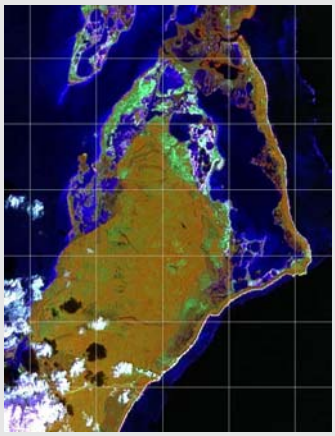
The Revised

Bacalar Chico National Park
&
Marine Reserve Management Plan



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LIST OF ABBREVIATIONS

ACMP	Ambergris Caye Management Plan
ACPC	Ambergris Caye Planning Committee
AMTVE	Accessories, Tools, Vehicles & Equipment
BAS	Belize Audubon Society
BCAC	Bacalar Chico Advisory Committee
BCES	Belize Center for Environmental Studies
BCMR	Bacalar Chico Marine Reserve
BCNP	Bacalar Chico National Park
BCNP/MR	Bacalar Chico National Park and Marine Reserve
BFD	Belize Fisheries Department
CCC	Coral Cay Conservation
CHPA	Central Housing Planning Authority
CIQRO	Centro de Investigaciones de Quintana Roo
ECOSUR	El Colegio De La Frontera Sur (Formerly, CIQRO)
COMPACT	Community Management Of Protected Areas Conservation Project
CZMA/I	Coastal Zone Management Authority and Institute
EU	European Union
FSCMRM	Financing System for Coastal and Marine Resource Management
GEF	Global Environmental Facility
GOB	Government of Belize
GRMR	Glovers Reef Marine Reserve
IRR	Internal Rate of Return
ITCF	International Tropical Conservation Foundation
IUCN	The World Conservation Union
LIBOR	London InterBank Offer Rate
LIC	Land Information Centre
MBRS	Mesoamerican Barrier Reef System
MMP	Marine Monitoring Program
MPAC	Marine Protected Areas Coordinator
ACMP	Ambergris Caye Master Plan
NACDC	Northern Ambergris Caye Development Corporation
NARMAP	Natural Resources Management and Protection Project
NPV	Net Present Value
PFB	Programme for Belize
REA	Rapid Ecological Assessment
RMP	Revised Management Plan
TMP	Terrestrial Monitoring Program
TNC	The Nature Conservancy
UNESCO	United Nations Educational, Scientific & Cultural Organization

1. INTRODUCTION

1.1 Background

Designation of the Bacalar Chico region on northern Ambergris Caye as a United Nations Educational, Scientific and Cultural Organization (**UNESCO)** world heritage site was more than a decade in the making. Early field studies of the region were quick to recognize the region's unique natural characteristics warranted managed conservation, and hence promised an ideal location for a mixed terrestrial and marine reserve.

In 1991, representatives of the Coastal Zone Management Unit *(Janet Gibson),* the International Tropical Conservation Foundation (*Dr. Martin Bijleveld van Lexmond*), Hol Chan Marine Reserve (*James Azueta)* and professors Dr. Archie Carr III and Dr. Philippe Kupfer of Gainesville, Florida conducted an official site visit to the Bacalar region (Gibson, 1991), and so were among the first contemporary conservationists to recognized the importance of the Bacalar region for preservation.

In 1993, the Broadhead Group, a US-based company, presented a proposal to develop Northern Ambergris Caye as a major resort and community for overseas retirees, which in turn prompted a the regions first detailed environmental assessment. Belize Center for Environmental Studies (**BCES**) conducted the assessment and found the Bacalar region to have a much higher terrestrial diversity than commonly found on Belizean cayes (BCES 1993). This finding resulted in BCES' designation of the region as having the highest possible rating for conservation (21), in respect of increasing developmental pressures on Ambergris Caye. Although recognizing the Bacalar region's need for protection, the Broadhead proposal ultimately did not succeed due to conflicts with many of Belize's development policies at the time and lack of sufficient integration with San Pedro Town stakeholders (Ishmael, 1994).

In 1994, the International Tropical Conservation Foundation (**ITCF**) conducted a terrestrial wildlife survey of the Bacalar region and determined that Jaguar (*Pantera onca*) and Puma (*Puma concolor*), both threatened species, continued to be extant within the Bacalar region (Cf. Smith 1995). More recent studies, however, suggest as least 10 threatened species continue to be extant within the Bacalar region (Samos personal communication). In 1995, a national initiative by the Natural Resources Management Plan and Protection Project (**NARMAP***)* to develop a protected areas system plan for Belize's diverse vegetation assemblages, specifically recommended the Bacalar region's unique salt marsh ecosystem for conservation within the national plan (Programme for Belize 1995).

The coastal reaches of the Bacalar region also support many unique natural characteristics, not the least significant of which is the area known locally as Rocky Point, which is the only location in Belize where the Belize Barrier Reef touches the shoreline. During the 1990's, the coastline from Rocky Point southwards to Robles Point was recognized as an important marine turtle nesting area, supporting the largest number of Loggerhead and Green Sea Turtle nests in Belize, as well as periodic visits by nesting Hawksbill Turtles. The offshore marine habitat was long known as an important breeding area for the commercially valuable Queen Conch, as well as a seasonal spawning bank for Nassau and Yellowfin Groupers, and a variety of other species.

The Bacalar region has a long history of cultural importance. Archaeological studies conducted in the 1980's recognized the coastal reaches of the Bacalar region once supported several trading, agricultural and fishing settlements established by the ancient Maya; and the area has intermittently been utilized by settlers from colonial times to the present day. The Bacalar Chico channel provides fishers from the mainland villages of Sarteneja and Corozal access to the inner lagoon, the main barrier reef and deep waters from the western side of Ambergris Caye, but the coastal reaches of the Bacalar region are also easily accessed by fishers entering from Mexico in the north as well as fishers entering from San Pedro Town in the south. Such ease of accessibility to the rich marine resources of the region, in the absence of any formal management presence, eventually led to depletion of the Bacalar regions marine resources, which by the early 1990's, prompted members from area fishing communities to begin expressing concern about illegal fishing in the area, particularly in regard to the Grouper and Queen Conch spawning banks, and the once viable populations of bonefish in the Laguna de Cantena.

The impetus to declare the Bacalar Chico area as a mixed terrestrial and marine reserve was in large part galvanized by the combined influences of the regions declining marine resource base, and the anticipated economic benefits that the traditional fishing communities of San Pedro, Sarteneja and Corozal Town might recover from utilizing the Bacalar region for tourism. Consequently, in the face of declining income, as well as the popularity and success San Pedro Town was realizing from establishment of the Hol Chan Marine Reserve, the community leaders of Sarteneja sought advice from the ITCF and the Belize Fisheries Department (**BFD**) about the possibility of protecting the Bacalar Chico Area.

In practice, the subsequent promotion of the Bacalar region as an ideal location for a National Park and Marine Reserve was an enormously collaborative effort, the endorsement for which came from a wide range of stakeholders, including area fishing communities and a number of local and international environmental organizations. The BFD formally initiated this process by preparing a plan to secure funding for the establishment of the Bacalar Chico National Park and Marine Reserve. The proposal was submitted to the European Union, with ITCF assistance, as *EU-DG VIII* in November 1992, in collaboration with the International Union for the Conservation of Nature (**IUCN**) and Coral Cay Conservation (**CCC**), and funds were made available to ITCF in 1993.

In 1995, funds were made available to the BFD and immediately a manager (Dylan Gomez), a terrestrial biologist (Michael Summerville), a marine biologist (Isaias Majil), two rangers (Auriol Samos and Remi Reyes), were hired as staff for the soon to be Bacalar Chico National Park and Marine Reserve. No infrastructure was available for staff at the time; but permission was granted by Mrs. Louise Young, a land owner on the Northern windward side of the region, to utilize her land and house at the end of a pier as staff quarters. The staff slept in tents with insect netting in order to avoid the mosquitoes that swarmed the area especially during the rainy season. Marine surveys were being conducted by a team of volunteers and project leaders from the CCC during this period to provide the information needed in preparation of a management zoning scheme for the area.

Both the Bacalar Chico National Park and Marine Reserve were granted legal recognition in 1996. In 1999, the Coastal Zone Management Authority and Institute (**CZMA/I**) started paying salaries and operational expenses for marine protected areas designated as UNESCO World Heritage Sites from UNDP funding of its *Sustainable Use of the Barrier Reef Project.* The five-year project, designed for institutional strengthening of the marine protected areas system in Belize, and for the Bacalar Chico National Park and Marine Reserve, ends in 2004 with the presentation of the management plan described herein.

1. 2 Legislation And Authority

Legislation

Statutory Instrument 89 of 1996 (Cf. **Addenda 1**) created the Bacalar Chico National Park (**BCNP**) under the National Park Systems Act (Laws of Belize Chapter 215, Revised 2000). The national park encompasses 12,640 acres of land and includes the Laguna de Cantena, which is one of the largest lagoons in Northern Ambergris Caye. Private lands within the National Park boundary acquired prior to designation are regulated by the Lands Department under the Ministry of Natural Resources, Environment and Industry.

Statutory Instrument 88 of 1996 (Cf. **Addenda 2**) created the Bacalar Chico Marine Reserve (**BCMR**) under the Fisheries Act (Laws of Belize Chapter 210, Revised 2000). The marine reserve encompasses 15,529.33 acres of coral reefs, sea grass beds and mangrove habitats. Statutory Instruments 68 and 136 of 2001 established the zones and regulations for the Bacalar Chico Marine Reserve (Cf. **Addenda 3** and **4**, respectively).

Authority

Ministerial responsibility for the Bacalar Chico National Park and Marine Reserve is shared between the Ministry of Natural Resources, Environment and Industry (responsible for National Parks, Natural Monuments, Wildlife Sanctuaries and Reserves) and the Ministry of Agriculture and Fisheries (responsible for marine reserves).

The Ministry of Housing has responsibility through the implementation of the Ambergris Caye Master Plan which applies to all the private land within the national park. The Ambergris Caye Planning Authority of the Central Housing and Planning Authority (Ministry of Housing) was established in 1990 under the Housing and Town Planning Act (Laws of Belize Chapter 182, Revised 2000) to implement the provisions of a declaration to prepare a zoning plan for Ambergris Caye. The Ambergris Caye Master Plan (**ACMP**), accepted by Cabinet, provides this zoning plan (Anon. 1992). In 1993, the Ambergris Caye Planning Authority was renamed the Ambergris Caye Planning Committee (**ACPC**). It is responsible for the implementation of the plan. Special responsibility for the development and management of Northern Ambergris Caye lies with the Northern Ambergris Caye Development Corporation (**NACDC**) set up in 1991 under Act No. 25 of 1991. The zoning scheme in the Ambergris Caye Master Plan includes provisions for the establishment of protected areas in Northern Ambergris Caye but none have ever been established as specified in the zoning scheme.

1.3 Development And Purpose Of The Revised Management Plan

The Revised Management Plan (**RMP**) for Bacalar Chico National Park and Marine Reserve (**BCNP/MR**) presented herein substitutes the draft Management Plan developed by Dotherow *et al* (1995), which has provided an informal management framework for the BCNP/MR over the past 9 years. The RMP presented here has been designed to serve as a comprehensive 10-year strategic plan, which addresses both the conservation and economic sustainability needs of the BCNP/MR. The Plan is presented in four sections. These include: (1) a review of the BCNP/MR's key environmental characteristics; (2) a review of the BCNP/MR's existing management framework; (3) an analysis of key threats and constraints to management effectiveness; and (4) a conservation and economic sustainability strategy for the BCNP/MR. An authoritative bibliography of reports and related studies is enclosed with the RMP, along with two CD's containing select reports in PDF format and GIS data for the BCNP/MR. Twenty-three of the 49 literature citations of this report, along with GIS and Jpeg files used to construct the map presentatoins are enclosed as a separate attachment in CD format.

2. ENVIRONMENTAL CHARACTERISTICS

2.1 Spatial Characteristics

Location and Boundaries

The location of the BCNP/MR is shown in **Illustrations 1** and **2**. The BCNP/MR spans the northern portion of Ambergris Caye from the Bahía Chetumal on the west to the Caribbean Sea on the east, and encompasses a total of 28,169 acres. The northern boundary of the BCNP/MR is formed by Belize's international boundary with Mexico. A portion of this boundary is described by the Bacalar Chico Canal, which is reputed to have been created by the ancient Maya ca. 500 AD (Guderjan 1993).

The boundaries of the National Park run from the Belize/Mexico Border southward along the eastern coastline to a point just south of Robles Point, then northwest to a point near the middle of Ambergris Caye, then southwest to a point east of Santa Rita, then northward along the western coastline to the Belize/Mexico Boarder. The National Park has a maximum width of 7.5 km between Rocky Point on the east coast and San Juan on the west, and encompasses 12,640 acres of terrestrial habitats, wetlands and inland lagoons.

The boundaries of the eastern Marine Reserve run from the northeast corner of the National Park at the Belize/Mexico Boarder eastward to 600 meters fathom outside the barrier reef, then southwest to the 600 meters fathom just south of Basil Jones, then to the northwest until intersection with the coastline, and thereafter along the coastline to the north eastern corner of the National Park. The boundaries of the western Marine Reserve run from Santa Rita westward across the Chetumal Bay to the south eastern corner of the Corozal Bay Manatee Wildlife Sanctuary, then northward to the Belize/Mexico Boarder, then eastward along the Belize/Mexico Boarder to the north western corner of the National Park, and thereafter southward along the coastline to Santa Rita. Signs at key locations inform users as to the boundaries of the National Park and Marine Reserve. The marine reserve spans 15,529 acres of coastal waters, which include the northernmost portion of the Belize Barrier Reef and the northernmost portion of the Barrier Reef Lagoon on the east, and a portion of Corozal-Chetumal Bay on the west.

Access

Access to the area is currently by sea. Travel time from San Pedro to Boca Bacalar Chico via the eastern side of Ambergris Caye is about one hour in moderate weather conditions. Travel via the eastern side is not recommended in heavy seas because boats must pass over the reef at Rocky Point to gain access to the northernmost span of the Barrier Reef Lagoon. Travel time from San Pedro to the Bacalar Chico Canal entrance via the western side of Ambergris Caye is about an hour and a half, and a further 30 minutes to traverse the Bacalar Chico Canal to the eastern side of the BCNP/MR. The western approach can be used in most weather conditions, but is only suitable for shallow draft vessels as the maximum depth on this coast is about 1.5 - 2.0 meters.

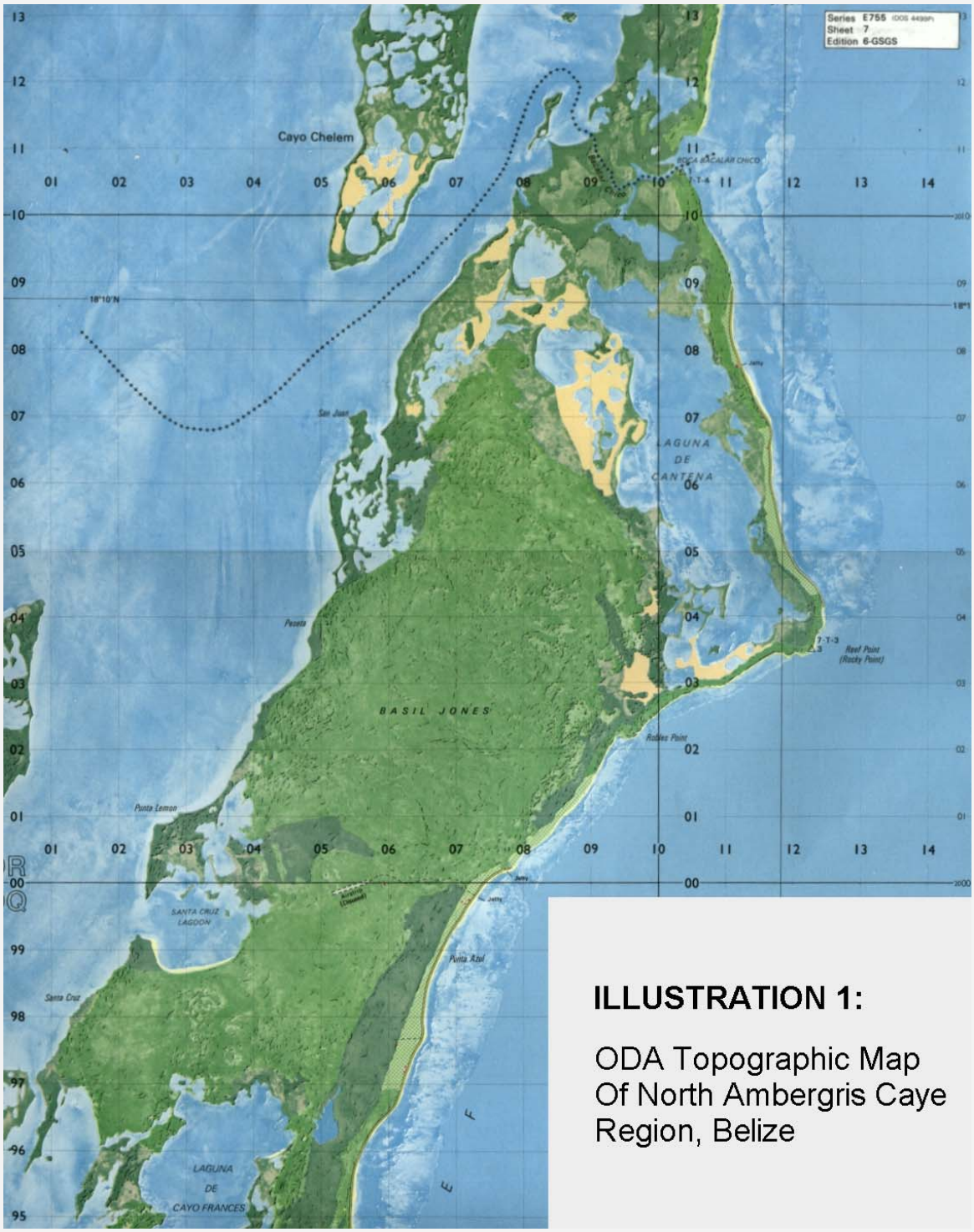


ILLUSTRATION 1:

ODA Topographic Map Of North Ambergris Caye Region, Belize

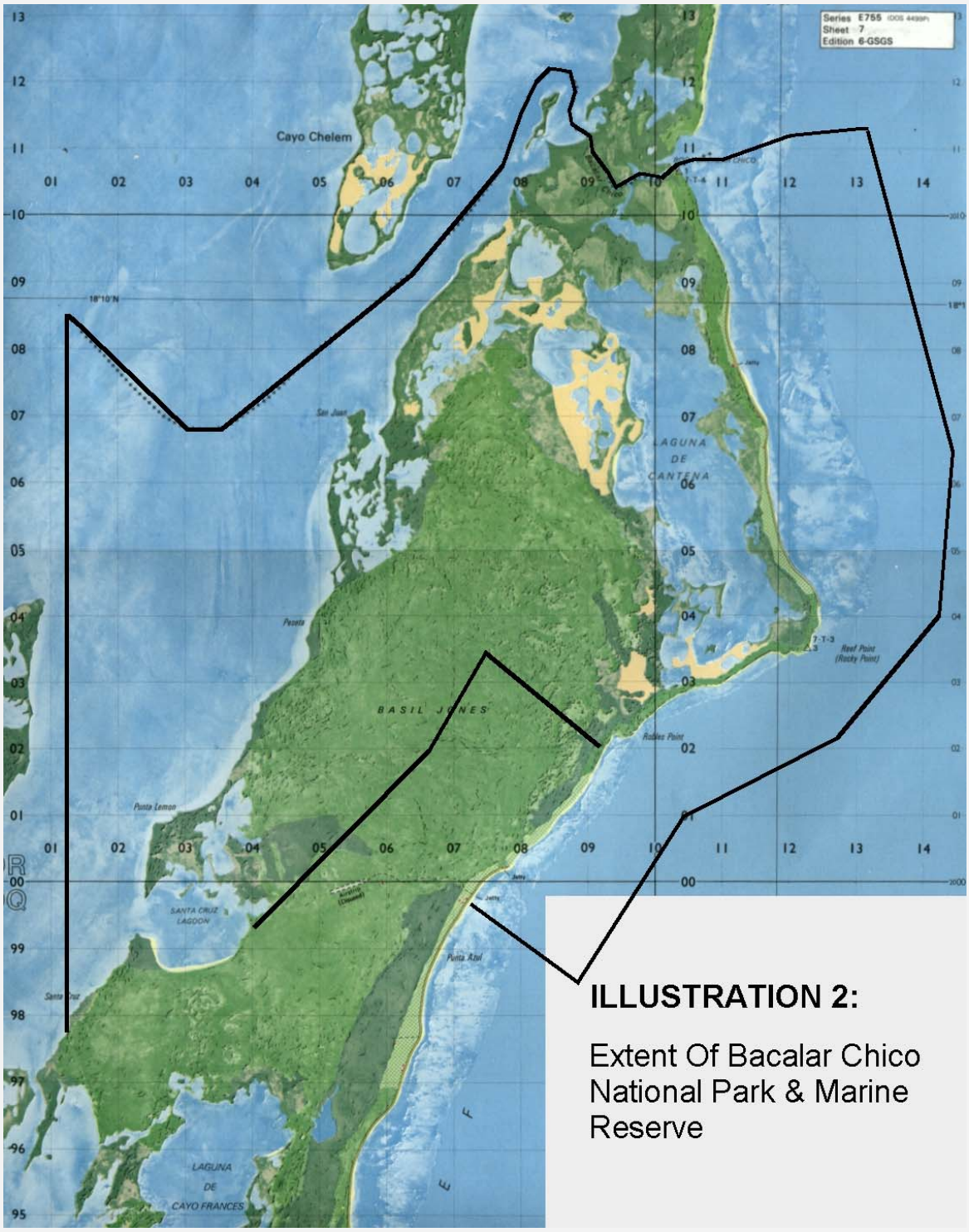


ILLUSTRATION 2:

Extent Of Bacalar Chico National Park & Marine Reserve

Journey time from Sarteneja, 20-25 kilometers across Corozal/Chetumal Bay, is about 1.5 hours, and is also limited to shallow draft vessels. During the period of November to March navigation on the west side is affected by strong northerly winds. Wind speeds during these conditions can blow from the North or West at 15 – 25 knots causing rough sea conditions and virtually zero navigation visibility. The southernmost reach of the BCNP/MR can be accessed overland via a dirt track which extends along the east coast; as well by small airplanes which can land at the NOVA Shrimp Hatchery airstrip.

