered species should be developed so as to manage visitor interaction to allow some viewing and yet avoid disrupting critical breeding or feeding patterns. Research on endangered species should be coordinated with existing studies, for example, the manatee study presently conducted by the CZMP.

Research & Monitoring Needs

* Seasonal aerial surveys of manatee populations.
* Genetics research of manatee population.
* Identify the manatee key feeding, calving and resting areas and migration routes.
* Investigate the presence of "Tucuxi" dolphins, rumored to visit the New Haven area.
* Conduct survey of the Atlantic Bottlenose Dolphin population.
* Monitor sea turtle nesting on the beaches of West Snake Caye, and Ycacos - Punta Negra.
* Evaluate bird-nesting sites.
* Evaluate crocodile populations.

Geological Studies

In order to fully characterize the Port Honduras coastal basin and its adjacent environment, the geology of this area must be understood. Thus far no study has been conducted to determine the geologic profile of this area. As a transition zone, coastline changes over time are the result of natural processes of weathering and disposition and possibly sea level rise.

Research & Monitoring Needs

* Conduct geological studies to determine the history of Port Honduras and adjacent areas.
* Update bathymetric maps for Port Honduras and adjacent waters.

9.3.3 Terrestrial Ecology

Flora and Faunal Studies

In contrast with limited information existing for the coastal waters of Port Honduras and hence the need for research, the terrestrial side has been relatively well studied. There is much existing information on the flora and fauna of the mainland and portion of Port Honduras. Flora information has been produced and is represented in Belize's vegetation maps. Mapping of the mangroves of Punta Ycacos itself has been accomplished. However there is no information on the actual extent of littoral forest on the cayes. This is an ecosystem that is rapidly vanishing. The avifauna of the area has not been investigated, and there is a need for information to sustainable use the fauna.

Research & Monitoring Needs

* Investigate the extent and characteristic of littoral forest communities on the Port Honduras cayes.

* Conduct wildlife population studies of top predators and key herbivores.

* Investigate the avifauna of Port Honduras.

Geological and Soils Study

As is the case with flora, many data exist regarding the soils and geology of Belize at a national level. Various hypotheses have been proposed for the geological formations of the Belize coastline but these need verification.

Research & Monitoring Needs

* Tie any terrestrial geological research with that of the coastal basin.

Land Use

The presence of humans is constantly changing the landscape and natural resources. Balancing human use with natural ecosystem dynamics requires knowledge of the area. Any change to a natural system will result in changes in systems function of the immediate and adjacent areas.

Research & Monitoring Needs

* Monitor upland land use using satellite imagery and use the data in the planing process.

* Study relationship between land use changes and hydrologic impacts such as sedimentation rates and volume flow etc.

Meteorological Studies

The Port Honduras area is within a transitional zone between subtropical wet and tropical moist life zones. Placing a meteorological station in Port Honduras can provide comprehensive climatological data of southern Belize that appears to have a unique climate.

Research & Monitoring

* Need to monitor rainfall, temperature, wind speed and direction, relative humidity, barometric pressure, and tidal changes.

* Need to monitor sea level rise through the Caribbean Planning Adaptation for Climate Change methodologies.

9.3.4 Archeological and Cultural Resources

Dr. Heather Mckillop (Louisiana State University) has investigated the archeological resource of Wild Cane Caye and other areas of Port Honduras for over 15 years (Mckillop, 1987; 1993). Dr. Mckillop's work can assist in the reserve's planning process. An archeological research plan will be developed spearheaded by the Archeology Department. Dr.Mckillop and other interested archeologists can assist.

The cultural resources from the communities of Port Honduras are invaluable and can be utilized within the tourism sector. These aspects require investigation and consolidation.

Research & Monitoring Needs

* Continue research on Wild Cane Caye and its role as an archeological trading post.

* Continue investigations of the archeological resources in and around Port Honduras.

* Further investigate and document the use of Port Honduras by pirates during the 17th and 18th centuries, and sites where buried treasure had been unearthed in Deep river and Bob Stuart Lagoon.

* Further historical investigation of the relatively recent use of Port Honduras (last 100 years.)

* Investigate the socio-cultural aspects of the people of Port Honduras including dory and boat building, trap building, net making, etc.

9.3.5 Monitoring Social and Economic Impacts

The reserve is presently used for commercial and sport fishing, a transport route, and ecotourism. Less than 100 people live within the proposed boundaries of the reserve. Two communities are located on the adjacent areas, and there exists scattered residents on the coastline. It is expected that tourism to the reserve will increase dramatically when the reserve is implemented. Most of the existing fishing within the proposed reserve is from illegal aliens who cross into Belizean water at night.

A critical objective of the reserve management will be to prohibit commercial fishing within the reserve conservation areas but will allow fishing in the GUZ, which is the largest zone. A goal of the reserve is to allow for local sustainable fishing. Another goal is to promote compatible uses such as ecotorism which allow economic development of surrounding communities without sacrificing any ecosystem.

Research & Monitoring Needs

* Need to monitor the numbers of persons from local communities employed as guides and the number of working days of each in the tourism industry, as hunters, commercial fishermen, etc.

* Need to monitor the attitudes of tourist and residents.

* Need to monitor the number of visitors to the reserve, dollars generated from their visits and conduct user satisfaction surveys on the visitors.

* Need to monitor commercial catch landing and revenue generated within the GUZ. This will be conducted with a voluntary reporting system of permitted local fishermen.

* Need to monitor sportfishing.

10. INTERPRETATION, EDUCATION AND COMMUNITY DEVELOPMENT

Interpretation and education are important visitor management tools that can assist with local enforcement by promoting compliance.

10.1 Interpretative and Information Programs

Overall Goal: To utilize interpretation techniques along with the dissemination of information about the Port Honduras Marine Reserve to enhance visitor experience, promote responsible behavior and use of the reserve, promote local and national pride through community protection efforts.

Target Audience: Users of the reserve.

Interpretation Points

Stationary interpretation points will include:

- a visitor center
- two conservation officer stations (Punta Ycacos &West Snake Caye)
- the tourism development area of Frenchman's Range to south Moho, West Snake Caye, Wild Cane Caye, Deep River and New Haven
- Punta Gorda Town

Mobile interpretation will be available through the conservation officers patrolling the area and the licensed tour guides operating in the reserve.

General Information Points

Local communities in the buffer area will be encouraged to distribute informational materials such as pamphlets and brochures about the reserve. Promotional materials will also be made available to the Fisheries Department, Belize Tourist Board and district tourist information center (TICs), conservation NGOs, and through the Coastal Zone Management Authority.

Interpretative Methods

The managing authority for the reserve will be responsible for developing interpretive programs and informational materials highlighting:

* Ecological importance of Port Honduras
* Cultural significance of the reserve
* Reserve rules and regulations
* Key points of interest with the reserve.

Methods used will include:

- Strategically located signs within the reserve
- Brochures, pamphlets and written guides
- Zoning maps and regulations
- Merchandize such as posters, T-shirts etc.
- Development of audio-visual programs for use within the visitor center and sale to cruise ships, resorts etc.
- Scheduled ranger talks
- Display material within the visitor center
- Licensed tour guide services

10.2 Education and Training Programs

A watershed approach to management of the Port Honduras Marine Reserve will be adopted. Therefore outreach programs to the communities within the watersheds that drain into Port Honduras in addition to the residents within the reserve and around the reserve boundaries will be necessary. Due to the transborder resources used by fishermen from Belize, Honduras and Guatemala, education extension services will be provided to regional NGOs. Training in aspects of protected areas management and the promotion of integrated conservation and development will also be critical to encourage local participation within the management of the reserve. Education opportunities presented by visiting researchers will be maximized.

Overall Goal: To create environmental awareness highlighting the significance of the Port Honduras area in terms of its biodiversity and management needs at the same time strengthening local capacity to assist in long term protection.

Target audience: Educators in reserve and buffer area
Students in reserve and buffer area
Local fishermen in reserve and buffer areas
General public
Regional NGOs

METHODOLOGIES

Schools Education and Training Programs:

- Summer teacher training camps for local educators organized in collaboration with Ministry of Education, NGOs, GROs.
- Educator package of information material about the reserve.
- Marine and coastal ecology workshops and resource materials.
- Outreach presentations.
- Educational field trips for local schools.
- Camping organized in collaboration with NGOs, Youth groups etc.
- Distribution of posters, booklets etc.
- Network with national academic institutions to promote field studies and workshops.

Fisheries Education Program:

/ Outreach presentations to fisheries co-operatives and local fishing communities.
/ Local training programs in monitoring and surveillance.
/ Fisher's training in alternative skills such as sport fishing, tour guiding etc.
/ Education extension services to regional NGOs (distribution of materials and networking).
/ Promote local fishermen as guest speakers at seminars and on media shows.
/ Special Events involving fishermen e.g. Net Sale Day where fishermen are encouraged to sell their illegal nets to restaurant and hotels for decorative purposes; Manatee protection week etc.

Public Education and Training Program:

- Catalyze participation in international and national events such as International year of the Reef, Earth Day, Beach Clean-up Day etc.
- Production and sale of educational materials such as posters, field guides etc.
- Scheduled seminars, talks, and presentations.
- Dissemination of audiovisual material on responsible practices produced.
- Involvement of locals within the research and monitoring projects.
- Quarterly reserve newsletter.