Land and Sea Tenure

National Park lands consist of Crown Lands held by the Government of Belize (**GOB**) and Private Lands held by independent title (Cf. **Illustration 3**). Approximately 80 % of the National Park consists of Crown Lands that acquired in 1990 by the GOB from the former Pinkerton Estate. Approximately 20 % of the National Park consists of Private Lands that were titled prior to designation and are held as 1 parcel at San Juan on the west (where BCNP/MR headquarters are located) and as several parcels along the entire shoreline on the eastern side of the BCNP. The seabed (defined as the land extending seawards from the high water mark of ordinary tides) is National Land owned by the Government of Belize under the authority of the National Lands Act (Laws of Belize Chapter 191, Revised 2000). Under Crown Land Rules (Statutory Rules and Orders 66 of 1939), a 66 ft wide strip of land along all water frontages, measured from high water mark, is designated as public easement, but lands titles prior to 1930 included the land to the high water mark and in some cases, below the high water mark.

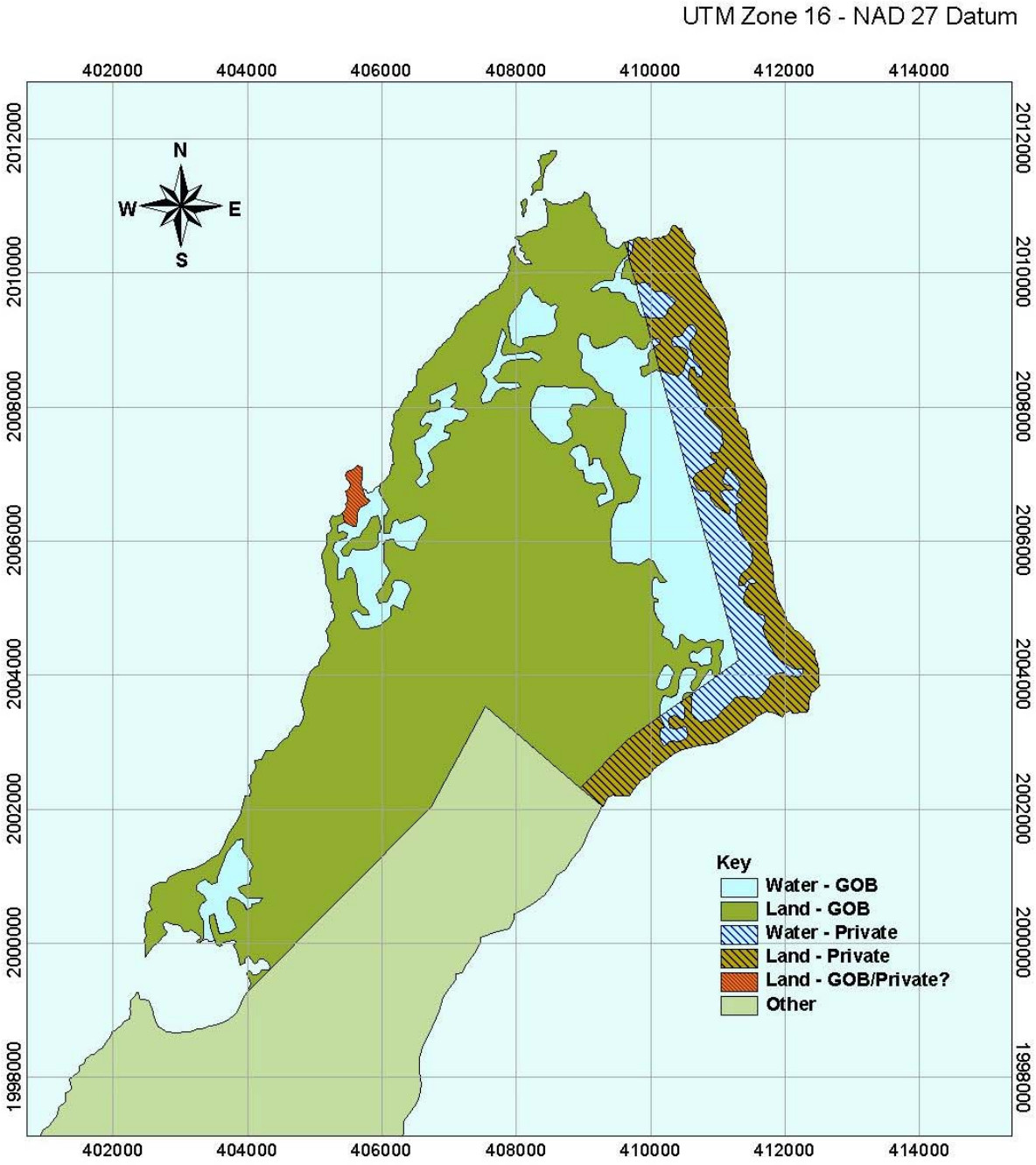
Imagery Coverage

Aerial photographs at 1:10,000 were taken by the Airborne Sensing Corporation in 1993, and were assembled by BCES to form a photographic mosaic of the whole of Ambergris Caye. A series of thirty-five 1:24,000 colour aerial photographs were taken by The Nature Conservancy (**TNC**) on 15 June 1994, which cover the entire BCNP/MR. These photographs were digitised and used to produce various geo-referenced base maps of the Bacalar Chico area based on 11 ground control points. These maps are available on ARC/INFO and ARC/VIEW software formats at the Fisheries Department, Coastal Zone Management Institute and the Land Information Center (**LIC**) in the Ministry of Natural Resources. Aerial panachromic photographs at 1:35,000 scale were taken by the British Forces survey in late 1980's. Mr. Jimmy Smith, photographer and land owner in the Bacalar Chico Area, has taken various large-format photographs of the area (Cf. **Illustration 4**). Some of Mr. Smith's photographs were used to digitise habitat maps of the area by reserve personnel. NARMAP and Programme for Belize (**PFB**) and produced two editions of vegetation map for Belize in GIS in 1995 and 2000.

Satellite imagery of the BCNP/MR is available from a variety of organizations, including the LIC and Ecoworks (a private sector consulting group). A LandSat 5 image collected in March/April 1993 is available at the LIC, which shows good detail of both marine and terrestrial habitats. Ecoworks has provided 1990 LandSat 5 (30-meter resolution) and and 2001 LandSat 7 (15-meter resolution) band arrangements emphasising vegetation cover (453/RGB) and sea floor characteristics (321/RGB) for presentation with the RMP described herein (Cf. **Illustrations 5** - **8**).

ILLUSTRATION 3:

Land Ownership Within The Bacalar Chico National Park, Ambergris Caye



Prepared By: T Grimshaw / Ecoworks

ILLUSTRATION 4:

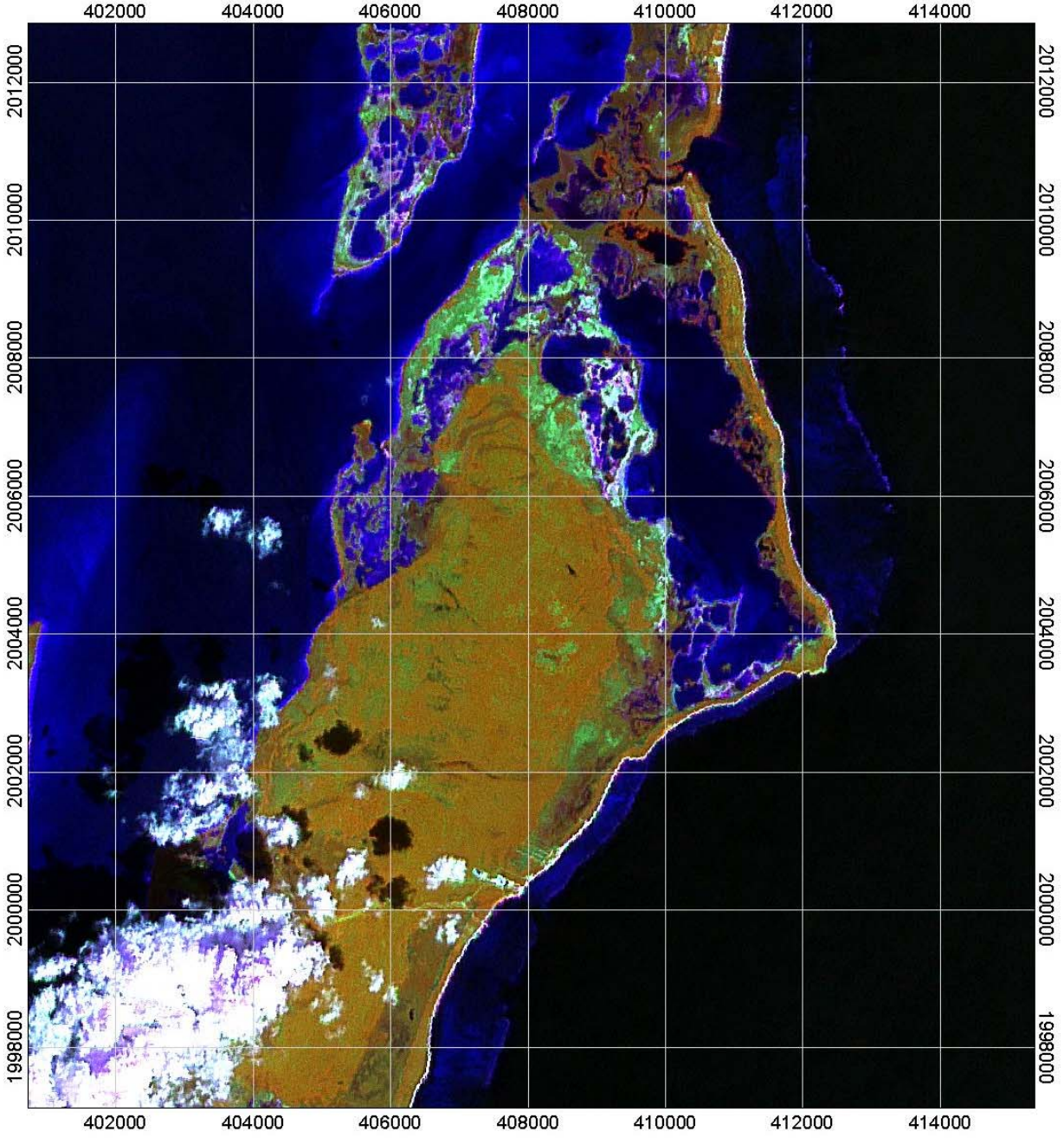
Aerial Photographs Of The Eastern Bacalar Chico Coastline

Upper Right, the barrier reef south of Boca Bacalar Chico. Lower Right, Rocky Point. Below, Nova Shrimp Hatchery, Basil Jones area, just south of the Bacalar Chico National Park and marine Reserve.

ILLUSTRATION 5:

2001 LandSat 7 Image Of Bacalar Chico, Ambergris Caye

UTM Zone 16 - NAD 27 Datum
15 Meter Resolution - Bands RGB/453

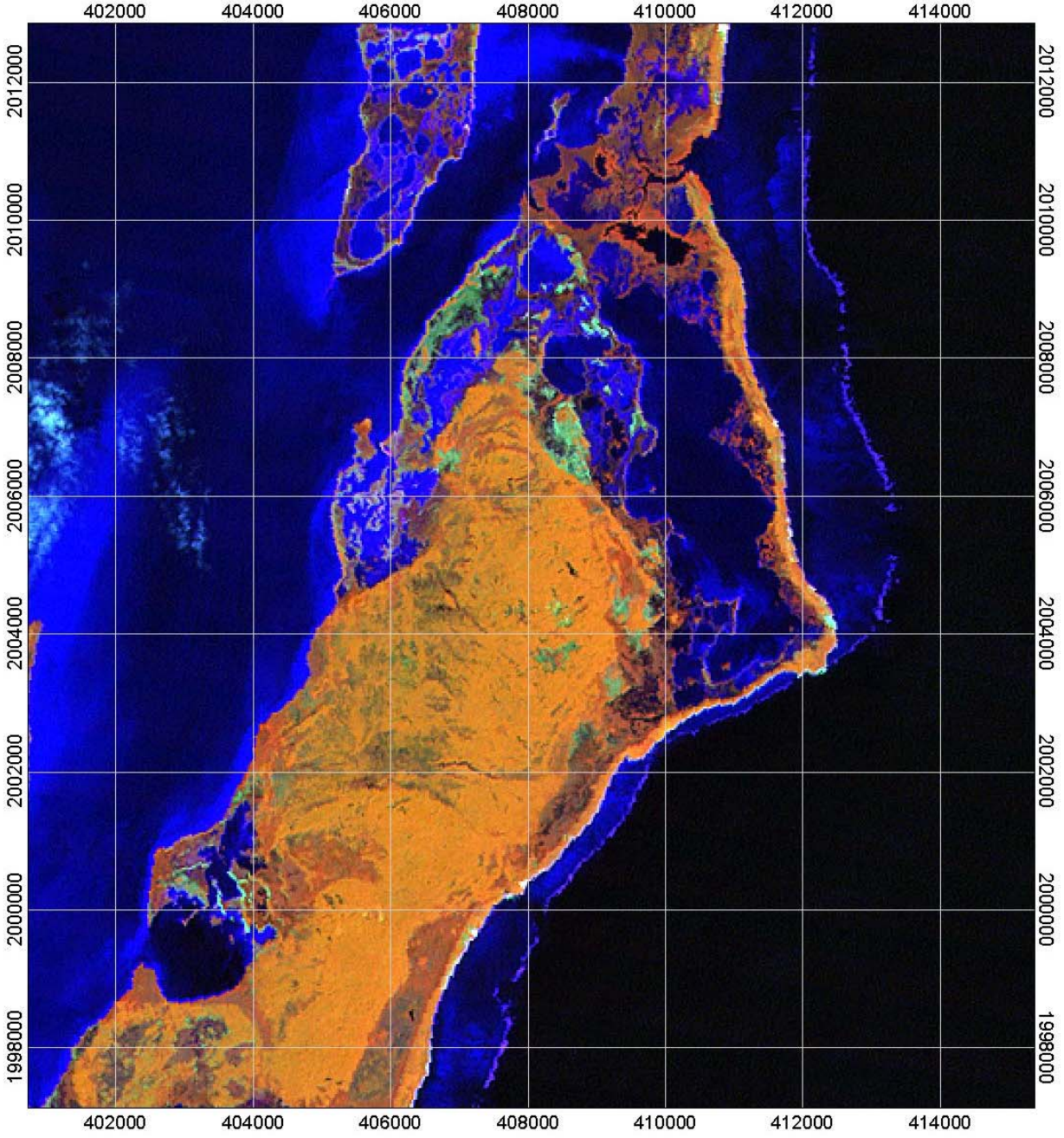


Prepared By: T Grimshaw / Ecoworks

ILLUSTRATION 6:

1990 LandSat 7 Image Of Bacalar Chico, Ambergris Caye

UTM Zone 16 - NAD 27 Datum
30 Meter Resolution - Bands RGB/453

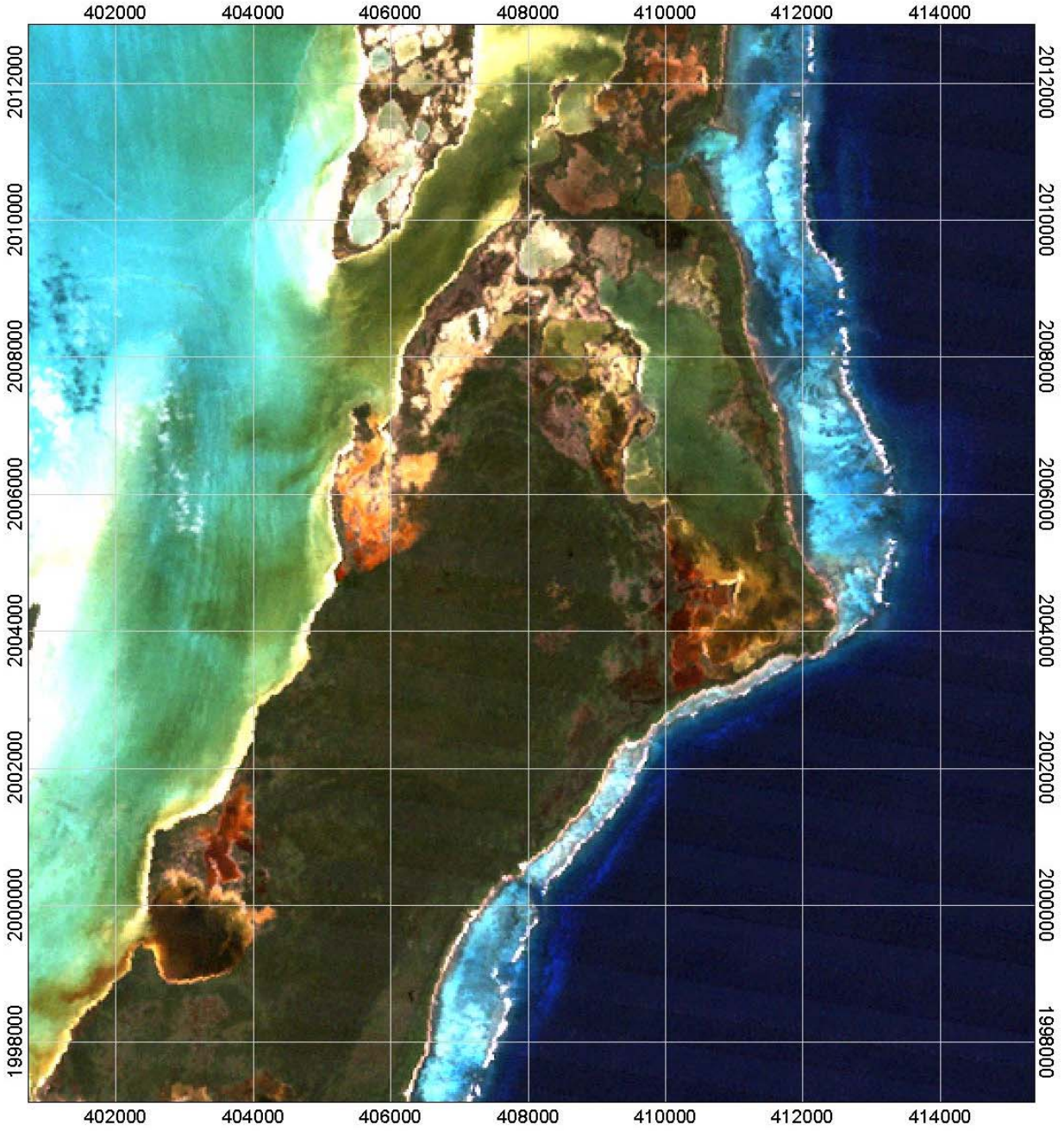


Prepared By: T Grimshaw / Ecoworks

ILLUSTRATION 7:

1990 LandSat 7 Image Of Bacalar Chico, Ambergris Caye

UTM Zone 16 - NAD 27 Datum
30 Meter Resolution - Bands RGB/321

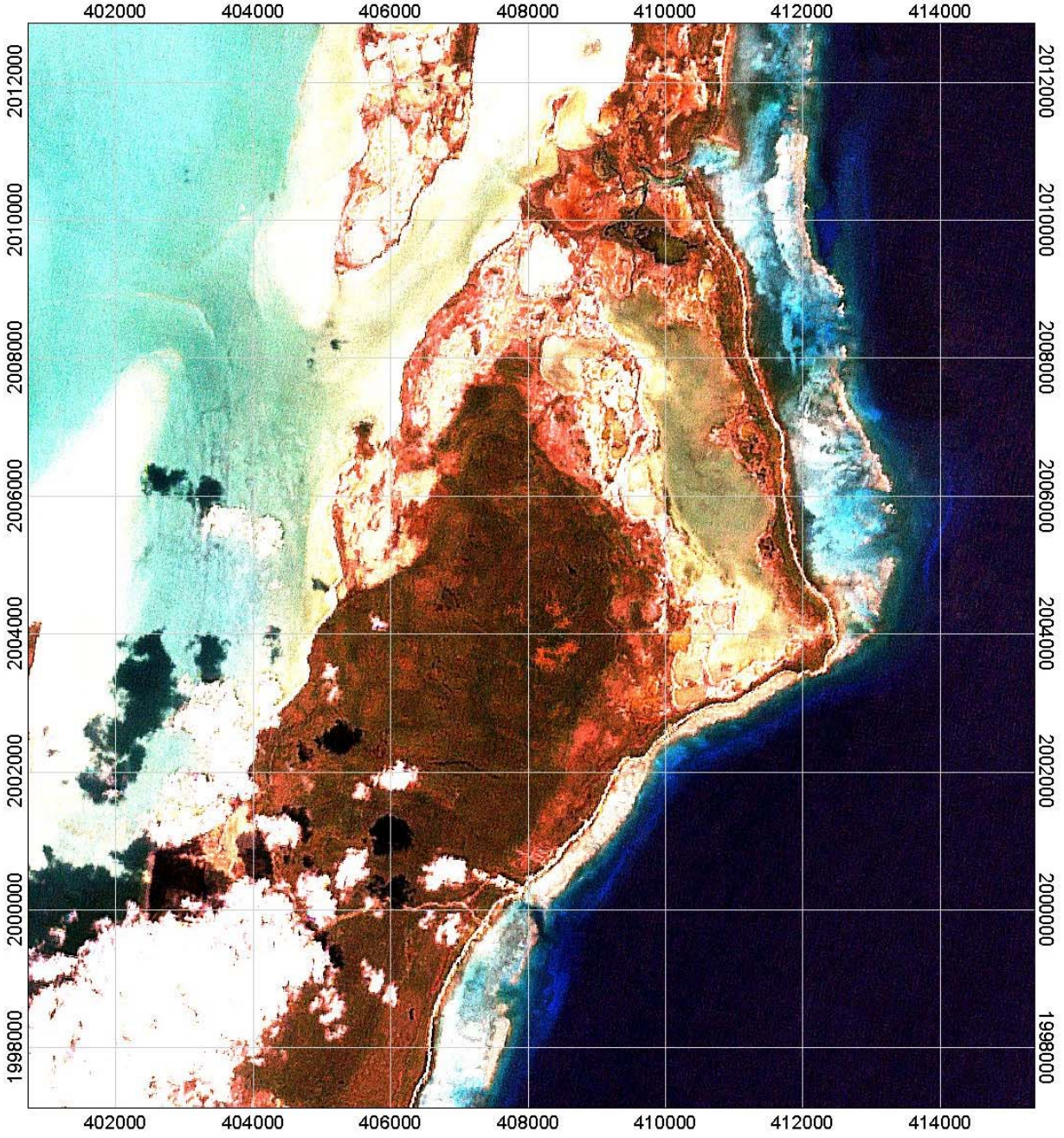


Prepared By: T Grimshaw / Ecoworks

ILLUSTRATION 8:

2001 LandSat 7 Image Of Bacalar Chico, Ambergris Caye

UTM Zone 16 - NAD 27 Datum
15 Meter Resolution - Bands RGB/321



Prepared By: T Grimshaw / Ecoworks

Through the years, various other projects related to the Bacalar Chico protected areas have produced various other satellite images for the area. One such project is the "Research and Advocacy Plan for Nassau Grouper in Belize Project" funded by the Global Environmental Facility/Small Grants Program and implemented by the Green Reef Environmental Institute. This project focuses on various grouper aggregation sites in the country including the Rocky Point Area. Several other charts and maps are available including: navigation charts; a 1989 Ordinance Survey map for the whole of Ambergris Caye at a scale of 1:50,000; and a 1:10,000 map of land use and proposed development areas produced by the Broadhead Group as part of their development proposal.

2.2 Physical Characteristics

Climate

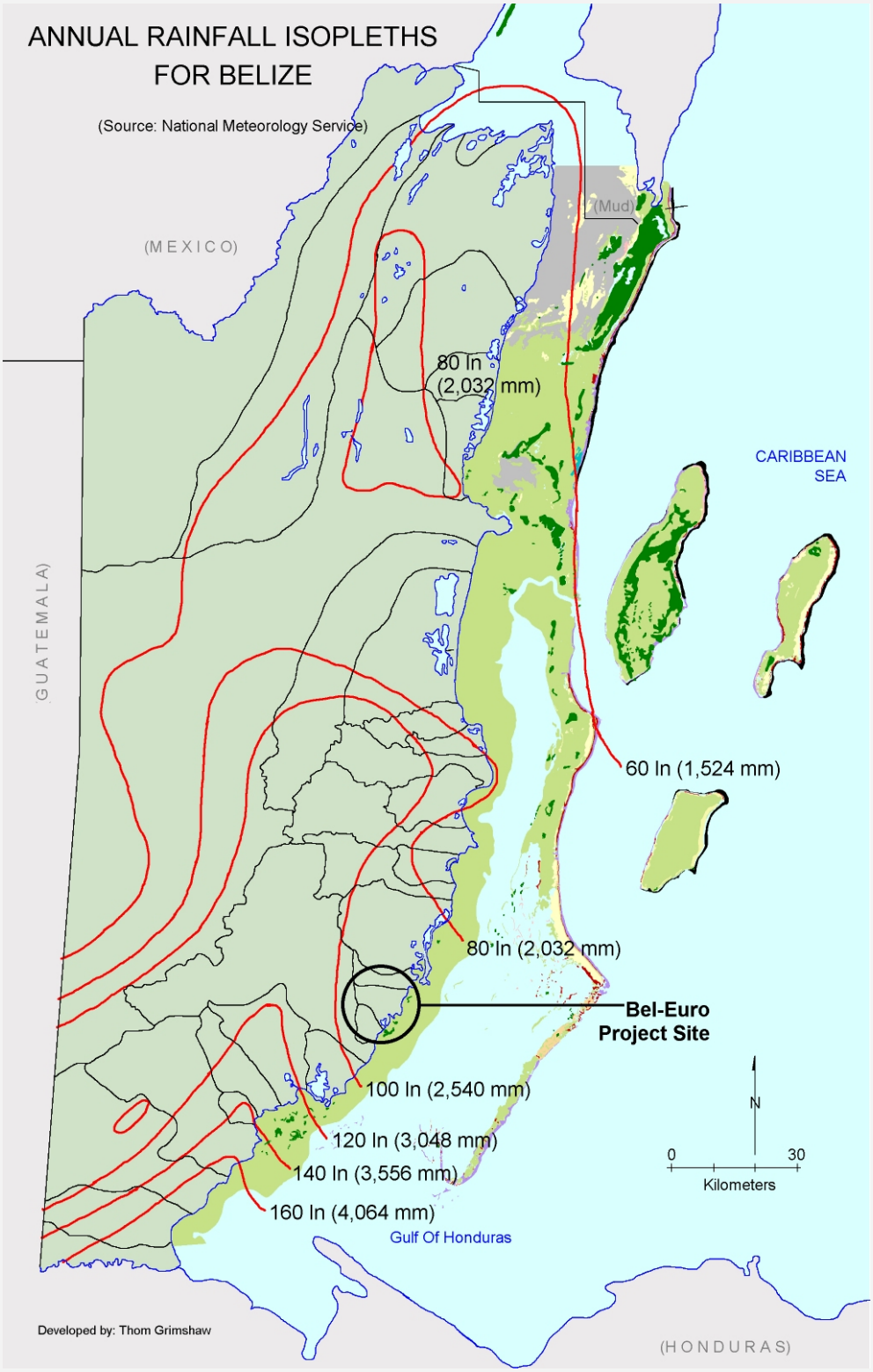
Minimum and maximum air temperatures are 22.8-26.1°C in summer and 27.8-31.1°C in winter, but can be much higher in inland savannahs and supratidal flats in summer. Annual rainfall in San Pedro averaged 138 cm between 1952 and 1970, 143 cm between 1971 and 1980 and 200 cm between 1981 and 2002 (see also **Illustration 9**). The dry season, with strong southeasterly winds, runs from January/February to May/June. The rest of the year has an average of 50 inches (127 cm) rain, with easterly but variable winds, and often a drier period in August. September, October and November are usually the months with most rainfall. However, there are wide variations between years.

Strong winter storms blow between October and February, often as 'northers', which bring cool temperatures, heavy rains, strong winds and rough seas. From March to May, winds tend to be easterly and strong and fairly constant, averaging 15 – 20 knots. In the summer months there are occasional strong squalls with winds up to 30 mph. The hurricane season is August-October, with the peak month in September. Hurricane Janet in 1955 destroyed all the coconut trees along the coast in the Bacalar Chico area (Godfrey 1983; Hartshorn *et al* 1984; BCES 1993; Ishmael 1994; and Smith 1995). In late October of 1998, Hurricane Mitch caused substantial damage to the Bacalar Chico's portion of the barrier reef, its sea turtle nesting areas, portions of the mangroves and some physical structural damage to the dock and kitchen area. Subsequent to Hurricane Mitch, a hurricane preparedness plan was developed by the BFD as a new protocol for management during such events (Cf. **Addenda 5**).

On October 1, 2000 Hurricane Keith's strong winds and violent wave action caused damages to the reserve but on a bigger scale. Wave erosion reached 12 – 15 feet on the windward side San Juan area where the present ranger station is located. Considerable damage was also done to area vegetation, as well as the rangers outpost (including lost of screens, windows and doors). The lagoon area around San Juan was observed to be dark red to brown in appearance for a period of six days, starting two days after the hurricane. This water was traveling easterly into the Corozal Bay and is believed to be as a result of the high waters flowing from out of the mangroves. A rapid assessment of the coastal mangroves indicated that approximately 30% of the mangroves were damaged by the strong winds and violent wave action, with the damage being mainly restricted to the canopy. Few mangroves that stood alone were uprooted, on either the windward or leeward sides of the island.

The windward side of the reserve had experienced an accretion of approximately 15 ft. This build up affected all sea turtle nests that had not hatched. Sea grass beds were also affected. Several patches of manatee grass were observed floating on both the windward and leeward sides of the island, which was later confirmed during snorkeling surveys. A rapid assessment of the coral reef at Bacalar Chico and Hol Chan Marine Reserves conducted on October 17, 2000 concluded, after diving both sites, that damages to the fore reef at both reserves were minimal. In the spur, some sand erosion occurred and on the groove, algal loss was observed. Video footage of the areas was documented and is available at the BFD.

ILLUSTRATION 9:



Hydrology

Freshwater resources are limited by the lack of elevation, the lack of a functional aquifer (the limestone bedrock lacks porosity and permeability) and the widespread system of caves, fractures and cenotes that creates a continuous subterranean connection between freshwater sources and the sea. A thin freshwater lens lies 1.0 - 2.5 meters under the east coast ridge. Limited soil cover in the area permits surface water drainage directly into underlying limestone fractures and thus into the caves and cenotes. Water stands in the supratidal flats and low areas for 8-9 months of the year but disappears in the dry season when the water table drops by about 1 meter. Freshwater is still generally available in some cenotes and mangrove swamp holes at this time (which are thus particularly important for wildlife), but many sinkholes are seasonal. Fresh water in the permanent sinkholes is only available to a depth between two and fifteen feet. Tidal fluctuations are seen in some sinkholes, suggesting that they are connected to the sea (BCES 1993, Ishmael 1994).

Bathymetry

Water depths on the west coast, in Chetumal Bay, rarely exceed 2 meters, and do so only where karst erosion has formed underwater caves and depressions in the bedrock. Depths are even shallower close to shore (BCES 1993) and can restrict navigation because of the bedrock found just inches below mud deposits. Depths on the east coast and in the inland lagoons range from 0.5 – 3.0 meters; while most of the inland lagoons average 1-2 meters depth (BCES 1993) except close to the channels where depth increases to 5 meters (Cf. **Illustration 10**). Depths in the Basil Jones Channel run to 15 meters.

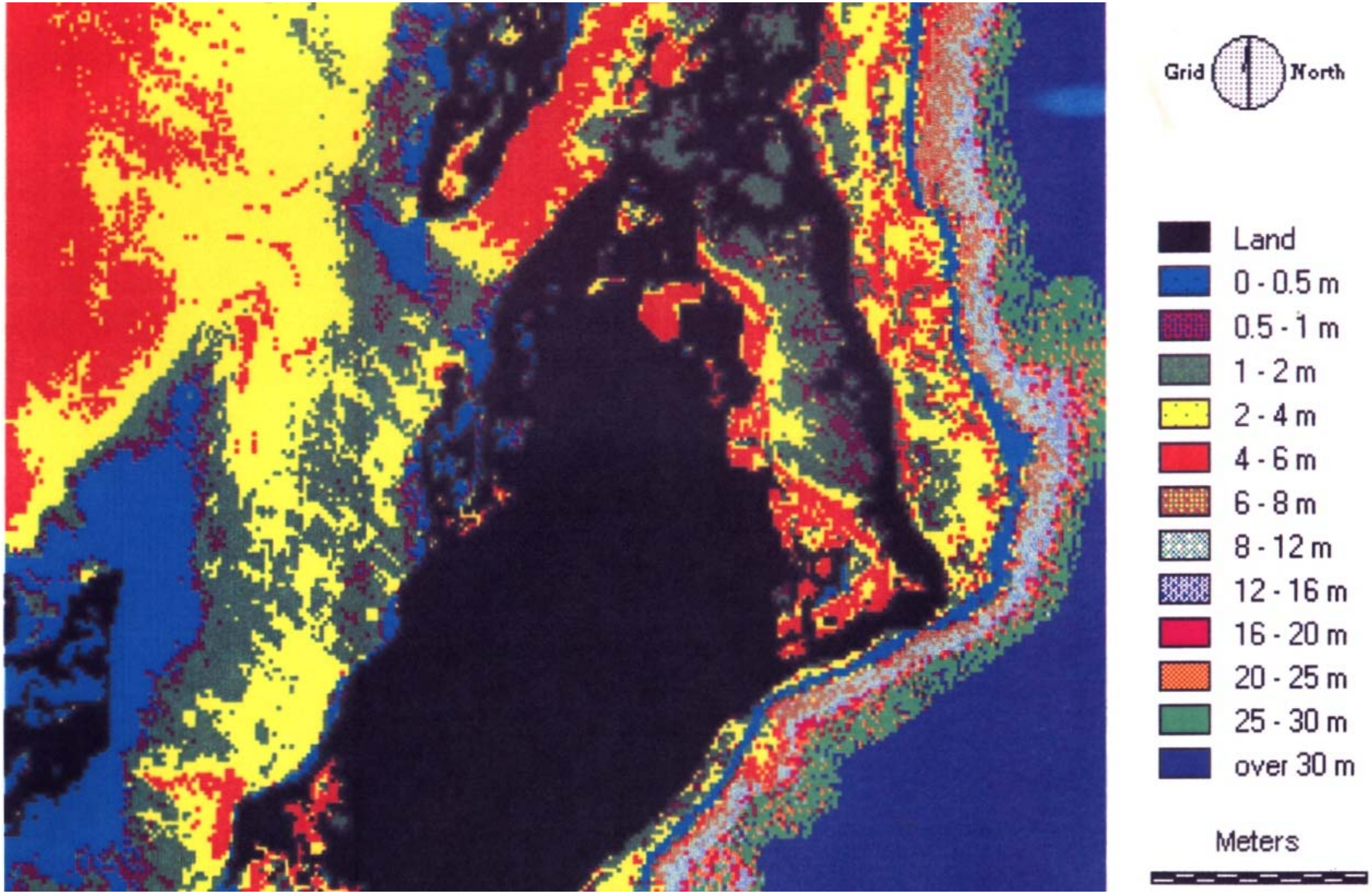
Tides and Currents

Maximum tidal range is 37 - 45 cm on exposed seaward shores, less on the leeward coast and from 0 to 15 cm in lagoons with tidal exchange (Ebanks 1975). The height can reach 55 cm on the shorelines, except on leap tides. Offshore water currents on the eastern side of the Reserve are dominated by the southwesterly Caribbean Current (velocity of 1-3 knots). The prevailing direction of the surface current within the reef lagoon and Corozal/Chetumal Bay is southerly. There are strong currents up to 7 knots in the reef channels especially during low tides.

Water Quality

Salinity in the reef lagoon averages 37.2 ppt and in the inland lagoons averages 40.9 ppt (BCES 1993). Highest salinities are found in the supratidal ponds, which may reach 123.8 ppt (Ishmael 1994). Turbidity varies especially during tide changes and the various months during the year. During the dry season in March to May, Easterly winds blow daily at 20 knots causing heavy turbidity, especially in the windward side of the marine reserve. Large volumes of water empting into the Bacalar Chico area during the rainy season bring large volumes of sediments from the mainland. During November to March, the Northerly winds (cold fronts) sometimes blow at 25 knots causing heavy siltation, especially on the leeward side of the marine reserve. Hurricanes also raise turbidity levels, which can persist for weeks following storms.

ILLUSTRATION 10: Estimated Bathymetry Of The Bacalar Chico Region



The general pH is 7.2 in the vicinity of the reef and surrounding areas but changes to 5.2 in the shallow mangrove areas. The alkaline pH is attributed to the high calcium carbonate saturation along the reef and the acidic pH to high organic decomposition in the mangrove detritus compounded by poor water circulation. Temperatures may reach 30°C in some of the inland lagoons and up to 42°C in shallow supratidal ponds (Ishmael 1994). The average water temperature is 25°C, where there is good water exchange.

Geology

Ambergris Caye and the northern part of the Belize mainland are part of the Yucatan Platform and are formed of Pleistocene limestone bedrock eroded over the years by rainfall and dissolution to form sinkholes and cenotes. A relict ridge forms the backbone of Ambergris Caye, and a raised beach ridge, 3 meters thick and 40-90 meters wide, runs along the east coast. This is covered by calcareous sand, except at Rocky Point, where the bedrock is exposed. Robles Point is probably the highest natural elevation on the caye, where coral boulders have been piled into a 5 meter-high barrier by heavy wave action and storms; elevations are 1-3 meters throughout the rest of the area (Smith 1995, Tebbutt 1975, and Ebanks 1975).

During the Pleistocene era, when sea levels were higher, much of what is now land on Northern Ambergris Caye was reef. Outcrops of fossilized reefs and associated communities can therefore be found throughout the area, especially in the central and western portions, along Rocky Point and in the inland lagoons. Although Ambergris Caye has received considerable geological attention (e.g. Gregg *et al* 2002; and Mazzullo *et al* 2003) Rocky Point is of particular geological interest as reef crest and back reef facies are exposed here (Tebbutt 1975; BCES 1993). Modern sediments include mainly white sandy sediments on the beaches and reef lagoon bottom composed of fragments of reef animals and calcareous algae; sandy sediment on the west coast in Corozal/Chetumal Bay is composed of peneroplid foraminifera; and sandy-mud sediments in the inland lagoons are composed mainly of miliolid foraminifera (BCES 1993).