11. TOURISM AND RECREATION DEVELOPMENT POTENTIAL

The reserve is zoned to accommodate tourism activity and recreational use specifically in the C2 zone as detailed in the zoning plan. Jet skiing and water skiing will not be permitted in any zone within the reserve due to speed, heavy pollution and noise disturbance.

In order to assess the full potential of the Port Honduras area for tourism and recreation a rapid assessment of its potential has been conducted taking into consideration ecologically sensitive habitats.

A full assessment of potential SCUBA diving sites will be conducted within GUZ, CIZ and CIIZ to provide mooring buoys.

11.1 Areas of High Tourism Potential

Areas of high tourism potential within the appropriate zoning were determined as Frenchman's Range to Moho Caye, South and West Snake Cayes, New Haven and Punta Ycacos Lagoon. These areas will require special management guidelines, monitoring of carrying capacities, and may need to be subzoned in the future to avoid conflicting activities such as bird watching during seasonal bird nesting. Areas of interest are Wild Cane Caye and the Deep River mouth.

11.1.1 Frenchman's Range to Moho Caye

The area referred to as Frenchman's Range includes Frenchman's Caye Lagoon, Frenchman's Caye, Tarpon Caye, Bobby's Caye and extends to include Moho Caye.

Key interests:

- Manatees frequent the lagoon area.
- Frigate and Bobby Bird nesting sites (mangrove cayes and Bird Caye)
- Potential tarpon and permit fishing.
- Five patch reef sites with snorkeling potential.
- Interesting mangrove channel.
- Areas of high ground permitting landing and some camping on Tarpon Caye Bobby's Caye, Frenchman's Caye and South Moho Caye.

4 Protected anchorage.

Potential Activities

Canoeing/kayaking, snorkeling, sport fishing, recreational fishing, sailing, manatee watching, bird watching, general site seeing and camping.

Potential Impact and Conflicts of Use

- The potential for conflict between Kayaks and canoe sailors and powerboats is high, particularly considering the narrow width of many of the mangrove channels in the area.
- The use of the area by wildlife must be considered to avoid propeller injury to manatees, noise disturbance to birds and other wildlife, and changes in natural behavior.
- Damage to the coral through unsupervised snorkeling practice and anchors also needs to be addressed.
- User carrying capacity may be exceeded, specifically in sport fishing areas.
- The excellent protection offered to sail boats within the narrow mangrove channel may cause navigational hazards to other users.

Site Specific Recommendations

* No Wake Zone for the area within the mangrove channels, lagoon and around bird nesting and roosting sites.
* Manatee awareness signs.
* Day mooring buoys deployed away from main access routes.
* Permanent overnight mooring buoys established away from access routes.
* Monitoring of wildlife to ensure no species disturbance resulting in migration.
* Voluntary queuing system for sport fishermen at Tarpon Hole considered.
* All vessels must stay minimum of 30 feet from bird nesting sites.

11.1.2 West Snake Caye

West Snake Caye is currently one of the most heavily used areas for recreation and tourism both by locals and foreign visitors.

Key interests:

4 Relaxation on the sandy stretch of beaches.
4 Bathing opportunities in front of sandy beaches.
4 Snorkeling opportunities on the fringing reefs.

Potential Activity

Picnicking, relaxation, bathing, snorkeling and sports fishing.

Potential Impacts and Conflicts of Use

- Presently vessels beach on the sandy area to off-load passengers. The potential for conflict with bathers in this area is high and has important safety implications.
- Snorkeling activity and potential anchor to the reef must be addressed.
- Carrying capacity is of concern, particularly in snorkeling areas.
- There are currently no toilet facilities.

Sites Specific Recommendation

* Acquisition of some cayes as public land for public use under the National Lands Act 1992.
* Construction of a docking structure to allow for the off loading of visitors and permanent day mooring buoys away from the bathing area.
* Additional mooring buoys established adjacent to the reef on the northern point of West Snake Caye for snorkeling activity.
* Construction and establishment of a small Ranger Station for check in, purchase of recreational passes, information, enforcement of reserve regulations and codes of conduct, and monitoring purposes.
* Allow overnight camping.
* The reserve could consider establishing a small shop.

11.1.3 South Snake Caye

Although privately owned, there is good snorkeling areas on the southeastern side of the caye. The caye can be development for some tourism.

Key interests:

4 Fringing reef
4 Proposed trails
4 Resort

Potential Activity

Accommodation, snorkeling, refreshment and landing point.

Potential Impacts and Conflicts of Use

- Clearance of vegetation could induce erosion of the cayes.
- Considering the number of people that any development can accommodate, waste disposal and pollution is a major concern especially to the fresh water lens.
- Anchor damage associated with snorkeling activity is of concern.

Site Specific Recommendation

* Halt all development until an EIA has been conducted and mitigation measures recommended.
* Place permanent day moorings in sandy areas adjacent to reef on the eastern side of the caye.

11.1.4 New Haven

New Haven falls within the Marine Buffer Zone of the Monkey River Special Development Area, which stipulates regulations for development of the area. The designation was made to ensure that the area of the Punta Ycacos promontory was not subject to development that would drastically after the character and value of the area (McGill), 1994). Regulations include the prohibition of hard development structures and a setback limit of no less that 20 meters calculated based on erosion susceptibility. Permits are required for docks and piers. (BCES, 1992).

New Haven provides a natural harbor well documented for its excellent anchorage and protection. It is for this purpose that this area will be managed. Currently the area of land around the harbor is being subdivided for sale, thus increased development either residential or for recreation can be assumed.

Key interest:

- Protected anchorage and sheltered waters
- Proximity to deep water access
- Small settlements
- Aesthetics

Potential Activity

Anchorage, tourism, landing site, Canoe/kayaks, small sailboats (under 35 foot).

Potential Impacts and Conflicts of Use

- Conflicts between long term residential use of the harbor and visiting vessels may become evident in the future.
- Impacts on water quality, and erosion due to shoreline development.
- Potential conflicts between motor traffic, kayaks, sailboats, and other recreational uses that may develop.
- Threat of destroying the natural appeal of the area through over crowding, and uncharacteristic development creating a negative visual impact.

Site Specific Recommendations

* Planning guidelines established for shore side development and dock facilities (Note: under the Monkey River Development Plan docks and piers can only be constructed after approval through a permit system from the appropriate GOB authorities. This regulation should remain.)
* Establish a permanent mooring buoys system for which fees will be charged. Fees will be structured to accommodate long term mooring leases, overnight charges, and moorings for residential and visitor use. This will assist in controlling visitation.

* No anchorage will be permitted unless mooring buoys are available.
* A No wake zone will be established for the whole harbor and access channel.
* The access channel will be marked and illuminated where possible.

11.1.5 Other Sites of Interest

11.1.5.1 Wild Cane Caye

Wild Cane Caye is privately owned, however it is also the site of five ancient Mayan burial mounds dated around A.D. 910. For this reason the mounds are considered national patrimony. Obsidian, chert and ceramic artifacts can be found. Excavations have been conducted which show that the caye was an ancient obsidian workshop and trading post on the main Mayan canoe route to Yucatan. Numerous fruit trees, and gravestones are evidence of more recent occupation.

Key interests:

4 Archaeological and historical past
4 Interesting mangrove channel entrance and lagoon
4 Varied attractive flora
4 Anchorage
4 Traditional Permit fishing grounds to the south of Wild Cane Caye

Potential Activity

Kayaking/canoeing, land visitation on interpretive trails, anchorage and flyfishing.

Potential Impacts and Conflicts

- Conflicted due to access for landings and visitation of archaeological sites.
- If land visitation is permitted potential impacts include erosion, damage to cultural property, and overcrowding.

Site Specific Recommendation

* Consultation with the Department of Archaeology and owners regarding the possibility of public access to the archeological sites.

* Development of interpretative trials for visitor.
* Overnight mooring buoys can be deployed inside the lagoon area.

11.1.5.2 Deep River Mouth

The area of the Deep River mouth is located in the C1 zone and therefore recreational activity is restricted to non-extractive. No fishing is permitted. A shallow 3 feet sandbar fronts the river mouth and could be a navigational hazard.

Key interests:

- Extensive diversity of orchids and bromeliads
- Birdlife
- Manatee sightings

Potential Activity

Bird watching, manatee watching, general sight seeing on river trips and Kayaking/canoeing.

Potential Conflicts and Impacts

- The potential for conflicts between recreational traffic (wildlife observers, kayaks etc.) and the river usage as a travel route is high.
- Special precaution is needed to avoid propeller injury to manatee, minimize noise disturbance and changes in natural behavior.

Site Specific Recommendation

* Entrance channel markers need to be erected.
* No wake regulations should be enacted.
* Manatee awareness signs should be erected.

11.2 Planning and Design Consideration for Development

11.2.1 Siting of Tourist Related Facilities

Tourist utilizing the proposed Port Honduras Marine Reserve will require accommodations, food service, transportation, interpretative centers, shopping, and tour operations. Due to the fragile nature of the ecological and physical characteristics of the area combined with access constraints, this infrastructure should be concentrated in the coastal settlements of the mainland (Monkey River, Punta Negra, and New Haven and Punta Gorda Town) and capitalize on existing facilities. It would be prudent for the reserve to acquire land for establishing the headquarters and visitor center for administration and visitor education in addition to providing the opportunity for income generation to the management body through the commercialization of food and beverage

service. Limited visitor facilities should be developed on the most heavily used cayes and in a manner not to detract from the natural attraction of the area.