2.3 Wildlife Characteristics

Terrestrial Ecosystems

Terrestrial habitats account for 45% of the BCNP/MR surface coverage, including sand beaches, exposed pleistocene limestone bedrock (on the eastern shore), limestone sink-holes or cenotes (inland), rocky outcrops with little soil cover (along the leeward shore) and a wide variety of vegetation assemblages.

Vegetation cover of the BCNP is more diverse than other Belizean cayes and is more diverse than the southern end of Ambergris Caye (Fosberg *et al* 1982, Stoddard 1974, Stoddard *et al* 1982a, Stoddard et al 1982b, and BCES, 1993; see also **Table 1**). At least five separate works providing descriptive classifications of vegetation cover or land systems within the BCNP have been produced to date. These include studies by Dachary *et al* (1991), King *et al* (1992), BCES (1993), PFB (1995) and Meerman and Sabido (2000), although Meerman (personal communication) has suggested that an authoritative analysis is needed before a zoning program can be finalized. The BCES study includes references from Dachary *et al*, as the Meerman and Sabido includes references from the PFB and King *et al* study. Hence, the classification of BCNP vegetation cover presented here (following) is largely derived from the more recent Meerman and Sabido (2000) with annotative reference to BCES (1993) classifications (see also **Illustrations 11** and **12**).

I. <u>*Tropical Littoral Forest and Beach Communities*</u> This forest type extends along the entire eastern marine of the BCNP (all of which is privately owned), and in occasional patches along the western margin of the BCNP. On the eastern side of the BCNP, the zone includes the Coastal Dune zone described by BCES (1993), which extends from the southern-most point of the BCNP to Rocky Point. The Coastal Dune is approximately 150 meters wide, and tapers inland to basin mangrove habitat.

The BCNP's *Littoral Forest and Beach Communities* are composed primarily of shrubs and grasses that endure strong winds, high salinity, and insolation. Within the beach forest, the dominant species are the Ziricote relative (*Cordia sebestena*), Teabox (*Myrica cerifera*), Gumbo Limbo (*Bursera simaruba*), Jamaican Tall Coconut (*Cocco nucifera*) and Coco plum (*Chrysobalanus icaco*). These are fringed by Sea Grape (*Coccoloba uvifera*), numerous shrubs and coconut trees. This forest type is not widespread in Belize, and is under considerable pressure from coastal development. The habitat is important to migratory birds, and is used (on the east) for nesting by marine turtles and (on both the east and west) the American Crocodile (*Crocodylus acutus*).

II. <u>*Mixed Mangrove Scrub*</u> This forest type is largely restricted to the north-eastern shoreline of the Cantina Lagoon, and two spans along the western margin of the BCNP on the Corozal Bay. The assemblage includes Red Mangrove (*Rhizophora mangle*), White mangrove (*Laguncularia racemosa*), Black Mangrove (*Avicennia germinans*), and Buttonwood (*Conocarpus erectus*), as well as terrestrial entrants such as the Freshwater Palmetto Palm (*Acoelorraphe wrightii*), Tea Box (*Myrica cerifera*) and salt tolerant trees and shrubs. The assemblage is similar to the *Tacistal* described by BCES (1993).

TABLE 1

TERRESTRIAL PLANTS OF THE BCNP/MR

FAMILY/Common Name	Scientific Name
POLYPODIACEAE	
Helecho de manglar	*Acrostichum danaeifolium*
---	*Adiantum princeps*
Culantrillo	*Adiantum tricholepis*
H-hesajo	*Cheilanthes microphylla*
Tsos'ak	*Microgramma nitida*
Helecho	*Phlebodium*
SCHIZACEAE	
---	*Anemia adiantifolia*
ACANTHACEAE	
Hulub	*Bravaisia tubiflora*
AGAVACEAE	
---	*Agave angustifolia*
AIZOACEAE	
Verdolaga de playa	*Sesuvium portulacastrum*
AMARANTHACEAE	
---	*Amaranthus spinosus*
---	*Celosia argentea*
---	*Iresine diffusa*
AMARYLLIDACEAE	
Lirio, Spider lily	*Hymenocallis littoralis*
ANACARDIACEAE	
Mango	*Mangifera indica*
Chechem Negro	*Metopium brownei*
ANNONACEAE	
Palo de corcho	*Annona glabra*
Guanábana, Soursop	*Annona muricata*
---	*Annona primigenia*
Anona, Wild Custard apple	*Annona reticulata*
Saramuyo, Sugar apple	*Annona squamosa*
APOCYNACEAE	
Chechem blanco, white poisonwood	*Cameraria latifolia*
Vicaria blanca	*Lochnera rosea*
Chakleón	*Mandevilla subsagittata*
Oleander	*Nerium oleander*
Flor de mayo, Fransipansi	*Plumeria obtusa*
Akitz	*Thevetia gaumeri*
---	*Thevetia peruviana*
ASCLEPIADACEAE	
Cancerillo, Cochinita, Cuchillo, Blood flower	*Asclepias curassavica*
BATACEAE	
---	*Batis maritima*
BORAGINACEAE	
Siricote	*Cordia curassavica*
Siricote de Playa	*Cordia sevestena*
X-coi	*Tournefortia gnaphalodes*
---	*Tournefortia volubilis*
BROMELIACEAE	
X-chu	*Aechmea bracteata*
Piñuela, Wild pineapple	*Bromelia alsodes*
X-ch'u	*Tillandsia dasyrilifolia*
BURSERACEAE	
Chacah, Gumbo limbo, Indio desnudo	*Bursera simaruba*
LAURACEAE	
Kankubal	*Cassytha filiformis*
Aguacate, Avocado	*Persea americana*
LEGUMINOSAE	
Katzim	*Acacia gentlei*
---	*Canavalia brasiliensis*
Frijol de playa	*Canavalia rosea*
---	*Caesalpinia pulcherrima*
---	*Crotalaria pumila*
Ahmuk	*Dalbergia glabra*
Pakum pak	*Desmodium incanum*
---	*Desmodium tortuosum*
Ruda de monte	*Diphysa carthagenensis*
---	*Galactia striata*
Palo de tinta	*Haematoxylan campechianum*
Huaxim, Waxim	*Leucaena leucocephala*
Kanasin	*Lonchocarpus rugosus*
Tsalam, Dzalam	*Lysiloma latisiliqua*
Katsim blanco	*Minosa bahamensis*
Dormilona	*Minosa pudica*
Habín	*Piscidia piscipula*
Chucum blanco	*Pithecellobium dulce*
Xyaxk'aax	*Pithecellobium keyense*
Verde lucero, Chakchucum	*Pithecellobium mangense*
Frijolillo, Yama bush, Rat bean	*Senna occidentalis*
Frijolillo	*Sophora tomentosa*
LILIACEAE	
Despeinada, Corcho	*Beaucarnea ameliae*
LORANTHACEAE	
Matapalo	*Struthanthus cassythoides*
LYTHRACEAE	
Crepe Myrtle	*Lagerstroemia indica*
MALPIGHIACEAE	
Nance agrio	*Byrsonima bucidaefolia*
Nance	*Byrsonima crassifolia*
MALVACEAE	
Sakwis	*Albutilon permolle*
Majahua	*Hampea trilobata*
Tulipán	*Hibiscus rosa-sinensis*
---	*Gossypium hirsutum*
Tulipán de monte	*Malvaviscus arboreus*
Chichibe	*Sida rhombifolia*
---	*Thespesia sp.*
MORACEAE	
---	*Artocarpus communis*
Guarumo, Trompeta, Trumpet tree	*Cecropia peltata*
---	*Ficus elastica*
Higuero, Amate, Fig tree	*Ficus maxima*
MUSACEAE	
	Musa sp.
MYRTACEAE	
Granada cimarrona	*Eugenia axillaris*
Guayaba, Guava	*Psidium guajava*

Continued…

TABLE 1

TERRESTRIAL PLANTS OF THE BCNP/MR

(Continued)

FAMILY/Common Name	Scientific Name
CACTACEAE	
---	*Acanthocereus pentagonus*
Sackam	*Selenicereus donkelaarii*
Pitaya de tortuga	*Selenicereus testudo*
	Stenocereus griseus
CANNACEAE	
Platanillo, Lengua de dragón	*Canna edulis*
CAPPARIDACEAE	
---	*Capparis incana*
CARICACEAE	
Papaya	*Carica papaya*
CASUARINACEAE	
Pino de mar	*Casuarina equisetifolia*
CELASTRACEAE	
Analche	*Rhacoma gaumeri*
CHENOPODIACEAE	
---	*Salicornia bigelovii*
---	*Suaeda linearis*
CHRYSOBALANACEAE	
Hicaco, Icaco, Jicaco, Cocoplum	*Chrysobalanus icaco*
COMBRETACEAE	
Pucte espinoso, Una de gato	*Bucida spinosa*
Mangle botoncillo	*Conocarpus erectus var typica*
Mangle botoncillo	*Conocarpus erectus var sericeus*
Mangle blanco, Sacocum	*Laguncularia racemorsa*
Almendro	*Terminalia cattapa*
COMPOSITAE	
Hawayche	*Ageratum littorale*
Margarita de mar, Bay tansy	*Ambrosia hispida*
---	*Aster subularis*
K'anmul	*Bidens pilosa*
Verdolaga de playa	*Borrichia arborescens*
---	*Calea peckii*
Sactok'aban	*Eupatorium albicaule*
Tok'aban	*Eupatorium odoratum*
K'anlolxiu	*Flaveria linearis*
Botón de plata	*Melanthera nivea*
Altaniza	*Parthenium hysterophorus*
X-pechuk'il	*Porophyllum punctatum*
Chache' (Santa Maria)	*Pluchea odorata*
CONVOLVULACEAE	
Manto	*Ipomoea alba*
---	*Ipomoea indica*
Riñonina, margarita, morning glory	*Ipomoea pes caprae*
	Ipomoea tuxtlensis
CYPERACEAE	
Zacate cortadera	*Cyperus ligularis*
---	*Dichromena ciliaris*
---	*Fimbristylis spadicea*
---	*Fimbristylis spathacea*
---	*Scleria bracteata*
EBENACEAE	
Silil	*Diospyros verae-crucis*
NYCTAGINACEAE	
	Guapira linearibracteata
ORCHIDACEAE	
X-k'ubemba	*Schomburgkia tibicinis*
PALMAE	
Tasiste	*Acoelorrhaphe wrightii*
---	*Chamaedrea sp.*
Coco, Coconut	*Cocos nucifera*
Kuka	*Pseudophoenix sargentii*
Guana	*Sabal yapa*
Chit	*Thrinax radiata*
PASSIFLORACEAE	
Love-in-a-Mist	*Passiflora foetida*
Pap bush	*Passiflora suberosa*
POLYPODIACEAE	
---	*Acrostichum aureum*
POLYGONACEAE	
---	*Coccolaba diversifolia*
Uva de mar	*Coccolaba uvifera*
	Gymnopodium floribundum
PORTULACACEAE	
Verdolaga de mar, Pussley, Purslane	*Portulaca oleracea*
	Talinum paniculatum
RHAMNACEAE	
---	*Colubrine asiatica*
---	*Zizypus mauritiana*
RHIZOPHORACEAE	
Mangle rojo, Tapche	*Rhizophora mangle*
RUBIACEAE	
Ibchu-ichhu, ich-hu	*Asemnanthe pubescens*
---	*Bourreria verticillata*
Skunk root, Rat root, Zorillo	*Chiococca alba*
---	*Clerodendron speciosissimum*
---	*Erithalis fruticosa*
Guayabillo	*Ernodea littoralis*
Xhanan, Tres hojitas, Red head, Sanalo-todo	*Hamelia patens*
Noni	*Molinda panamensis*
Pinita	*Morinda royoc*
K'anal, Planta macho	*Psychotria nervosa*
Cruceta	*Randia aculeate*
Yaaxkanche	*Randia longiloba*
---	*Strumpfia maritima*
RUTACEAE	
Limón agrio	*Citrus limon*
SAPINDACEAE	
Xakanke	*Cupania dentata*
---	*Serjania goniocarpa*
Huaya, Guaya	*Talisis olivaeformis*
SAPOTACEAE	
---	*Bumelia americana*
Chicozapote	*Manilkara zapota*
Kaniste	*Pouteria campechiana*

Continued…

TABLE 1

TERRESTRIAL PLANTS OF THE BCNP/MR

(Continued)

FAMILY/Common Name	Scientific Name	FAMILY/Common Name	Scientific Name
ERYTHROXYLACEAE			
---	Erythroxylum confusum	**SCROPHULARIACEAE**	
		Claudiosa, Apote de monte, Tan chi	Capraria biflora
EUPHORBIACEAE		---	Stemodia maritima
---	Chamaesyce buxifolia		
Chaya mansa	Cnidoscolus chayamansa	**SIMAROUBACHEAE**	
---	Euphobia heterophylla	Pantsil	Suriana maritima
Flor de pascua del monte, Wild poinsettia	Euphorbia pulcherrima		
---	Euphorbia schlechtendalii	**SOLANACEAE**	
---	Phyllantus niruri	Chile habanero	Capsicus sp.
---	Ricinus communis	Chile max, Chile de monte	Capsicus frutescens
		Hierba mora	Solanum americanum
FLACOURTIACEAE		---	Solanum erianthum
Cafetillo de monte	Casearia nitida	---	Solanum schlechtendalianum
GENTIANACEAE		**STERCULIACEAE**	
---	Eustoma exaltatum	Trompillo, Tzutup	Helicteres baruensis
		Malva de monte	Waltheria americana
GRAMINEAE			
---	Andropogon bicornis	**THEOPHRASTACEAE**	
---	Bambusa sp.	Palo de animas	Jacquinia aurantiaca
Espino de playa, Burr burr	Cenchrus echinatus		
---	Cenchrus incertus	**TURNERACEAE**	
---	Dactyloctenium aegyptium	---	Turnera ulmifolia
---	Digitaria sp.		
---	Distichlis spicata	**ULMACEAE**	
---	Laciasis divaricata	---	Trema micrantha
---	Paspalum sp.		
---	Sacharum officinalis	**VERBENACEAE**	
---	Sporobolus virginicus	Mangle Negro, Tapche	Avicennia germinans
Maíz	Zea mays	Pukim	Callicarpa acuminata
GOODENIACEAE		Flor de caballero, Palabra de caballero, Corona de sol, Wild sage	Lantana camara
---	Scaevola plumieri	Sikilhaxiw, Oregano de monte	Lantana involucrata
		---	Phyla nodiflora
		Mosate, Sticky burr burr, pega ropa	Priva luppulacea
		Ibin xiw, Verbena, Verveine	Stachytarpheta jamaicensis
		VITACEAE	
		Xtakanil	Cissus sicyoides

…End

ILLUSTRATION 11:

2001 Vegetation Clasification For The Bacalar Chico Area, Ambergris Caye

Adapted From Meerman And Sabido 2001
UTM Zone 16 - NAD 27 Datum

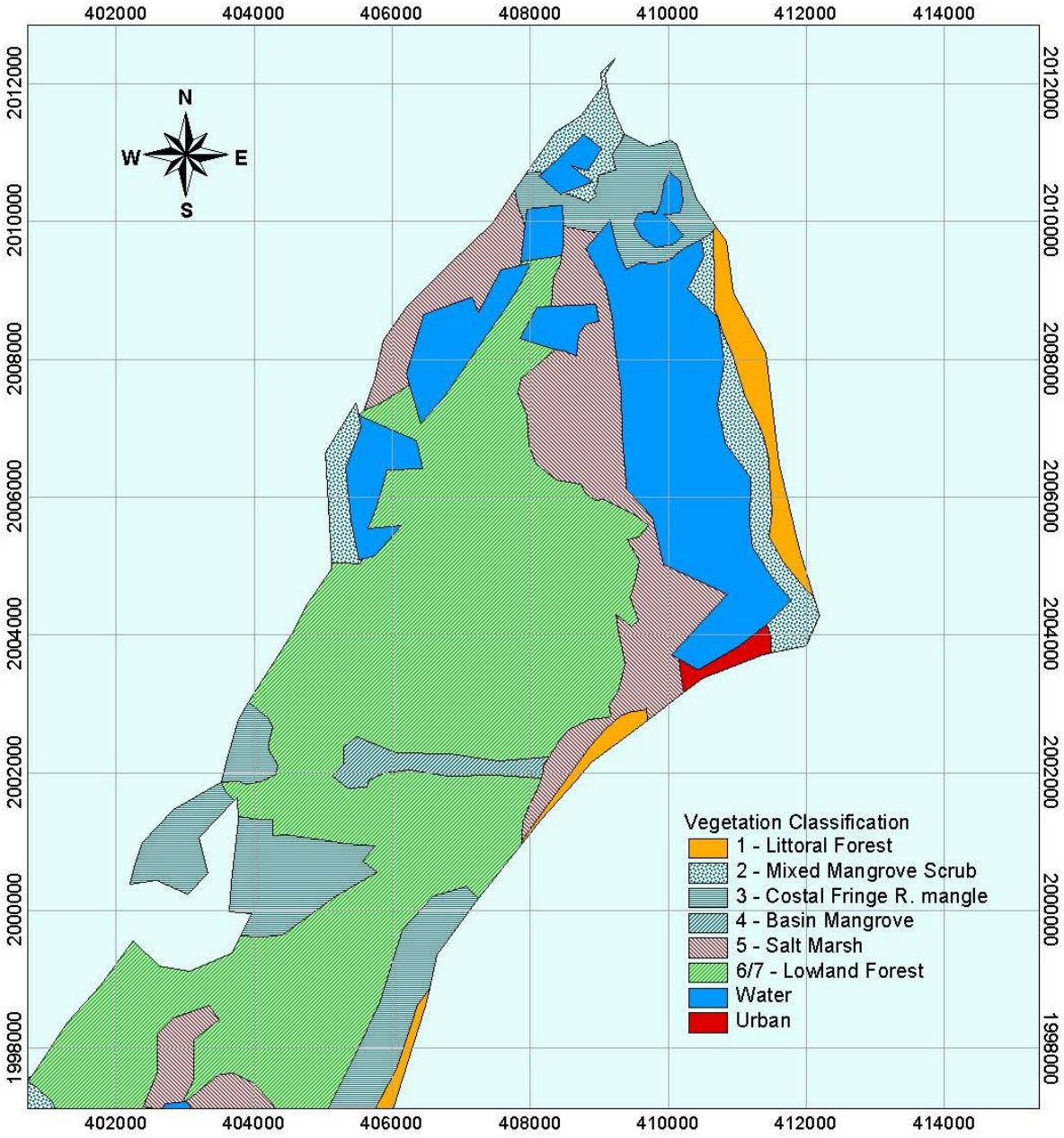
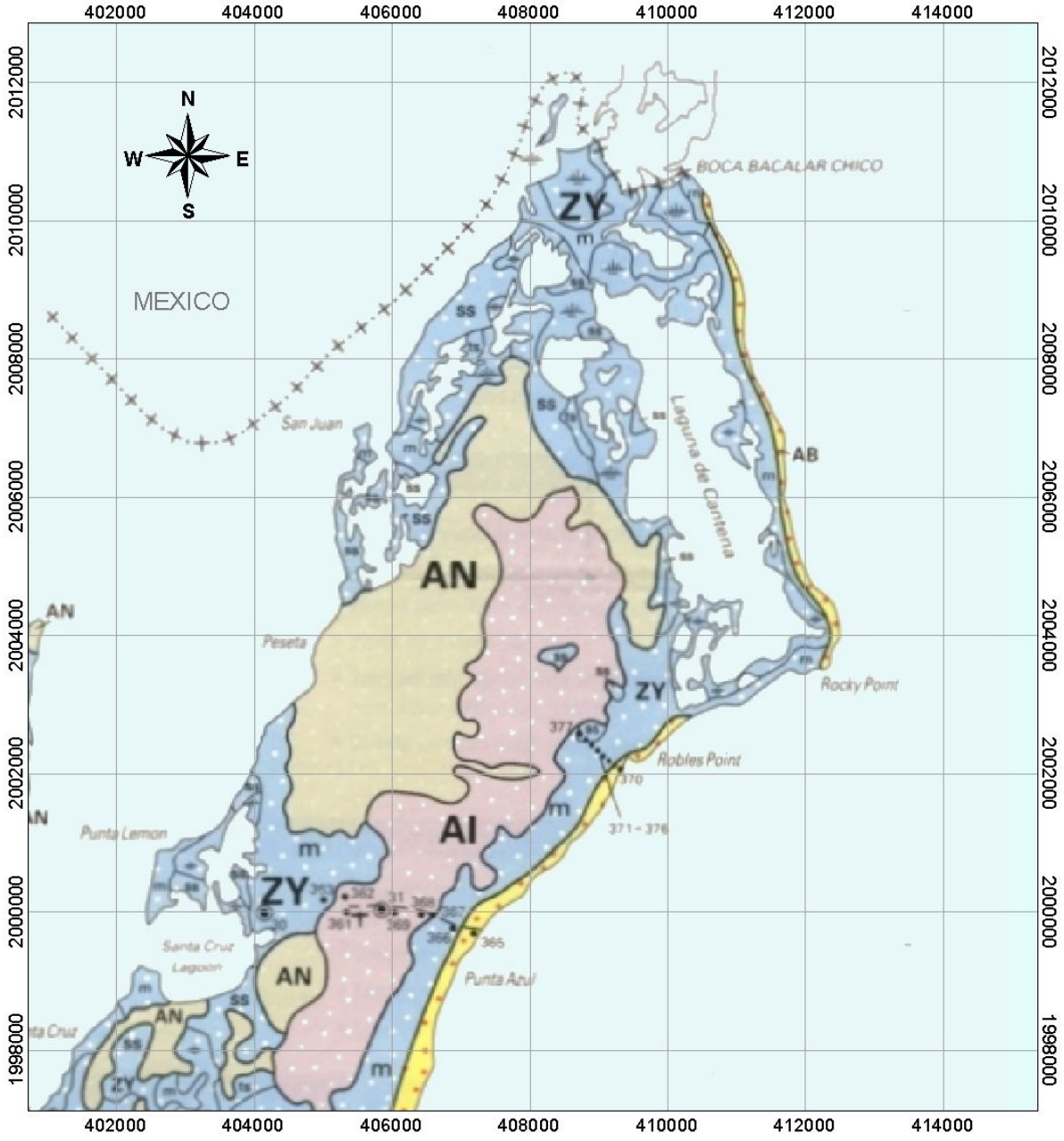


ILLUSTRATION 12:

Land Systems Of The Bacalar Chico Area, Ambergris Caye

Adapted From King et al (1992)

UTM Zone 16 - NAD 27 Datum



Prepared By: T Grimshaw / Ecoworks

(Key: Addenda 6)

III. *Coastal Fringe Rhizophora mangle-Dominated Forest* This forest type is found in the northern most and southern most reaches of the BCNP, along the Bacalar Chico canal and western shoreline near Santa Cruz Lagoon (respectively) in permanently inundated areas, and is dominated by Red Mangrove (2- 14 meters in height).

IV. *Basin Mangrove Forest* This forest type is restricted to a narrow inland depression in the south-eastern portion of the BCNP, where it represents the only assemblage of mangroves growing on marginal depressions in rocky outcrops. The species composition of this single stand of Basin Mangrove Forest within the BCNP has yet to be described.

V. *Marine Salt Marsh With Many Succulent Species* This community type is very rare in Belize, and in the BCNP, is found along the southern side of Cantina Lagoon, along the western margin of the Coastal Dune, and along the western shoreline where salinity levels are high. Described by BCES (1993) as *Herbaceous Marsh and Swamp*, (and likely to include the *Savanna Zone*), this vegetation class is very heterogeneous with patches dominated by different species, that collectively form the Salt Marsh community type. Common dominants include *Batis maritima*, *Distichlis spicata*, *Fimbristylis spadicea*, *Fuirena* sp., *Juncus* spp. *Salicomia perennis*, *Solanum donianum* and *Spartina cynosuroides*. Flats with these principally herbaceous species may contain stunted White Mangrove or Dwarf Red mangrove (similar to *Carrizal-Saibal-Tular Zone* described by BCES, 1993), while slightly elevates areas may contain *Bravaisa tubiflora*, Black Poison Wood or Chechem (*Metopium borwnei*), *Manilkara zapota* and the Salt Water Palmetto (*Thrinax radiata*).

VI. *Tropical Semi-Deciduous Broadleaf Lowland Forest* This is a distinctive forest type which has only been described from the Sarteneja area in the Corozal District but is also believed to occur within the BCNP. The forest has a low canopy of 8 – 12 meters, and is found on shallow soils over calcareous rock, with a more deciduous aspect that most other forest types in Belize. The type probably includes the *Chechemal* Zone described by BCES (1993). Leguminous trees, such as *Lysiloma latisiliquum* and *Acacia* spp., are frequent. The habitat is important for Yucatan endemics such as the Yucatan Jay (*Cyanocorax yucatanicus*) and the Orange Oriole (*Icterus auratus*).

VII. *Tropical Drought-Deciduous Microphyllous Lowland Forest* This forest type is found over exposed calcareous rock, which is well drained, but subject to infrequent flooding. The forest has a lower canopy than *Tropical Semi-Deciduous Broadleaf Lowland Forest* (7-8 meters), and trees commonly have a narrow girth, which gives the forest a 'scrubby' appearance. The type is probably synonymous with the *Low Semi-Deciduous Forest Zone* described by BCES (1993). Notable species include *Agave angustifolia*, *Amyris elemifera*, *Beaucamea pliabilis*, *Caesalipinia violaceae*, *Croton glandulosepalus*, *Eugenia* spp. *Gymnopodium floribundum*, *Hyperbaena winzerlingii*, *Manilkara zapota*, and *Pseudophoenix sargentii*.

Terrestrial Invertebrate Fauna

No surveys have as yet been conducted of terrestrial invertebrate fauna within the BCNP, and therefore should be of particular importance to include in future biodiversity surveys. Of critical importance in this regard are key pollinating insects, which often decline in response to land development and pesticide use, as do the flowering plants dependant on their role as pollinators.

Terrestrial Vertebrate Fauna

- *Birds* The Laguna de Cantena area is important for several groups of birds, with some 194 species inhabiting the area over the course of any given year (Samos, pers comm; Cf. **Table 2**). Notable species include the Yucatan endemics, such as the Black catbird (*Melanoptila glabrirostris*), Red-Vented Woodpecker (*Centurus pygmaeus*), Yucatan Jay (*Cyanocorax yucatanicus*) and Yucatan Vireo (*Vireosylva magister*), most of which reach the southern end of their range in the BCNP. The area's wetlands and lagoons are also very important to both resident and migrant wetland birds, including the Reddish Egret (*Egretta rufescens*), the Boat-billed heron (*Cochlearius cochlearius*), Roseate Spoonbill (*Ajaia ajaja*), and Wood Stork (*Mycteria americana*).

  Meadows (1995) identified 186 species of birds in a survey conducted in the Laguna de Cantena area of the BCNP. A comparison of timed surveys in different habitats determined that the *Littoral Forest* habitat has approximately three times the level of species frequency as the more expansive central scrub forest. This forest type is usually the first that is disturbed (if not totally removed) by private developments, particularly subdivision developments. The BCNP's bird fauna therefore is at particular risk from such developments, as the majority of Littoral Forest habitat falls within privately owned land. Furthermore, human commensal species, such as grackles (*Quiscalus mexicanus*) and the bronzed cowbird (*Molothrus aeneus*), normally increase in numbers around human settlements and result in the loss of nesting success in other bird species (Meadows, 1995).

  Certain cayes within Laguna de Cantena are important bird roosting areas. Meadows (1995), reported that within a time span of approximately 1 hour during the wet season, some 1,401 individuals representing 10 species were found roosting on a single mangrove caye. Subsequent surveys conducted by Samos (pers. comm.) established however that bird diversity and abundance is substantially lower in the dry season than in the wet season, indicating the BCNP's particular importance to migratory species.

- *Mammals* Smith (1995) identified 31 species of mammals within the BCNP (Cf **Table 3**). The most common mammal noted was the Raccoon (*Procyon lotor*), which preys on both sea turtle and crocodile eggs. Other common mammals included the White-Tailed Deer (*Odocoileus virginianus*) and the Collared Peccary (*Tayassu tajacu*). More recently, group size of the less common White-Lipped Peccary (*Tayassu pecari*), which is declining throughout its range, appears to have increased in number within the BCNP from 2 – 6 individuals per group prior to the parks designation, to has as high as 12 individuals per group following designation.

TABLE 2

BIRDS OF THE BACALAR CHICO NATIONAL PARK

Family/Common Name	Common/Species Name
PODICIPEDIDAE	**Grebes/Zambullidores**
Least Grebe	*Tachybaptus dominicus*
Pied-billed Grebe	*Podilymbus podiceps*
PELECANIDAE	**Pelicans**
Brown Pelican	*Pelecanus occidentalis*
PHALACROCORACIDAE	**Cormorants**
Double crested Cormorant	*Phalacrocorax auritus*
ANHINGIDAE	**Anhingas**
Anhinga	*Anhinga anhinga*
FREGATIDAE	**Frigatebirds**
Magnificent Frigatebird	*Fregata magnificens*
ARDEIDAE	**Herons, Egrets and Bittens**
Least Bittern	*Ixobrychus exilis*
Bare-throated Tiger-Heron	*Tigrisoma mexicanum*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
Boat-billed Heron	*Cochlearius cochlearius*
Cattle Egret	*Bubulcus ibis*
Green Backed Heron	*Butorides striatus*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Reddish Egret	*Egretta rufescens*
Snowy Egret	*Egretta thula*
Great Egret	*Ardea albus*
Great Blue Heron	*Ardea herodias*
THRESKIORNITHIDAE	**Ibises**
White Ibis	*Eudocimus albus*
PLATALEINAE	**Spoonbills**
Roseate Spoonbill	*Platalea ajaja*
CICONIIDAE	**Storks**
Wood Stork	*Mycteria americana*
CATHARTIDAE	**Vultures/Zopilotes**
Turkey Vulture	*Cathartes aura*
Lesser Yellow-headed Vulture	*Cathartes burrovianus*
Black Vulture	*Coragyps atratus*
ANATIDAE	**Ducks, Geese and Swans**
Anatinae	
American Wigeon	*Anas americana*
Blue-winged Teal	*Anas discors*
Lesser Scaup	*Aythya affinis*
ACCIPITRIDAE	**Hawks, Eagles, Kites/Gavilanes**
Pandionidae	
Osprey	*Pandion haliaetus*
Accipitrinae	
Hook-billed Kite	*Chondrohierax uncinatus*
Black-Shouldered Kite	*Elanus caeruleus*
Crane Hawk	*Geranospiza caerulescens*
Common Black-Hawk	*Buteogallus anthracinus*
Roadside Hawk	*Buteo magnirostris*
CAPRIMULGIDAE	**Nightjars/Tapacaminos**
Chordeilinae	
Common Nighthawk	*Chordeiles minor*
Lesser Nighthawk	*Chordeiles acutipennis*
Caprimulginae	
Common Pauraque	*Nyctidromus albicollis*
Tawny-Collared Nightjar	*Caprimulgus salvini*
APODIDAE	**Swifts/Vencejos**
Chaeturinae	
Chimney Swift	*Chaetura pelagica*
Vaux's Swift	*Chaetura vauxi*
TROCHILIDAE	**Hummingbirds/Chupaflores**
Trochilinae	
Fork-Tailed Emerald	*Chlorostilbon canivetii*
Cinnamon Hummingbird	*Amazilia rutila*
Ruby-throated Hummingbird	*Archilochus colubris*
TROGONIDAE	**Trogons**
Trogoninae	
Black-headed Trogon	*Trogon melanocephalus*
ALCEDINIDAE	*Kingfishers/Pescadores*
Cerylinae	
Belted Kingfisher	*Ceryle alcyon*
Green Kingfisher	*Chloroceryle americana*
PICIDAE	**Woodpeckers/Carpinteros**
Picinae	
Golden-fronted Woodpecker	*Melanerpes aurifrons*
Red-vented Woodpecker	*Melanerpes pgymaeus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Lineated Woodpecker	*Dryocopus lineatus*
TYRANNIDAE	*Flycatchers/Mosqueros*
Caribbean Elaenia	*Elaenia martinica*
Yellow-bellied Elaenia	*Elaenia flavogaster*
Common Tody-flycatcher	*Todirostrum cinereum*
Least flycatcher	*Empidonax minimus*
Yucantan Flycatcher	*Myiarchus yucatanensis*
Dusky-capped Flycatcher	*Myiarchus tuberculifer*
Brown Crested Flycatcher	*Myiarchus tyrannulus*
Great Kisdadee	*Pitangus sulphuratus*
Social Flycatcher	*Mylozetates similis*
Tropical Kingbird	*Tyrannus melancholicus*
Couch's Kingbird	*Tyrannus couchii*
Eastern Kingbird	*Tyrannus tyrannus*

Continued…

TABLE 2

BIRDS OF THE BACALAR CHICO NATIONAL PARK

(Continued)

Family/Common Name	ommon/Species Name
FALCONIDAE	**alcons/Halcones**
Falconinae	
Merlin	alco columbarius
Peregrine Falcon	alco peregrinus
CRACIDAE	**uans, Chachalacas**
Plain Chachalaca	rtalis vetula
PHASIANIDAE	**urkeys/Guajolotes**
Singing Quail	actylortyx thoracius
RALLIDAE	**ails**
Rufous-necked Wood-Rail	ramides axillaris
Sora	orzana carolina
Common Moorhen	allinula chloropus
Clapper Rail	allus longirostris
American Coot	ulica americana
ARAMIDAE	**impkins/Caraos**
Limpkin	ramus guarauna
CHARADRIIDAE	**lovers**
American Golden-Plover	luvialis dominica
Black-bellied Plover	luvialis squatarola
Semipalmated Plover	haradrius semipalmatus
Wilson's Plover	haradrius wilsonia
Killdeer	haradrius vociferus
RECURVIROSTRIDAE	**vocets, Stilts/Candeleros**
Black-necked Stilt	imantopus mexicanus
SCOLOPACIDAE	**andpipers**
Whimbrel	umenius phaeopus
Long-billed Curlew	umenius americanus
Upland Sandpiper	artramia longicauda
Greater Yellowlegs	ringa melanoleuca
Lesser Yellowlegs	ringa flavipes
Solitary Sandpiper	ringa solitaria
Willet	atoptrophorus semipalmatus
Spotted Sandpiper	ctitis macularia
Ruddy Turnstone	renaria interpres
Common Snipe	allinago gallinago
Short-billed Dowitcher	mnodromus griseus
Sanderling	alidris alba
Semipalmated Sandpiper	alidris pusilla
Least Sandpiper	alidris minutilla
Western Sandpiper	alidris mauri
LARIDAE	**ulls and Terns**
Stercorariinae	
Parasitic Jaeger	tercorarius parasiticus
Larinae	
Laughing Gull	arus atricilla
Sterninae	
Gull-billed Tern	terna nilotica
Caspian Tern	terna caspia
Least Tern	terna antillarum
Royal Tern	terna maxima
Sandwich Tern	terna sandvicensis

Family/Common Name	Common/Species Name
PARULINAE	**Wood-Warbles/Chipes olivaceos**
Blue-winged Warbler	Vermivora pinus
Tennessee Warbler	Vermivora peregrinaeopygia
Northern Parula	Parula Americana
Yellow/Mangrove Warbler	Dendroica petchia
Magnolia Warbler	Dendroica magnolia
Cape May Warbler	Dendroica tigrina
Black-throated Blue Warbler	Dendroica caerulescens
Yellow-rumped Warbler	Dendroica coronata
Black-throated Green Warbler	Dendroica vinens
Blackburnian Warbler	Dendroica fusca
Yellow-throated Warbler	Dendroica dominica
Prairie Warbler	Dendroica discolor
Palm Warbler	Dendroica palmarum
Black-poll Warbler	Dendroica striata
Black and White Warbler	Mniotilta varia
American Redstart	Setophaga ruticilla
Prothonotary Warbler	Protonotaria eitrea
Worm-eating Warbler	Helmitheros vermivorus
Swainson's Warbler	Limnothlyps swainsonii
Oven Bird	Seiurus aurocapillus
Northern Waterthrush	Seiurus noveboracensis
Louisiana Waterthrush	Seiurus motacilla
Kentucky Warbler	Oporornis formosus
Mourning Warbler	Oporornis philadelphia
Common Yellowthroat	Geothylpis trichas
Gray-crowned Yellowthrouat	Geothylpis poliocephala
Hooded Warbler	Wilsonia citrina
Yellow-breasted Chat	Icteria virens
HIRUNDINIDAE	**Swallows/Golondrinas**
Purple Martin	Progne subis
Gray-breasted Martin	Progne chalybea
Tree Swallow	Tachycineta bicolor
Mangrove Swallow	Tachycineta albilinea
North Rouchwing Swallow	Stelgidopteryx serripennis
Bank Swallow	Riparia riparia
Cliff Swallow	Hirundo pyrrhonota
Barn Swallow	Hirundo rustica
CORVIDAE	**Crows, Jays/Urracas, Cuervos**
Yucatan Jay	Cyanocorax yucatanicus
SYLVIINAE	**Gnatcatchers/Perlitas**
Blue-gray Gnatcatcher	Polioptila caerulea
MIMIDAE	**Thrashers/Cuitlacoches**
Veery	Catharus fuscescens
Gray-cheeked Thrush	Catharus minimus
Swainson's Thrush	Catharus ustulatus
Wood Thrush	Hylocichla mustelina
Gray Catbird	Dumetella cardolinensis
Black Catbird	Melanoptila glabrirostris
Tropical Mockingbird	Mimus gilvus
VIREONIDAE	**Vireos/Vireos**
White-eyed Vireo	Vireo griseus
Mangrove Vireo	Vireo pallens
Yellow-throated Vireo	Vireo flavifrons
Red-eyed Vireo	Vireo olivaceus
Yucatan Vireo	Vireosylva magister
Rufous-browned Peppershrike	Cyclarhis gujanensis

Continued…

TABLE 2

BIRDS OF THE BACALAR CHICO NATIONAL PARK

(Continued)

Family/Common Name	Common/Species Name	Family/Common Name	Common/Species Name
COLUMBIDAE	**Pigeons, Doves/Palomas**	**COEREBINAE**	**Bananaquits/Plataneras**
White-crowned Pigeon	*Columba leucocephala*	Banana Quit	*Coereba flaveola*
White-winged Dove	*Zenaida asiatica*		
Common Ground-Dove	*Columbina passerina*	**THRAUPINAE**	**Tanagers/Tangaras, Pirangas**
Caribbean Dove	*Leptotila jamaicensis*	Summer Tanager	*Piranga rubra*
		Scarlet Tanager	*Piranga olivacea*
PSITTACIDAE	**Parrots, Parakeets, Macaws**		
		CARDINALINAE	**Grosbeaks, Buntings/Picogruesos**
Arinae		Black-headed Saltator	*Saltator atriceps*
Olive-throated Parakeet	*Aratinga nana*	Rose-breasted Grosbeak	*Pheucticus ludovicianus*
		Blue Grosbeak	*Guiraca caerulea*
CUCULIDAE	**Cuckoos, Anis**	Indigo Bunting	*Passerina cyanea*
Coccyzinae		**EMBERIZINAE**	**Brush-finches, Sparrows, Towhees**
Yellow-billed Cuckoo	*Coccyzus americanus*	White-collared Seedeater	*Sporophila torqueola*
Mangrove Cuckoo	*Coccyzus minor*	Lincoln's Sparrow	*Melospiza lincolnii*
Squirrel Cuckoo	*Piaya cayana*		
		ICTERINAE	**Blackbirds, Orioles/Tordos, Bolseros**
Crotophaginae		Melodius Blackbird	*Dives dives*
Groove-billed Ani	*Crotophaga sulcirostris*	Great-tailed Grackle	*Quiscalus mexicanus*
Smooth-billed Ani	*Crotophaga ani*	Oachard Oriole	*Icterus spurious*
		Hooded Oriole	*Icterus cucullatus*
STRIGIDAE	*Owls/Tecolotes*	Yellow-backed Oriole	*Icterus chrysater*
Great Horned Owl	*Bubo virginianus*	Northern Oriole	*Icterus galbula*
Mottled Owl	*Ciccaba virgata*	Yellow-billed Cacique	*Amblycercus holosericeus*

…End

TABLE 3

TERRESTRIAL MAMMALS OF THE BACALAR CHICO NATIONAL PARK

Scientific Name	Common Name
Marsupials	
Philander (Metachirops) opossum	Four-Eyed Opossum
Edentates	
Tamandua mexicana	Ant Bear, Tamandua
Rodents	
Agouti paca	Gibnut
Heteromys gaumeri	Spiny Pocket Mouse
Sigmodon hispidus	Hispid Cotton Rat
Sphiggurus (Coendou) mexicannus	Mexican Porcupine
Sciurus sp.(probably) deppei	Yucatan Squirrel
Oryzomys couesi	Black-eared Rice Rat
Reithrodontomys gracilis	Slender Harvest Mouse
Carvivores	
Urocyon cinereoargenteus	Grey Fox
Procyon lotor	Raccoon
Leopardis (Felis) pardalis	Ocelot
Panthera (Felis) onca	Jaguar
Puma (Felis) concolor	Puma, Mountain Lion
Eira barbara	Bush dog, Gray-headed Tayra
Bassariscus sumichrasti	Cocomistle or Ring-tail Cat
Patos flavus	Martucha, Kinkajou, Nightwalker
Nasua nasua	Quash, Coatimundi, White-nosed Coati
Herpailurus (Felis) yagouaroundi	Jaguarundi, Halari
Leopardis (Felis) wiedii	Margay
Galictis vittata	Greater Grison, Grisón
Perissodactyls and Artiodactyls	
Tayassu pecari	White-Lipped Peccary, Warrie
Tayassu tajacu	Collared Peccary
Odocoileus virginianus	Savanna Deer, White-Tail Deer
Bats	
Artibeus jamaicensis	Jamaican Fruit-eating Bat
Micronycteris mealotis	Brazilian Large-eared Bat
Dermanura (Artibeus) phoeotis	Pygmy Fruit-eating Bat
Uroderma bilobatum	Common Tent-making Bat
Rhogeessa tumida	Central American Yellow Bat
Marine Mammals	
Tursiops truncatus	Bottlenose Dolphin
Trichechus manatus	Manatee

Other mammals recorded in the area include the Ant Bear (*Tamandua mexicana*), Gibnut (*Agouti paca*), the Bushdog (*Eira Barbara* - listed as an Endangered subspecies *E. barbara senex*), and the Cacomistle or Ring-Tail Cat (*Bassariscus sumichrasti* -Vulnerable). Margay (*Leopardus wiedii*), Ocelot (*Leopardis pardalis*), Jaguar (*Panthera onca*) and Puma (*Puma concolor*) have also been observed in the BCNP, suggesting the habitat and abundance of prey species appears to be sufficient to support the large cats. Many of the mammals in the BCNP demonstrate little fear of humans, which is likely a result of the parks remote location and limited exposure to hunting, and offers significant tourism value for the BCNP.