11.2.2 Planning Guidelines for Private and Leased Lands

Considerations should be made for the development of a master plan to deal specifically with tourism/recreational development addressing:

- Architectural style and design;
- Maximum number of rooms with respect to hotel/resort accommodations (under the Belize Tourist Board Act);
- Proximity of water bodies;
- Vegetation clearance;
- Potential disturbance to archeological sites;
- Beach disturbance;
- Impact on wildlife;
- Sewage and solid waste disposal.

A case by case assessment should be made of any proposed development on the cayes and within the buffer coastal areas in accordance with provision of the Environmental Protection Act 1992.

11.3 Constraints and Opportunities for Tourism and Recreational Development

The ecological and cultural diversity of the Port Honduras and buffer areas shows considerable potential for tourism development. This type of development should occur both in line with Government strategy for overall development and specific management objectives for the area. Incentives should be provided for small-scale local operations that respect the ecology and cultural resource of the area. These operations minimize negative impacts, maximize the preservation of biodiversity, and spread economic benefits within the communities.

Present constraints incorporate infrastructure, human resources and financial limitations as shown below along with opportunities provided for management action.

	Constraint	**Opportunity**
Physical	*Poorly developed in-district access routes and travel opportunities. *Poorly developed on site infrastructure. *Lack of interpretative materials. *Limited communications and information centers. *Lack of support industries e.g. craft	-Organize regular tour itineraries. -Maintain but develop the offbeat experience. -Establish a visitor center. -Develop and encourage information centers in local communities. -Sale of information materials (maps etc.) -Develop traditional practices into niche

	centers. *Lac of emergency services.	industries. -Improve social and community development.
Human Resource	*Lack of knowledge regarding statutory requirements within the tourism industry. *Lack of basic training opportunities within the hospitality industry. *Limited trained personnel.	-Use extensive local knowledge of natural and cultural history of the area. -Capitalize from local skills such as boat handling, interpersonal skills and small business skills. -Encourage cultural interaction (Maheia, 1995) -Develop site specific training materials using community inputs.
Financial	*Poor marketing of the area. *Limited capital resources particularly for those individuals currently with a subsistence lifestyle.	-Small scale enterprises may have minimum start-up costs. -Often tangible resources are in existence e.g. motor boats, dories, natural products and land. -Opportunities for joint initiatives e.g. marketing, tours circuits etc.

11.4 Visitor Management Policies and Code of Conduct

11.4.1 Visitor Entrance Fees

Recreational and Tourism Use

Pass category: ***recreational pass***

An entrance fee system of recreational passes will be structured for all visitors using the marine reserves for recreational and tourism purpose. This will contribute towards management of the area and provision for infrastructure to enhance visitor experience.

Belizeans and foreigners under the age of 12 will not pay any recreational fees.

The recreational pass will be structured at different rates to accommodate:
* Daily use
* Weekly use

Administration

All recreational passes must be shown upon request to patrolling enforcement officers and other management personnel in the reserve.

Independent Visitor

All independent visitors must register and purchase a recreational pass. Recreational passes will be made available at a number of strategic locations to accommodate most entrance routes to the area. These include:

* Reserve Headquarters (Punta Gorda Town)
* West Snake Caye Substation
* Punta Gorda Town (Customs and Immigrations of BTB or TIDE).
* Monkey River Village

Note: In the event that necessary recreational passes are not held, passes must be purchased directly from the patrolling conservation officers.

Visitor with Licensed Tour Guides

Visitors with licensed tour guides will be able to purchase recreational passes directly from the guide. This will ensure less inconvenience to both the visitor and the tour guide undertaking booked tours and activities. Licensed guides and tour operators should purchase passes in advance from the managing authority.

Note: The license of any guide found to be inconsistent with the recreational pass procedures will have his/her licence revoked.

Cruise ships

Cruise ship operators may purchase recreational passes in advance for their passengers from the managing body. All cruise ships will be required to radio their arrival within the reserve boundaries for reserve personnel boarding.

11.4.2 Reserve Residents

Pass Category: Resident Pass

All residents of the Coastal Area buffering the Port Honduras Marine Reserve and those residing within the reserve boundaries will not require a pass.

Administration

Belizeans will have to prove their citizenship.

11.4.3 Access Only

No pass necessary. All boats and passengers utilizing the Port Honduras marine reserve for access only, with no intent to partake in recreational, commercial or fishing activity or any other use of the reserve will not be subject to entrance pass fees and requirements. Access users must remain in access channels while in the reserve and comply with reserve regulations.

11.4.4 Commercial Fishers

No pass necessary. All individuals using the reserve for commercial fishing purpose must obtain an annual commercial fishing licence from the management authority in accordance with the reserve regulations.