Survival of the BCNP's mammal population, however, will depend on the biological corridor between Ambergris Caye and the Yucatan Peninsula remaining intact. The corridor presently lies within fully protected areas extending from the BCNP, across the Mexican border to Xcalak, as mandated by the Belize/Mexico Bilateral Agreement. The narrow width and shallow depth of the Bacalar Chico channel allows for the transmigration of some species between Belize and Mexico, including the large cats, but a newly constructed channel across the southern end of the Yucatan Peninsula (near Xcalak) designed for cruise ship access undermines the corridors function.

- *Reptiles* Some 36 species of terrestrial reptiles are presently recognized as inhabiting the BCNP (Samos, pers comm; Cf. **Table 4**). In an earlier survey, Smith (1995) reported sightings of 25 reptile species within the BCNP, including 11 lizards, 8 snakes, and 2 inland turtles. The most commonly observed reptile was the Wish Willy (*Ctenosaura similis*), which occurred in most habitats, butwas most commonly found around the Bacalar Chico headquarters due to an assemblage of fruit trees and abundant food scraps from the headquarters facility. Fallen leaf litter appears to be an important habitat for many of the ground lizards and the parks single Skink (*Eumeces* sp.). Lizards and snakes were most abundant on the *Littoral Forest Coastal Dune* between Robles and Rocky Points. None of the lizard or snake species are listed as threatened, but the *Littoral Forest Coastal Dune* habitat in which they thrive faces a long-term threat from private development. Inland turtle species include the semi-aquatic mud turtle (*Kinosternon scorpiodes*) and the black belly turtle (*Rhinoclemys arelota*), both of which are found in the region west of Laguna de Cantena (Smith, 1995).

- *Amphibians* The Marine Toad (*Bufo marinus*) is the only amphibian species recorded in the BCNP to date (Smith, 1995), a likely result of the Marine Toad's tolerance for limited freshwater availability in dry weather, and other amphibian species intolerance of limited freshwater water availability. Further surveys, particularly in the less well studied interior of the Park, may yield one or more additional species of amphibian near other yet unrecorded micro-habitats, such as cenotes, where freshwater could be available in dry weather.

TABLE 4

REPTILES AND AMPHIBIANS OF THE BCNP/MR

Scientific Name	Common Name
REPTILES	
Lizards - Sauria	
Phylodactylus tuberculosus	Mangrove Gecko
Sphaerodactylus glaucus	Smooth-Scaled Gecko
Norops (Anolis) lemurinus	Lemurs Anole
Norops (Anolis) limifrons	Yellow Fan Anole
Norops (Anolis) sagrei	Brown Anole, Bark Anole
Basiliscus vittatus	Jesus Christ Lizard, Stripped Basilisk
Ctenosaura similis	Wish-Willy, Spiny-tail Iguana
Sceloporus chrysostictus	Yucatan Spiny Lizard
Eumeces sp. (probably) schwartzei	Skink
Ameiva undulata	Rainbow Ameiva
Cnemidophorus sp. (probably) gularis	Black-bellied Racerunner
Aristelliger georgeensis	Weatherman
Snakes - Serpentes	
Leptotyphlops goudoti	Blind Snake
Boa constrictor	Boa, Wowla
Drymarchan corasis	Black Tailed Indigo Snake
Drymobius margaritiferus	Speckled Racer
Leptophis mexicanus	Mexican Tree Snake
Oxybelis aeneus	Gray Vine Snake
Oxybelis fulgidus	Green Vine Snake
Tantilla canula	Black-Headed Snake
Leptodeira frenata	Cat-eyed Snake
Leptodeira septentrionalis	Central American Cat-eyed Snake
Spilotes pullatus	Thunder and Lightning Snake, Cribo
Tantilla schistosa	Black-headed Snake
Thamnophis proximus	Central American Ribbon Snake
Micrurus diastema	Coral Snake
Micrurus nigrocinctus	Coral Snake
Crocodilidans	
Crocodylus acutus	Crocodile
Turtles - Testudines	
Kinosternon scorpioides	Mud Turtle
Kinostermon leucostomum	White-faced Mud Turtle
Rhinoclemys areolata	Black Belly Turtle
Caretta caretta	Loggerhead Sea Turtle
Chelonia mydas	Green Turtle
Eretmochelys imbricata	Hawksbill Sea Turtle
AMPHIBIANS	
Bufo marinus	Marine Toad
Bufo valliceps	Gulf Coast Toad

Inland Brackish Water Ecosystems

There are a number of brackish inland lagoons about which there is little information. The following information has been summarized from BCES (1993) and Gibson (1991) by Azueta (unpub report).

- *Bacalar Lagoon* is connected to the Bacalar Chico channel by the Rio Bacalar. Existing knowledge suggests that it is the most productive lagoon in the BCNP. The lagoon bottom has a dense coverage of turtle grass with patches of manatee grass, as well as abundant algae (predominantly the red alga *Laurencia* sp.). The upside-down jellyfish (*Cassiopoea xamachana* and possibly *Cassiopoea frondosa*), typical of still coastal waters, are abundant. There is at least one underwater cave or 'blue hole' within the Lagoon, which is surrounded by bare sediment. Depths in Bacalar Lagoon rarely exceed 0.5 meters, except where there is a cenote. The lagoon is fringed with Red Mangroves that have densely encrusted prop roots. Fish sightings reported by BCES (1993) included many large Snappers, Tarpon, Permit, Yellow Jacks, Barracuda, Cichlids, Needlefish and Gray Angelfish. Similar plant and animal communities are found in the Bacalar Chico channel and in the narrow channel (Rio Cantena), which leads from Bacalar Lagoon into the Laguna de Cantena.

- *Laguna de Cantena* is a large lagoon with a few islands and a maximum depth of 4 meters in the centre. In a survey by Gibson (1991), anecdotal accounts of the Laguna de Cantena once being an important fishing ground for Snappers, Grunts, Sharks, Bonefish and Snook, were noted, but it was reported that the Lagoon had very little aquatic vegetation and was essentially void of fish. BCES (1993), reported the area near to Rio Cantena as having a similar biological community to that observed in Bacalar Lagoon and its associated channels, but a significant decline in aquatic diversity southward, where biocover abruptly changes to sparse patches of Shoal Grass (*Diplanthera wrightii*) growing on calcareous mud overlying a limestone rock bottom and fish abundance falls to zero. BCES (1993) further noted that the algae *Batophora oerstedii* supports large populations of the Isopod Scaribe (*Spaeroma tenebrans*), and Fighting Conch (*Strombus alatus*) in the southernmost part of the Lagoon. Smith (pers comm) however, reports observations of dense gastropod, stone bass, bonefish, algae and sea grass populations in the southernmost region of the Lagoon in 1994.

Inland Brackish Water Invertebrate Fauna

No authoritative studies have as yet been conduced on the brackish water invertebrate fauna of the BCNP. The only existing accounts of these organisms are those incidental records of jellyfish and small mobile crustaceans reported above. Further study of brackish water invertebrates within the BCNP Lagoons is warranted as reports to date are either conflict or reflect a very dynamic environment where higher organisms may benefit opportunistically, which in either case may provide useful information for appropriate management of human access to the these habitats.

Inland Brackish Water Vertebrate Fauna

No authoritative studies have as yet been conduced on the brackish water vertebrate fauna of the BCNP save and except for the variable accounts of fish abundance reported above. Further study of brackish water vertebrates within the BCNP Lagoons is warranted, in conjunction with the previously recommended study of brackish water invertebrate fauna, in order to generate more authoritative information for managing human access to the these habitats.

Marine Ecosystems

The main components of the marine environment are the barrier reef and reef lagoon on the eastern side of the BCMR, and the shallow coastal waters of Corozal/Chetumal Bay on the western side of the BCMR. Two marine habitat classifications have been developed for the BCMR. An initial classification scheme was developed by Coral Cay Conservation (1994) and later updated by Mumby et al (1998). Both classifications (shown in **Illustrations 13** and **14** respectively) are based on partially ground-truthed 30-meter LandSat imagery analysis. A 2001 15-meter, LandSat 7 image (Bands 321/RGB) of the same region described by both studies is shown in **Illustration 5** for comparison. The following annotative description of the primary habitats within the BCMR has been summarized from the earlier study by Azueta (unpub report).

- *The Barrier Reef lies* approximately 1 kilometer off shore from the eastern coastline of the BCNP, A shallow lagoon separates the reef from the shoreline, except at Robles Point and Rocky Point, where the reef meets the coastline. The profile of the barrier reef within the BCMR is relatively uniform, with few exceptions. The seaward margin of the reef is characterized by high-relief spur and groove formations extending from a depth of approximately 35 meters up to 20 meters, as a steeply sloping eastward wall. Initial field inspections suggest the high-relief spurs support the greatest coral diversity of the BCMR Barrier Reef. *Montastrea annularis* is particularly common, appearing as large, outcropping sheets. Species diversity in general, and fish abundance in particular are also high, especially pelagic species. Sandy grooves between the high-relief spurs contain isolated soft corals and macroalgae with occasional hard corals on rocky outcrops (Raines *et al* 1995).

  The spurs merge into a steep sandy escarpment along their seaward margin that extends to a depth of at least 150 meters and decreases in height towards the reef crest, forming a low-relief spur and groove formation in shallower water. Hard corals are replaced by soft corals with the westward decline in spur depth and relief. At approximately 10 meters depth, the spurs and grooves merge with a flat plain dominated by soft corals and a rich macro-algal community referred to as the *Gorgonian Plain*, which varies in width from 200 to 400 meters. The reef crest, which is characterized by abundant *Acropora palmata*, *Millepora spp.*, and *Diploria spp.*, borders the westward side of this Plain, where it spans some 20 meters in breadth at less than 2 meters depth.

  Exceptions to this typical fore reef profile include three types of variation. The first exists just south of the Boca Bacalar Chico, where the barrier reef presents a double reef crest: one continuous with the main reef crest and another which lays further seaward and parallel to the first that is separated by a broad, sandy area of approximately 20 meters depth.

ILLUSTRATION 13: Preliminary Bacalar Chico Marine Habitat Classification

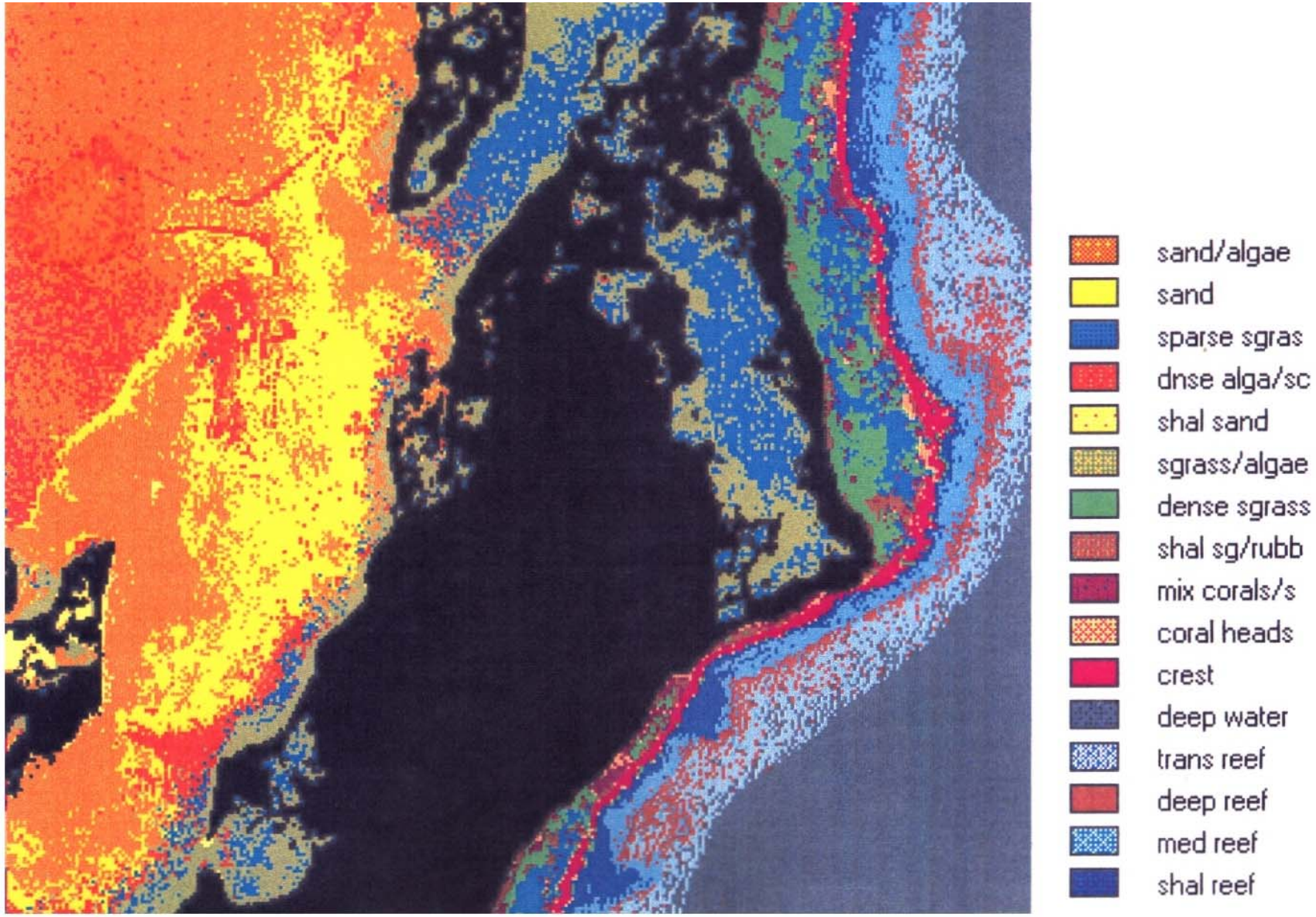
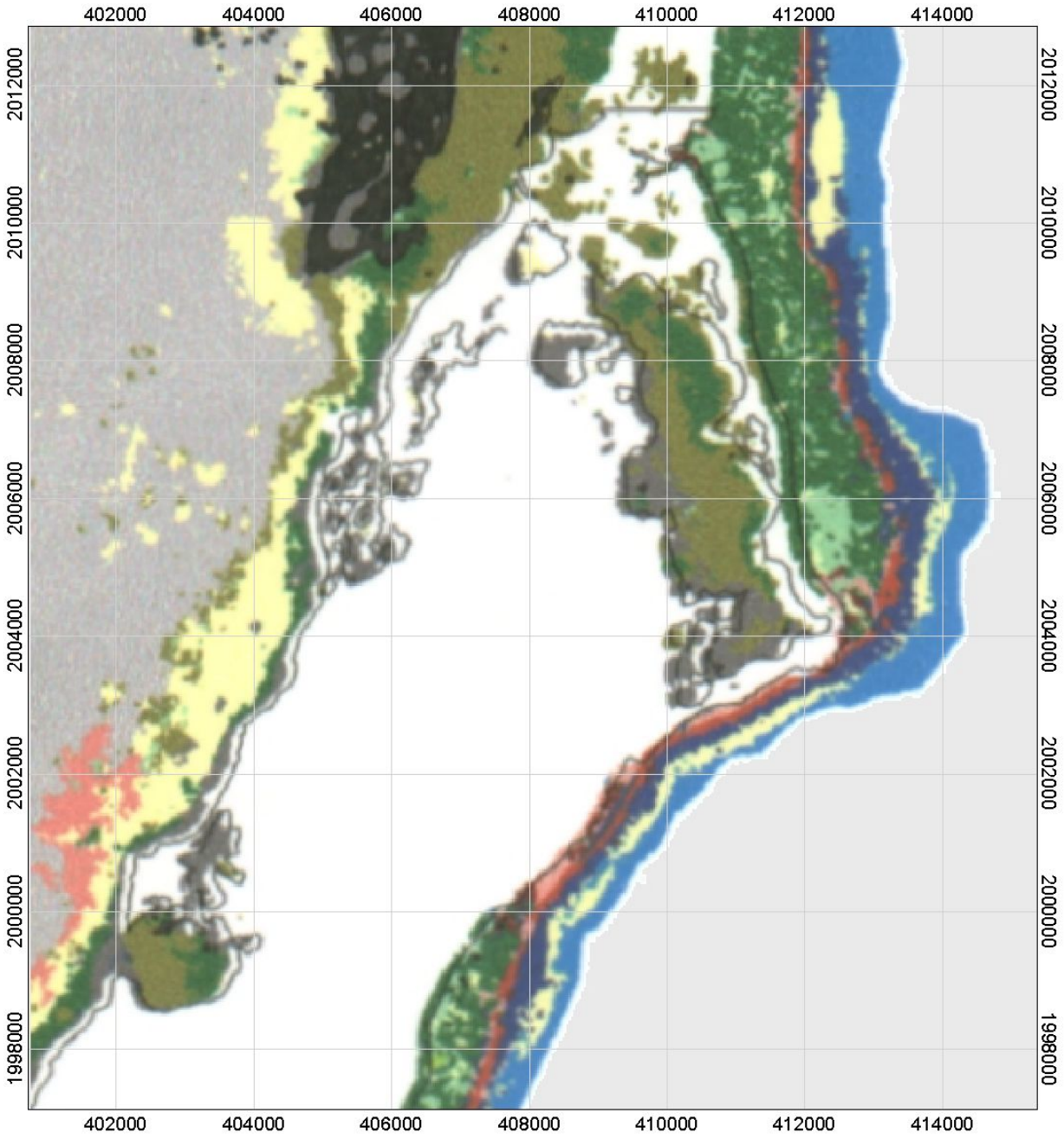


ILLUSTRATION 14:

Marine Habitat Classification For Bacalar Chico Marine Reserve, Ambergris Caye

Adapted From Mumby et al, 1998

UTM Zone 16 - NAD 27 Datum



Prepared By: T Grimshaw / Ecoworks

(Key: Addenda 7)

This secondary reef crest is similar to the main reef crest with sporadic stands of *Acropora palmata*, but lies in deeper water at about 6 meters depth. The fore reef profile of the seaward reef is similar to that of the main barrier reef, with a gorgonian plain giving way to spur and grooves (Raines *et al* 1995). The sandy plain between the double reef crest is locally known as *La Poza* (the well), and has recently been verified (McField *et al* 2003) as an important spawning aggregation site for Queen Conch (*Strombus gigas*).

The second type of variation is present where the barrier reef adjoins the shoreline at Rocky Point. At this location, there is no extensive back reef area, and the *Gorgonian Plain* is much wider, extending seaward for approximately 1 kilometre to depths in excess of 30 meters. Raines *et al* (1995) suggested that echolocation techniques might useful in determining whether spur and groove formations exist at greater depth, and recent discoveries of deep water marine fish spawning aggregations some 3 kilometers seaward from the shoreline at Rocky Point offer further support for the investigation.

The third type of variation exists as transverse cuts or channels through the main barrier reef complex. Cuts are typically smaller than channels, and are primarily found south of Rocky Point, where they support coral formations that extend to within 0.5 meters of the surface. Two wide channels are present north of Rocky Point, and are known locally as *Two* and *Three Channel Cuts* (the names reflecting the number of openings in the reef at each site). Three-Channel Cut lies approximately 3 kilometers south of Boca Bacalar Chico, and Two-Channel Cut lies approximately 2 kilometres north of Rocky Point.

- *The Back Reef Lagoon* extends to the north and south of Rocky Point, between the reef crest and shoreline and encompasses a complex mosaic of habitats. Immediately west or leeward of the reef crest in many areas is a coral rich back-reef habitat similar to that of the reef crest, which supports some of the more delicate coral species (e.g. *Porites branneri*) and otherwise high coral and fish diversity. This back reef habitat grades into scattered patch reef habitats visible from aerial photographs, one of which lies just inside the main reef in the middle of Two-Channel Cut, where Elkhorn Coral grows close to the water surface. Cantena Reef, a system of patch reefs to the north of Rocky Point, was briefly surveyed in 1993 and species lists and a general description are given in BCES (1993). The shallower back reef coral habitats are apparently highly vulnerable to bleaching and were severely damaged in Belize's 1995 and 1998 bleaching events (Cf. Smith 1998 and/or McField , 1999).

  Most other Lagoon habitats are dominated by sea grasses (*Thalassia testudinum* and *Syringodium filiforme*) and macroalgae. The mosaic of patch reefs extending westward from the back reef habitat variously grade into a much less diverse habitat mosaic of sparse algal canopy, low density sea grass cover and/or bare sand, often with numerous burrows of the Southern Lugworm (*Arenicola cristata*). Two large depressions exist in this shallow back reef region approximately halfway between Boca Bacalar Chico and Rocky Point, which contain abundant fish populations. North of Rocky Point this habitat grades into a dense sea grass habitat along the shoreline.

- *The Western Lagoon* is a relatively shallow expanse of costal waters supporting few habitat types. The bottom is mainly limestone rock covered in some areas by a thin layer of sandy mud that supports inter-mixed patches of the alga *Batophora oerstedii* and Turtle Grass (*Thalassia testudinum*).

Marine Algae and Plants

No works have as yet been published on marine algae or plants of the BCMR. This topical area is important from the standpoint of understanding species that from the forage base for Manatee, Spiny Lobster and Conch within the Reserve. A provisional species list of marine algae and plants is shown in **Table 5**.

Marine Invertebrate Fauna

BCMR marine invertebrates (Cf. **Table 6**) can be loosely grouped into four basic categories in respect to the level of study they have received. These include (1) burrowing invertebrates such as polychaete worms and bi-valve molluscs; (2) non-burrowing, sessile invertebrates, which are largely represented by corals, but also include other groups such as tunicates; (3) mobile benthic invertebrates, which largely include echinoderms, crustacean and molluscs such as Conch; and (4) planktonic invertebrates.

Burrowing invertebrates have received limited attention in field investigations, the majority of work having been conducted in studies by Dachary et al (1991) and variously by Mazzullo *et al* (1992). All of the field investigations on non-burrowing, sessile invertebrates have to date been limited to coral studies concerned with distribution and diversity (e.g. BCES 1993, Raines *et al* 1995, Mumby *et al* 1998, and Gibson and Carter 2003), and/or responses to disturbance (e.g. Smith 1998, McField 1999 and Kramer and Kramer 2000) which collectively have provided the coral species list shown in **Table 4**, but otherwise offer few insights on other taxa in this category.

Mobile benthic invertebrates have received limited attention by field investigations, virtually all of which has been limited to commercial species (e.g. McField *et al* 2003, Paz and Grimshaw, 2003). Azueta (unpub report) reports that a recent (2002) study verified three specific breeding aggregation sites for Queen Conch within the BCMR as being located at: Basil Jones (20 meters depth), Rocky Point (27 meters depth), and La Poza (20 meters depth). Azueta further reported in the same study that Queen Conch population density was approximately 0.0013 animals per square meter within general use zones, and 0.0353 animals per square meter within conservation zones. In a study of Spiny and Spotted Lobster (*Panulirus argus* and *P. gutatus*, respectively) abundance within the BCMR, Azueta (unpub report) reports that juvenile lobster abundance was inversely related to adult lobster abundance, regardless of fishing season, suggesting that habitat cover availability, juvenile-adult interactions and/or fishing pressure, may significantly influence juvenile recruitment within the reserve. Reports on non-commercial species are scant. Smith (pers comm) reported that Rocky Point is an important site for breeding hermit crabs (*Coenobita clypeatus*) in July and August, and Hol Chan Marine Reserve (HCMR) staff are reported (BCES 1993) to have conducted a study on a large population of edible West Indian Top Shell (*Livona pica*).

No works have as yet been published on planktonic invertebrate fauna of the BCMR. This topical area is important from the standpoint of understanding species recruitment dynamics within the Reserve, particularly in the northern region known locally as *La Poza,* which supports both spawning and juvenile populations of the Queen Conch.

TABLE 5

MARINE ALGAE AND PLANTS OF THE BACALAR CHICO MARINE RESERVE

Chlorophyta
Uva spp
Acetabularia spp
Caulerpa spp
Caulerpa paspaloides
Caulerpa cupressoides
Caulerpa prolifera
Rhipocephalus phoenix
Penicillus capitatus
Penicillus dumetosus
Avrainvillae spp
Penicillus pyriformis
Udotea flabellum
Cladocephalus luteofuscus
Udotea wilsonii
Udotea occidentalis
Udotea cyathiformia
Halimeda incrassata
Halimeda monile
Halimeda opuntia
Halimeda goreaui
Halimeda copiosa
Halimeda tuna
Halimeda discoidea
Cladophora prolifera
Ventricaria ventricosa
Enteromorpha flexuosa

Rhodophyta
Calfified encrusting
Filamentous
Sheetlike
Fine branched
Coarse branched
Calcified
Encrusting
Amphiroa spp.
Wrangelia argus
Liagora spp.
Halymenia floresia
Kallymenia limminghei

Phaeophyta
Dictyota spp
Lobophora variegata
Sargassum spp
Sargassum hystrix
Turbinaria turbinara
Padina gymnospora
Padina stypopodium

Marine Plants (Seagrasses)
Thallasia Testudinum
Syringodium filiforme

TABLE 6

CORAL SPECIES OF THE BACALAR CHICO MARINE RESERVE

Family/Species	Common Name
SCLERACTINIA (Hard Corals)	
Acroporidae	
Acropora cervicornis	Staghorn coral
Acropora palmata	Elkhorn coral
Acropora prolifera	Fused Staghorn
Agaricidae	
Agaricia agaricites	Lettuce coral
Agaricia fragilis	Fragile Saucer Coral
Agaricia humilis	Low Relief Lettuce Coral
Agaricia lamarcki	Lamarck's Sheet coral
Agaricia tenuifolia	Thin Leaf Lettuce coral
Agaricia purpurea	Lettuce coral
Agaricia undata	Scroll Coral
Leptoseris cucullata	Sunray Lettuce Coral
Astrocoenidae	
Stephanocoenia michelinii	Blushing Star Coral
Caryophyllidae	
Eusmilia fastigiata	Smooth Flower Coral
Faavidae	
Colpophyllia natans	Boulder Brain coral
Diplora clivosa	Knobby Brain coral
Diplora labyrinthiformes	Grooved Brain coral
Diplora strigosa	Symmetrical Brain Coral
Montastrea annularis	Boulder Star coral
Montastrea cavernosa	Great Star Coral
Manicina areolata	Rose Coral
Favia fragum	Golfball Coral
Solenastrea bournoni	Smooth Star Coral
Solenastrea hyades	Knobby Star Coral
Meandrinidae	
Dendrogyra cylindrus	Pillar coral
Dichocoenia stokesii	Elliptical Star Coral
Meandrina meandrites	Maze Coral
Mussidae	
Isophyllastrea rigida	Rough Star Coral
Isophyllia sinuosa	Sinuous Cactus coral
Mycetophyllia aliciae	Knobby Cactus Coral
Mycetophyllia ferox	Rough Cactus Coral
Mycetophyllia danaana	Lowridge Cactus coral
Mycetophyllia lamamarckiana	Ridged Cactus Coral
Mussa angulosa	Spiny Flower Coral
Scolymia lacera	Atlantic Mushroom Coral
Siderastreidae	
Siderastrea radians	Lesser Starlet Coral
Siderastrea siderea	Massive Starlet coral
Poritidae	
Porites porites	Finger coral
Porites astreoides	Mustard Hill coral
Porites furcata	
Porites colonensis	Honeycomb Plate Coral
Porites divaricata	
Seriatoporidae	
Madracis decactis	Ten-Ray Star Coral
Madracis mirabillis	Yellow Pencil coral
Madracis pharensis	Star Coral
Class Hydrozoa	
Millipora alcicornis	Branching Fire Coral
Millipora complanata	Brade Fire Coral
OCTOCORALLIA (Soft Corals)	
Anthothelidae	
Erythropodium caribaeorum	Encrusting Gorgonian
Icligorgia schrammi	Deep water Sea Fan
Briareidae	
Briareum asbestinum	Corky Sea Finger
Plexauridae	
Eunicea calyculata	Warty Sea Rod
Eunicea fusca	Doughnut Sea Rod
Eunicea laxispica	
Eunicea mammosa	Swollen-Knob Sea Rod
Eunicea succinea	Shelf-Knob Sea Rod
Eunicea tourneforti	
Mucicea atlantica	
Mucicea elongata	Orange Spiny Sea Rod
Mucicea laxa	Delicate Spiny Sea Rod
Mucicea muricata	Spiny Sea Rod
Muriceopsis flavida	Rough Sea Plume
Plexaura flexuosa	Bent Sea Rod
Plexaura homomalla	Black Sea Rod
Plexaura sp.	
Plexaurella grandiflora	Silt-Pore Sea Rod
Plexaurella nutans	Giant Slit-Pore Sea Rod
Pseudoplexaura porosa	Porous Sea Rod
Gorgonidae	
Gorgonia flavellum	Venus Sea Fan
Gorgonia mariae	Wide-Mesh Sea Fan
Gorgonia ventalina	Common Sea Fan
Pseudopterogorgia sp.	Sea Plumes
Pseudopterogorgia bipinnat	Bipinnate Sea Plume
Pterogorgia anceps	Angular Sea Whip
Pterogorgia citrina	Yellow Sea Whip
Pterogorgia guadalupensis	Grooved-Blade Sea Whip

Marine Vertebrate Fauna

All of the published and informal reports on marine vertebrates have to date been limited to those species utilizing the eastern seaward waters of the BCMR, save perhaps for limited anecdotal accounts concerning West Indian Manatee (*Trichechus manatus* - Endangered) and select species of birds.

- *Mammals* The West Indian Manatee is the only marine mammal species recurrently noted as utilizing the coastal waters of the BCMR. Various sightings of this species have been made of this species along the western coastline of Bacalar Chico during the aerial surveys (CZM, 199X), and Smith (pers comm.) has frequently reported on Manatee resting in the Basil Jones Channel.

- *Reptiles* Three of the five turtle species found in the BCNP are sea turtles, and include the Loggerhead Turtle (*Caretta caretta* - Vulnerable), Green Turtle (*Chelonia mydas* - Threatened) and Hawksbill Turtle (*Eretmochelys imbricata* - Endangered). Sea turtle usage of the park is largely restricted to nesting use of the same *Littoral Forest Coastal Dune* habitat, which supports an abundance of other reptile species. Juvenile Green and Hawksbill turtles can be found in the sea grass beds and inner lagoon/patch reefs, while juvenile Loggerheads are not found in the area. Sub-adult and mature Loggerheads and Hawksbills can be found foraging on the fore reef. Mature Green Turtles are normally only in the area while mating and nesting. Of primary conservation value are the Loggerhead and Green Turtles, because the *Littoral Forest Coastal Dune* habitat where they nest supports more nests per year for these two species than all other known sites in Belize combined.

  A survey of marine turtle nesting activity within the BCNP by the Belize Fisheries Department (**BFD**) established that the Loggerhead/Green Turtle nesting season commences with the first nest being laid on or about 27 May and concludes with the last nest being laid on or about 7th September (Majil 2000). The greatest number of nest laid in any single month during the survey period was in June, and more nests were laid at Robles Point than at Rocky Point. The mean incubation period estimated for 2000 was 52 days. A total of 47 nests were identified within the BCNP, during the 200 survey, of which 36 were laid by Loggerhead Turtles, and 11 of which were laid by Green Turtles. Park staff inspected 22 nests, and reported egg counts to range from 43 to 157. Total egg count from these 22 nests was 2,713, approximately 82 % of which hatched successfully; and 466 (17 %) failed to hatch, with 1 hatchling dieing in the nest. Tour guides brought more than 200 turtle watching visitors to the BCNP in 2000.

  A resident population of the American Saltwater Crocodile (*Crocodylus acutus* - Vulnerable) uses the Laguna de Cantena for nesting and nursery, with juveniles (30 – 40 cm in length) observed to occupy the root framework of Red Mangroves. Platt (1997) captured adult and juvenile Crocodiles in the BCNP to measure length, weight, stomach contents and blood levels of heavy metals. The animals collected in the Park demonstrated normal levels of heavy metals in contrast to the New River population on the Belize mainland, which showed higher levels and possible impact on nesting success.

- *Fin Fish of the Fore Reef Habitat* All of the field investigations concerning fore reef fish fauna of the BCMR have focused on spawning aggregations of commercially important species. The primary locality where these aggregations occur is 1-3 kilometers offshore from Rocky Point (Cf. **Illustration 15**). Paz and Grimshaw (2001) reported to spawning aggregation activity at this location by Black Grouper (*M. bonaci*), Dog Snapper (*L. jocu*), White Marget (*H. album*) and Horse-Eye Jack (*C. latus*). Historical reports document the site as an important aggregation site for Nassau Grouper (*E. striatus*), but no aggregations were noted Paz and Grimshaw (2001). Other species variously reported by Majil (pers comm) and/or Paz (pers comm) to spawn at the Rocky Point aggregation site are shown in blue type face in **Table 7**.

- *Fin Fish of the Back Reef Habitat* The BCMR supports a wide range of fin fish species which presently numbers some 187 species (Cf. **Table 7**). Virtually no information is available on the fish fauna of the western BCMR, as all such studies conducted to date have focused on the BCMR's eastern fish fauna. The BFD conducted 15 transect surveys of fin fish population in back reef habitat over a 2 month period from December to January 2000/01, and recorded the occurrence of 17 fin-fish families comprising 34 species (Cf. **Table 8**). Haemulidae were a conspicuous element of the sampled habitat, representing > 75 % of the total number of recorded individuals. The Blue-Stripe Grunt (*Haemulon sciurus*) was the single most common fish surveyed, having an average transect frequency of 10, and a total count of 1,051, representing > 61 % of sampled individuals. Trophic classification of counted individuals suggests a food chain rich in secondary consumers, with herbivores and browsers comprising approximately 6 %; planktivors comprising approximately 9 %; invertivores comprising approximately 73 % and piscavores comprising approximately 9 % of total fish counts.

  Many fish known to inhabit the area were not represented in the visual estimate because they were either nocturnal, occupy cryptic habits, were too numerous or were not suitable for sampling due to their small size (e.g. Gobies and Blennies). Sedberry and Carter (1993) conducted a fish survey of *Laguna Boca Ciega* on the southern end of Ambergris Caye, and noted a number of fish species in sea grass and sand-rubble habitats not evaluated in the BFD survey. The most common species observed included: the Shortband Herring (*Jenkinsia stolifera*), the Blue-Strip Grunt (*Haemulon sciurus*), the Ocean Sturgeon (*Acanthurus bahianus*), and the Fringed File Fish (*Monacanthus ciliatus*), with the fish fauna of sea grass beds in the lagoon being predominately comprise of juvenile reef species, suggesting that sea grass habitat has an important nursery function.

  Paz and Grimshaw (2003) surveyed commercial species abundance in the eastern BCMR and found the area to support a complex, spatially and temporally segregated assemblage of 6 Snapper species. Cuberra (L. cyanopterus) and Yellowtail (O. chrysurus) Snappers were largely restricted to the fore reef zone in the north and south (respectively), while Mutton (L. analis), Dog (L. jocu) and Black (L. griseus) Snappers intermingled across the southern back reef zone. Five of the six Sapper species surveyed were less abundant during the middle of the year, while Cuberra Snapper were found to be opportunistically abundant during their absence.

TABLE 7

FISH SPECIES OF THE BACALAR CHICO MARINE RESERVE[1]

Family/Species	Common Name
Chaetodontidae	
Chaetodon capistratus	Foureye Butterflyfish
Chaetodon ocellatus	Spotfin Butterflyfish
Chaetodon aculeatus	Longsnout Butterflyfish
Chaetodon striatus	Banded Butterflyfish
Chaetodon sedentarius	Reef Butterflyfish
Pomacanthidae	
Pomacanthus paru	French Angelfish
Holacanthus ciliaris	Queen Angelfish
Pomacanthus arcuatus	Gray Angelfish
Holacanthus tricolor	Rock Beauty
Centropyge argi	Cherubfish
Acanthuridae	
Acanthurus bahianus	Ocean Surgeonfish
Acanthurus chirugus	Doctorfish
Acanthurus coeruleus	Blue Tang
Carangidae - Jacks	
Trachinotus falcatus	Permit
Trachinotus goodie	Palometa
Seriola zonata	Banded rudderfish
Seriola rivoliana	Almaco jack
Seriola dumerili	Greater amberjack
Caranx latus	Horse-eye jack
Caranx hippos	Crevalle jack
Caranx crysos	Blue runner
Caranx rubber	Bar jack
Caranx bartholomei	Yellow jack
Alectic ciliaris	African pompano
Trachinotus carolinus	Florida pompano
Elagatis bipinnulata	Rainbow runner
Lutjanidae - Snappers	
Lutjanus griseus	Gray snapper
Lutjanus apodus	Schoolmaster
Lutjanus analis	Mutton snapper
Lutjanus synagris	Lane snapper
Lutjanus cyanopterus	Cubera snapper
Lutjanus jocu	Dog snapper
Lutjanus vivanus	Silk snapper
Lutjaus bucanella	Blackfin snapper
Etelis oculatus	Queen snapper
Ocyurus crysurus	Yellowtail snapper
Apsilus dentatus	Black snapper
Lutjanus mahogoni	Mahogany snapper
Pristopomoides aquilonaris	Wenchman
Lutjanus campechanus	Red snapper

Family/Species	Common Name
Holocentridae	
Holocentrus adscensionisis	Squirrelfish
Holocentrus rufus	Longspine Squirrelfish
Sargocentron vexillarius	Dusky Squirrelfish
Neoniphon marianus	Longjaw Squirrelfish
Sargocentron coruscus	Reef Squirrelfish
Myripristis jacobus	Blackbar Soldierfish
Priacanthus arenatus	Bigeye
Apogonidae	
Apogon townsendi	Belted Cardinalfish
Mullidae	
Mulloidichthys martinicus	Yellow Goatfish
Pseudupeneus maculatus	Spotted Goatfish
Balistidae	
Canthidemis sufflamen	Ocean Triggerfish
Balistes vetula	Queen Triggerfish
Melichthys niger	Black Durgon
Muraenidae	
Gymnothorax funebris	Green Moray
Gymothorax moringa	Spotted Moray
Monacanthidae	
Cantherhines pullus	Orangespotted Filefish
Aluterus scriptus	Scrawled Filfish
Sparidae	
Calamus calamus	Saucereye Porgy
Calamus bajonado	Jolthead Porgy
Archosargus rhomboidalis	Sea Bream
Gerreidae	
Diapterus auratus	
Eucinostomus argenteus	
Eucinostomus gula	Silver Jenny
Eucinostomus jonesi	Slender Mojarra
Eugerres plumieri	Chihua
Gerres cinereus	Yellowfin Mojarra
Ephippidae	
Chaetodipterus faber	Atlantic Spadefish
Sphyraenidae	
Sphyraena barracuda	Great Barracuda
Elopidae	
Elops saurus	Ladyfish
Megalops atlanticus	Tarpon