11.4.5 Research and Educational Purpose

No pass necessary. All individuals using the reserve for educational purpose must report to the managing authority for permission and guidelines prior to any activity. Independent research not conducted as a component of the research and monitoring Programs of the reserve will require a research permit. Research activities conducted in conjunction with the managing body will also require research permits although fees may vary or be waived.

11.4.6 Licensed Tour Guides

No pass necessary while acting in the capacity of tour guide within the reserve boundaries.

11.4.7 Additional Charges

Mooring fees

No mooring fees will be charged to vessels overnighting within the Port Honduras Marine Reserve.

11.5 Tour Guide Requirement

All tour guides operating in the Port Honduras Marine Reserve must hold a tour guide license issued by the BTB.

All licensed tour guides must comply with the following:

☑ completed site specific guide training program offered by the managing authority covering:

-natural history and ecology of the area
- archaeological information
-public relations
-interpretation skills
-water safety
-first aid

-reserve regulations and "codes of conduct"

- ☑ must be over the age of 18
- ☑ must be of proven good character
- ☑ must be a Belize national or have Belize resident status
- ☑ must pay annual boat license
- ☑ all those wishing to conduct SCUBA activities must hold minimum qualification of PADI Dive Master or equivalent

11.6 Cruise Ship and Recreational Vessel Requirements

Existing Government Legislation apply for all cruise ships and commercial recreational vessels operating within the reserve. This includes:

- ⦿ Belize Tourist Board (Private and Commercial Recreational Vessels) Regulations SI #6 of 1996;
- ⦿ Cruise Ship Environment Compliance Plan regarding anchoring of recreational vessel activities, waste disposal and cumulative impacts of ship in Belize;

In addition:

Day excursion from cruise ships to inland and small island destinations within the reserve must be offered to the passengers through local Belizean companies. All services such as transportation, food, drinks, sales, souvenirs etc. must also be provided by local Belizean companies. All guides used must be licensed tour guides.

Maximum negative impacts groups should be evaluated for each Caye within the reserve and carrying capacity threshold numbers adhered to.

- ⦿ Physical size of area (acreage);
- ⦿ Ecological importance and sensitivity;
- ⦿ Cultural importance and sensitivity;
- ⦿ Facilities provided to accommodate and mange tourist behavior;
- ⦿ Time of the year e.g. turtle nesting time.

In the interim DOE compliance numbers as stated below should be adhered to:

SITE	**MAXIMUM NUMBER OF PEOPLE**
Archaeological Site	**25 persons** at any site at any one time
Snorkeling Sites and Cayes	**No more than 50 persons** should Be take to any

snorkeling site/Caye at any one time

11.7. Code of Conduct for Users

11.7.1 Sailing *To be determined*

11.7.2 Kayaking *To be determined*

11.7.3 SCUBA *To be determined*

11.7.4 Snorkeling *To be determined*

11.7.5 Recreational Fishing *To be determined*

11.7.6 Camping *To be determined*

11.7.7 Jet Skiing ***No jet Skiing will be allowed in the reserve.***

12. AMINISTRATION

It is proposed that the Fisheries Department and TIDE will be responsible for the overall management of the Port Honduras Marine Reserve. As described in the legislative authority section of this management plan, community and stakeholders will be imperative to the success of the reserve.

12.1 Staffing

Hiring of staff will be a crucial activity at the beginning of the implementation of management plans for the Port Honduras Marine Reserve. A protected area manager will be hired and will be responsible for the overall management. Two biologist, four conservation officers, a secretary and volunteers will support the manager. The staff will be responsible for administration, collecting user fees, surveillance and enforcement, and research and monitoring. Salaries will be a major cost in the management plan implementation.

Initially, six four conservation officers will be hired. Two biologists will be hired at the associates degree level. They will be responsible for conducting the research and monitoring programs and will work with visiting researchers. The entire staff will be responsible for interpretation and education. An accountant will be hired for financial auditing at the end of the year.

Training

Upon hiring of the staff it will be necessary to provide training to the rangers, biologists, and administrative staff. The Fisheries Department and TIDE will be responsible for preparing a training program for the staff. Training will be in coastal and marine ecosystems management, protected areas management and interpretation, public relations and law enforcement. The training program will be conducted nationally within the other institutionally managed marine reserves and internationally where applicable.

12.2 Infrastructure

As with the initiation of any business, management of the Port Honduras Marine Reserve will require a substantial investment especially for infrastructure. The reserve headquarters and two substations will need to be constructed. This infrastructure will house and facilitate the manager

and staff in conducting their duties of collecting fees, ensuring appropriate use, providing interpretation and education, research and monitoring.

In the initial stage of implementation of the management plan TIDE office in Punta Gorda can serve as a temporary headquarters.

Necessary equipment for transportation, communication, and monitoring will also need to be procured in the initial phase. It is envisaged that at least two boats with engines will need to be bought preferably with backup engines.

12.3 Budget

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries & Wages (A)					
1 Manager	$22,000.00	$23,500.00	$25,000.00	$27,000.00	$29,000.00
2 Biologists	$36,000.00	$38,000.00	$40,000.00	$42,000.00	$44,000.00
4 Conservation Officers	$52,000.00	$55,000.00	$59,000.00	$64,000.00	$70,000.00
1 Secretary	$9,600.00	$10,000.00	$10,500.00	$11,600.00	$12,200.00
1 Janitor	$6,000.00	$6,600.00	$7,300.00	$8,100.00	$9,000.00
Consultation Fees	$20,000.00	$20,000.00	$20,000.00	$15,000.00	$10,000.00
Overtime	$20,000.00	$20,000.00	$20,000.00	$20,000.00	$20,000.00
Social Security	$3,000.00	$3,000.00	$3,000.00	$3,000.00	$3,000.00
Sub-Total	**$168,600.00**	**$176,100.00**	**$184,800.00**	**$190,700.00**	**$197,200.00**
Expendable (B)					
Uniforms - 16 pairs/20 pair shoes	$1,600.00	$1,700.00	$1,800.00	$1,900.00	$2,000.00
Fuel -	$60,000.00	$60,000.00	$65,000.00	$70,000.00	$70,000.00
Lube -	$20,000.00	$20,000.00	$21,000.00	$23,000.00	$23,000.00
Subtotal	**$81,600.00**	**$81,700.00**	**$87,800.00**	**$94,900.00**	**$95,000.00**
Office Equip./Supplies(C)					
5 Desks	$2,500.00		$1,000.00		$1,000.00
5 Filing cabinets	$3,000.00		$1,200.00		$1,200.00
4 Display cases	$5,000.00		$1,300.00		$1,300.00
2 Computer systems	$10,000.00		$5,000.00		
1 Photocopier	$10,000.00				
1 Multipurpose Projector	$10,000.00				
1 Base Station Transceiver	$2,200.00				$2,400.00
3 Display Tables	$1,500.00		$600.00		$1,300.00
Photographs/Maps/Brochures	$6,000.00	$7,000.00	$8,000.00	$9,000.00	$10,000.00
Toner/paper/pens etc.	$10,000.00	$11,000.00	$12,000.00	$13,000.00	$14,000.00
Subtotal	**$60,200.00**	**$18,000.00**	**$29,100.00**	**$22,000.00**	**$31,200.00**
Utilities (D)					
Electricity	$7,000.00	$7,500.00	$7,500.00	$8,000.00	$8,000.00
Water	$2,500.00	$2,500.00	$2,500.00	$3,000.00	$3,000.00
Telephone/fax/internet	$8,000.00	$8,000.00	$8,500.00	$9,000.00	$9,000.00
Repeater Rental	$2,500.00	$2,500.00	$2,700.00	$3,000.00	$3,000.00
Subtotal	**$20,000.00**	**$20,500.00**	**$21,200.00**	**$23,000.00**	**$23,000.00**
Equipment (E)					
1Headquarter/2 Substations	$180,000.00				

2 27ft. Boats & engine (complete)	$120,000.00		$36,000.00		$50,000.00
5 Handheld radios	$6,000.00		$2,000.00		$4,000.00
4 Base station radios complete	$8,000.00		$1,000.00		$3,000.00
4 Binoculars	$3,200.00				
2 Infra-red scopes	$3,000.00				
4 Mega-phones	$1,800.00				
2 High beam lights	$1,400.00		$1,500.00		
1 Radar complete	$6,000.00				$2,000.00
4 Sets diving gear complete	$14,000.00		$2,000.00		$3,000.00
1 Air compressor	$10,000.00		$2,000.00		$2,000.00
20 Scuba tanks	$4,000.00				$2,000.00
1 Hydro lab complete	$20,000.00		$5,000.00		
1 Field laptop computer	$6,000.00		$2,000.00		
Lab equipment	$10,000.00		$4,000.00		$3,000.00
Lab chemicals	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00
Marker buoys	$10,000.00		$3,000.00		$2,000.00
Mooring buoys	$40,000.00	$3,000.00	$3,000.00	$3,000.00	$5,000.00
Subtotal	**$449,400.00**	**$9,000.00**	**$67,500.00**	**$9,000.00**	**$82,000.00**
Travel (F)					
30 Trips (incountry)	$3,500.00	$3,500.00	$3,500.00	$4,000.00	$4,000.00
Per diems	$6,000.00	$7,000.00	$8,000.00	$9,000.00	$10,000.00
5 Trips (international)	$4,000.00	$5,000.00	$5,000.00	$6,000.00	$6,000.00
Per diems	$6,000.00	$7,000.00	$8,000.00	$9,000.00	$10,000.00
Subtotal	**$19,500.00**	**$22,500.00**	**$24,500.00**	**$28,000.00**	**$30,000.00**
Education (G)					
Staff: seminars,conferences etc.	$20,000.00	$20,000.00	$15,000.00	$15,000.00	$15,000.00
Outreach programs:					
Workshops	$12,000.00	$12,000.00	$12,000.00	$12,000.00	$12,000.00
Posters,signs,booklets etc.	$25,000.00	$15,000.00	$15,000.00	$10,000.00	$10,000.00
Subtotal	**$57,000.00**	**$47,000.00**	**$42,000.00**	**$37,000.00**	**$37,000.00**
Grand Total	**$856,300.00**	**$374,800.00**	**$456,900.00**	**$404,600.00**	**$495,400.00**

Note: Expenditures on equipment item for subsequent years involves replacements & repairs.

13. FINANCIAL SUSTAINABILITY PLAN

Financial sustainability of the Port Honduras Marine Reserve is a stated goal in this management plan. Capital expenses that will be incurred in the initial stages will be sought through grant funds. It is expected that funds will be generated through entrance and user fees, a trust fund, and merchandizing of souvenirs.

13.1 Entrance & User Fees

There will be a general admittance fee of $5.00 for entrance to the Port Honduras Marine Reserve. This fee will allow for snorkeling and site seeing in designated areas. A special fee will be charged for sportsfishing in designated areas. The Fisheries Department and TIDE will need to lobby so that the 20% contribution from user fees to PACT be abolished. This contribution is ***detrimental*** to the financial status of any marine protected area in Belize as experienced by the Hol Chan Marine Reserve.

13.2 Trust Fund

The Fisheries Department, TIDE and the advisory committee will lobby to establish a trust fund similar to the Hol Chan Marine Reserve Trust Fund. This mechanism can be instrumental in assuring that revenue collected by the reserve is used for management and equipment acquisition. The trust fund Statutory Instrument should be gazetted as the proposed reserve boundaries and regulations are enacted.

This fund can generate additional funding through a membership drive and donation by funding agencies and corporations.

13.3 Sales and Marketing

There will be an opportunity to sell gift items such as crafts and T-shirts that reflect aspects of the area. This should generate some of the funds to aid in management cost. Special marketing will need to encourage ecotourism in the area. This will be done in conjunction with the Belize Tourist Board who is preparing a tourism plan for the Toledo District.

14. IMPLEMENTATION PLAN

Due to size of the Port Honduras area, severely limited financial and human resources, the implementation of the Port Honduras Marine Reserve Management Plan will need to be conducted in three phases. Much emphasis will be to be given to capacity building. It is the intent of this plan to assist in providing alternative employment and entrepreneurial opportunities for the local residents of the protected area, especially those who will need to alter their means of earning a living. Communities and stakeholders will be represented on the reserve advisory committee.

Phase I: Preparatory

The first activity for the implementation of management plan will be the appointment of the members for the reserve advisory committee as outlined within the legislative authority section of this plan. Meeting with the Police Force, Belize Defense Force Maritime Wing, Custom and Immigration Departments will be conducted during to establish coordinated and effective enforcement.

Funding for the plan's implementation will be sought. A reserve manager will be hired as soon as the reserve is established. An important activity will be to continue the work that TIDE's planning team and the communities of the area began during the planning phase. There will be a need to work with those persons and families that will be impacted by the establishment of this protected area. Alternative economic activities that be conducted within the reserve will be addressed. The communication system as described in the enforcement section can also be implemented.

Phase II: Establishment

This phase should begin with the employment of the rest of staff. Initially, the conservation officers will need to undertake training in protected areas management, and become familiar with the management plan and the zoning scheme. Boats and communication equipment will become necessary at this time.

Of utmost importance during this phase is the demarcation of the park boundaries and the various zones according to the zoning plan of this document. The placement of sign and moorings in strategic locations will also be conducted.

Construction of the headquarters, with a visitor center and laboratory, should begin at this stage. This should be followed by the construction of the substations and procuring the necessary equipment.

Enforcement will be complimented with an education campaign targeting the communities and users of this reserve. This is in order to provide a reasonable time-frame for the Belizean public to become aware of the establishment of the Port Honduras Marine Reserve.

Phase III: Operational

This phase will begin the full implementation of the zoning scheme and permitting arrangements according to this management plan. The visitor center and research station should be fully operational at all time. In the initial stage of implementation of the management plan the TIDE office in Punta Gorda can serve as a temporary headquarters.

Necessary equipment for transportation, communication, and monitoring will also need to be procured. It is envisaged that at least two boats and engines will need to be purchased preferably with back-ups.

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