[1]Spawning Aggregation Species shown in blue type face

Continued…

TABLE 7

FISH SPECIES OF THE BCMR[1]

(Continued)

Family/Species	Common Name
Pomadasyidae	
Haemulon carbonarium	Caesar Grunt
Haemulon sciurus	Bluestriped Grunt
Haemulon flavolineatum	French Grunt
Haemulon plumieri	White Grunt
Haemulon aurolineatum	Tomtate
Haemulon striatum	Striped Grunt
Haemulon macrostomium	Spanish Grunt
Haemulon parra	Sailors Choice
Haemulon chrysargyeum	Smallmouth Grunt
Haemulon album	Margate (White)
Anisotremus surinamensis	Black Margate
Anisotremus virginicus	Porkfish
Haemulon melanurum	Cottonwick
Pomacentridae	
Stegastes planifrons	Treespot Damselfish
Stegastes partitus	Bicolor Damselfish
Stegastes leucostictus	Beaugregory
Stegastes fuscus	Dusky Damselfish
Stegastes variabilis	Cocoa Damselfish
Stegastes diencaeus	Longfin Damselfish
Microspathodon chrysurus	Yellowtail Damselfish
Abudefduf saxatilis	Sergeant Major
Chromis multilineata	Brown Cromis
Chromis cyanea	Blue Chromis
Serranidae - Hamlets	
Hypoplectrus indigo	Indigo Hamlet
Hypoplectrus puella	Barred Hamlet
Hypoplectrus gummingatta	Golden Hamlet
Hypoplectrus unicolor	Butter Hamlet
Hypoplectrus guttavarius	Shy Hamlet
Hypoplectrus aberrans	Yellowvbelly Hamlet
Hypoplectrus gemma	Blue Hamlet
Serranidae - Groupers	
Epinephelus striatus	Nassau Grouper
Epinephelus guttatus	Red Hind
Epinephelus itajara	Goliath Grouper
Mycteroperca venenosa	Yellowfin grouper
Mycteroperca interstitialis	Yellowmouth grouper
Mycteroperca bonaci	Black grouper
Epinephelus nigritus	Warsaw grouper
Epinephelus morio	Red grouper
Mycteroperca tigris	Tiger grouper
Epinephelus adscensionis	Rock Hind
Epinephelus fulvus	Coney
Epinephelus cruentatus	Graysby
Centropomidae	
Centropomus undecimalis	Common Snook
Albulidae	
Albula vulpes	Bonefish
Clinidae	
Malacoctenus boehlkeri	Diamond Blenny
Aulostomidae	
Aulostomus maculatus	Trumpetfish
Coryphaebudae	
Coryphaena hippurus	Dolphin
Malacanthidae	
Malacnathus plumieri	Sand Tilefish
Tetraodontidae	
Canthigaster rostrata	Sharpnose Puffer
Sphoeroides spengleri	Bandtail Puffer
Sphoeroides testudineus	Checkered Puffer
Diodontidae	
Chilomycterus schoepfi	Striped Burrfish
Diodon holocanthus	Balloonfish
Diodon hystrix	Porcupinefish
Synodotidae	
Synodus saurus	Bluestriped Lizardfish
Scombridae	
Scomberomorous regalis	Cero
Scomberomorous cavalla	King mackerel
Scomberomorous maculates	Spanish mackerel
Acanthocybium solandri	Wahoo
Euthynnus alletteratus	Little tunny
Thunnus atlanticus	Blackfin tuna
Katsuwonus pelamis	Skipjack tuna
Thunnus albacares	Yellowfin tuna
Thunnus alalunga	Albacore
Sarda sarda	Atlantic bonito
Xiphiidae	
Xiphias gladius	Swordfish
Istiophoridae	
Makaira nigricans	Blue marlin
Tetrapterus albidus	White marlin
Istiophorus platypterus	Sailfish

[1]Spawning Aggregation Species shown in blue type face

Continued…

TABLE 7

FISH SPECIES OF THE BCMR[1]

(Continued)

Family/Species	Common Name	Family/Species	Common Name
Rachycentridae			
Rachycentron canadus	Cobia	**Rhincodontidae**	
		Ginglymostoma cirratum	Nurse Shark
Serranidae - Sea Bass			
Serranus tortugarium	Chalk Bass	**Carcharhinidae**	
Serranus tigrinus	Harlequin Bass	*Negaprion brevirostris*	Lemon Shark
Serranus tabacarius	Tobacofish	*Carcharhinus leucas*	Bull Shark
		Carcharhinus perezi	Reef Shark
Grammidae		*Carcharhinus limbatus*	Blacktip Shark
Gramma melacara	Blackcap Basslet	*Galeocerdo cuvier*	Tiger Shark
Gramma loreto	Fairy Basslet		
		Narcinidae	
Scaridae		*Narcine brasiliensis*	Lesser Electric Ray
Scarus taeniopterus	Princess Parrotfish		
Scarus vetula	Queen Parrotfish	**Dasyatidae**	
Scarus guacamaia	Rainbow Parrotfish	*Dasyatis guttata*	
Scarus coeruleus		*Dasyatis americana*	Southern Stingray
Scarus coelestinus	Midnight Parrotfish	*Dasyatis sabina*	
Scarus iserti		*Himantura schmardae*	Caribbean Stingray
Sparisoma aurofrenatum	Redband Parrotfish		
Sparispoma viride	Stoplight Parrotfish	**Myliobatidae**	
		Aetobatus narinari	Spotted Eagle Ray
Labridae			
Lachnolaimus maximus	Hogfish	**Urolophidae**	
Bodianus rufus	Spanish Hogfish	*Urolophus jamaicensis*	Yellow Stingray
Halichoeres maculipinna	Clown Wrasse		
Halichoeres garnoti	Yellowhead Wrasse	**Haemulidae**	
Halichoeres radiatus	Puddingwife	*Haemulon Chrysargyreun*	Smallmouth Grunt
Halichoeres bivittus	Slippery Dick	*Haemulon Macrostomum*	Spanish Grunt
Thalassoma bifasciatum	Bluehead	*Haemulon parra*	Sailors Choice
Clepticus parrae	Creole Wrasse	*Haemulon plumieri*	White Grunt
Xyrichtys martinicensis	Rosy Razorfish	*Haemulon sciurus*	Bluestriped Grunt
Doratonotus megalepis	Dwarf Wrasse	*Haemulon flavolineatum*	French Grunt
		Haemulon album	White Margate
Ostracidae			
Lactophyrus triqueter	Smooth Trunk Fish		

[1]Spawning Aggregation Species shown in blue type face

… End

TABLE 8

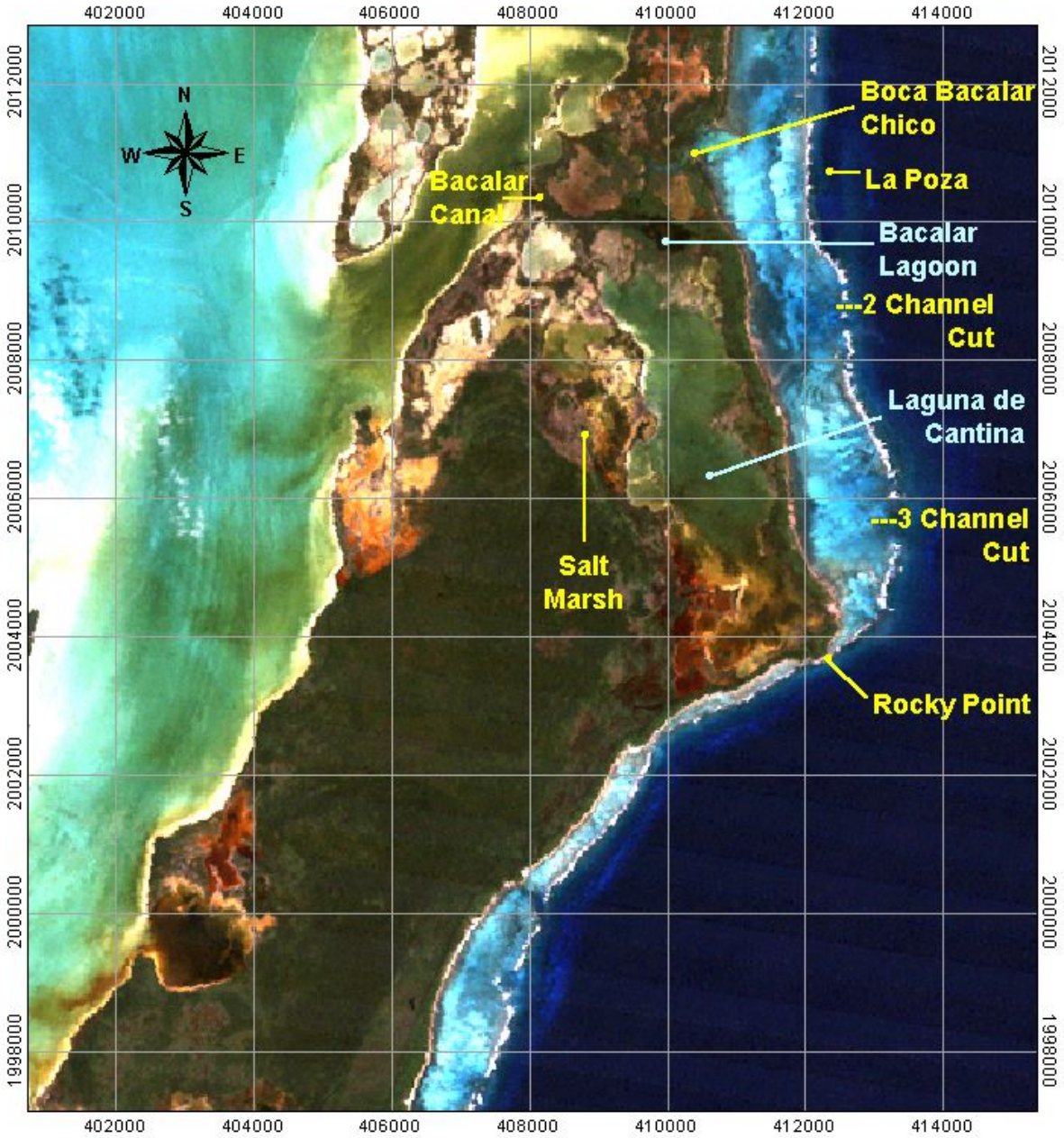
FISH SPECIES OF THE BACK REEF HABITAT OF THE EASTERN BCMR

Family	Scientific Name	Common Name	Trophic Class	Avg Count	% Total
Acanthuridae	*Acanthurus coeruleus*	Blue Tang	Herbivore	3	1.93%
Balistidae	*Balisties vetula*	Queen Triggerfish	Pisc/Invert	2	0.18%
Balistidae	*Melichthys niger*	Black Durgon	Invertivore	1	0.06%
Carangidae	*Caranx ruber*	Bar Jack	Piscavore	5	1.93%
Carangidae	*Cranx bartholomaei*	Yellow Jack	Piscavore	1	0.53%
Chaetodontidae	*Chaetodon capistratus*	Foureye Butterflyfish	Browser	1	0.18%
Chaetodontidae	*Chaetodon striatus*	Banded Butterflyfish	Browser	2	0.18%
Haemulidae	*Haemulon chrysargyreun*	Smallmouth Grunt	Invertivore	1	0.06%
Haemulidae	*Haemulon macrostomum*	Spanish Grunt	Invertivore	1	0.12%
Haemulidae	*Haemulon parra*	Sailors Choice	Invertivore	1	5.84%
Haemulidae	*Haemulon plumieri*	White Grunt	Invertivore	2	0.23%
Haemulidae	*Haemulon sciurus*	Bluestriped Grunt	Invertivore	10	61.35%
Haemulidae	*Halemulon flavolineatum*	French Grunt	Invertivore	5	7.59%
Holocentridae	*Holocentrus adscensionis*	Squirrelfish	Invertivore	1	0.70%
Holocentridae	*Holocentrus vexillarius*	Dusky Squirrelfish	Invertivore	1	0.06%
Labridae	*Thalassoma bifasciatum*	Blueheaded Wrasse	Plnk/Invert	4	2.34%
Lutjanidae	*Lutjanus analis*	Mutton Snapper	Pisc/Invert	1	0.12%
Lutjanidae	*Lutjanus apodus*	Schoolmaster	Pisc/Invert	3	1.93%
Lutjanidae	*Lutjanus synagris*	Lane Snapper	Pisc/Invert	4	0.76%
Lutjanidae	*Ocyurus chrysurus*	Yellowtail Snapper	Pisc/Invert	1	2.28%
Malacanthidae	*Malacanthus plumieri*	Sand Tilefish	Invertivore	6	0.06%
Mullidae	*Mulloidichtlys martinicus*	Yellow Goatfish	Invertivore	2	0.23%
Muraenidae	*Gymnothorax funebris*	Green Moray	Piscavore	1	0.06%
Ostraciidae	*Lactophyrus triqueter*	Smooth Trunk Fish	Piscavore	1	0.06%
Pomacanthidae	*Abudefduf saxatilis*	Sergeant Major	Plnk/Invert	4	6.83%
Pomacanthidae	*Holocantus tricolor*	Rock Beauty	Browser	1	0.06%
Pomacanthidae	*Microspathodon chrysurus*	Yellowtail Damselfish	Browser	3	0.06%
Pomacanthidae	*Pomacanthus arcuatus*	Gray Angelfish	Browser	3	0.53%
Scaridae	*Scarus coelestinus*	Midnight Parrotfish	Herbivore	1	0.12%
Scaridae	*Scarus vetula*	Queen Parrotfish	Herbivore	1	0.12%
Scaridae	*Sparisoma aurofrenatum*	Redband Parrotfish	Herbivore	2	0.29%
Scaridae	*Sparisoma viride*	Stoplight Parrotfish	Herbivore	6	2.57%
Serranidae	*Epinephelus guttatus*	Red Hind	Piscavore	1	0.06%
Sphyraenidae	*Sphyraena barracuda*	Great Baracuda	Piscavore	5	0.64%
17 FAMILIES	**34 SPECIES**			**86**	**100%**

ILLUSTRATION 15:

Key Coastal Features Of The Bacalar Chico Area, Ambergris Caye

UTM Zone 16 - NAD 27 Datum



Prepared By: T Grimshaw / Ecoworks

2.4 Cultural Characteristics

Historical Occupation

- *Mayan Occupation* The ancient Maya are best known for their stone temples and impressive carvings or stellae, which can be found throughout mainland Belize. The Maya were also sea traders, however, and Ambergris Caye was an important commercial trading center during the Classic Maya Period of 300 - 900 A.D. (Guderjan 1993). Mayan traders are reputed to have excavated the Bacalar Chico channel between 700 and 900 A.D. in order to reduce travel time (Garber, 1986), and/or possibly travel risk in the open sea associated with crossing the Rocky Point area of the Caye.

  The BCNP encompasses at least 9 known archaeological sites (see **Illustration 16**). The four sites of Chac Balam, San Jan, Punta Limon and Peseta are located on the western side of the BCNP, and believed to have been maintained as coastal trading sites. The Chac Balam site suggests the greatest level of development among all of the n9 sites within the BCNP. The San Juan site has been excavated and mapped by archaeologists who found artifacts from Mayan, Spanish and British settlements. The five sites of Ek Luum, Valencia, Franco, Burning Water and Robles Point are located on the eastern side of the BCNP, and are believed to have been maintained as coastal fishing villages. A tenth site, Basil Jones, is located just west of the southern boundary of the BCNP and is regarded as being especially important for its remaining wall network throughout the settlement, and its potential to provide missing information on the transition from Classic Mayan to modern times (BCES 1993).

  In addition to the cultural and historical value of these lesser-known sites, their existence adds to the tourism potential of the reserve. Establishment of the existing field station at the San Juan site now provides a deterrent to looting and other disturbances of the western sites. However, the establishment of the protected area has not encouraged archaeological research at these sites.

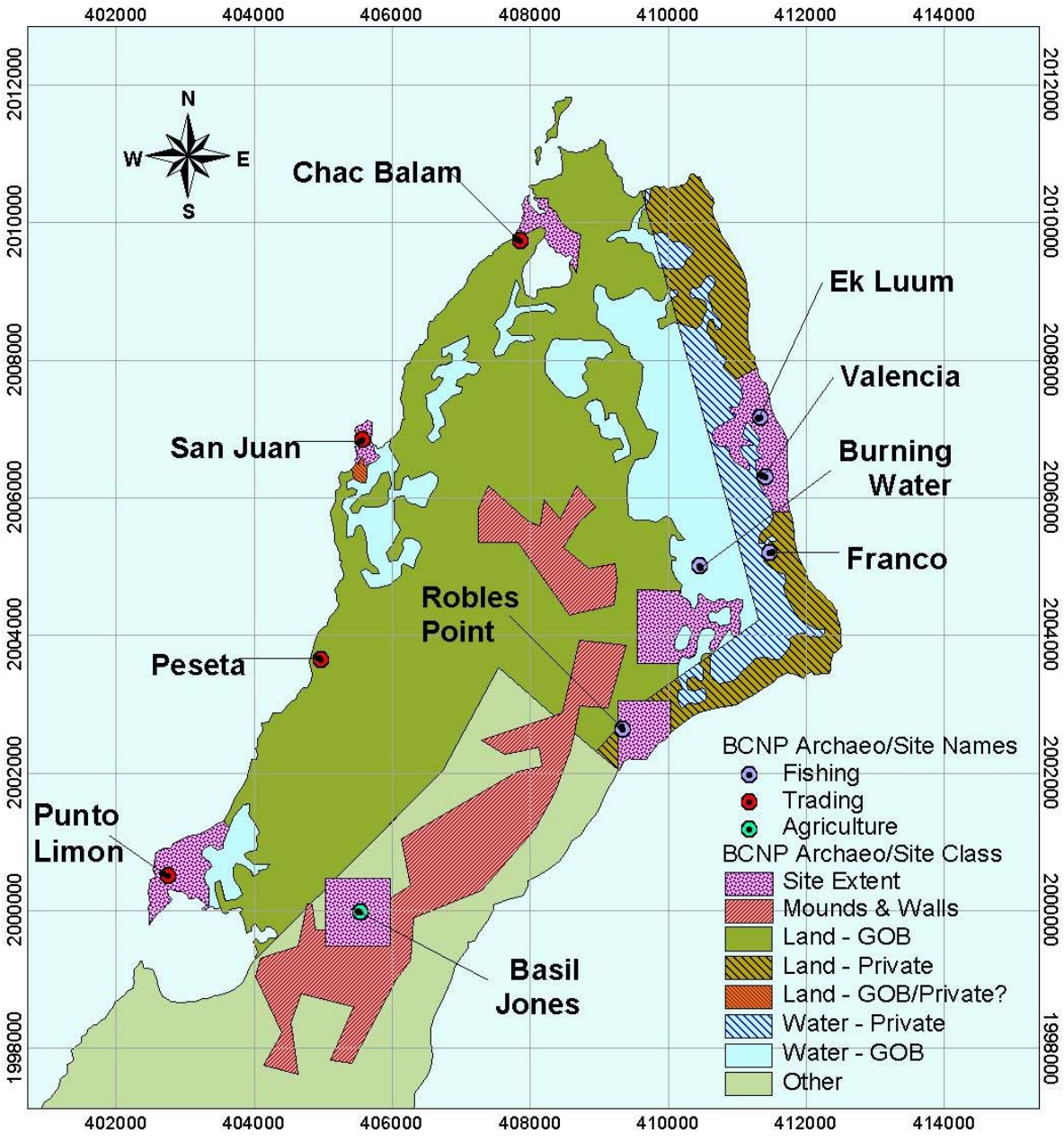
- *Colonial Occupation* The BCNP region of north Ambergris Caye was occupied by the Spanish at the end of the Maya era, and later by the English until modern times. Woods 1998 has identified evidence of several Spanish period shipwrecks off the shores of the BCNP. The Rocky Point area has yielded 3 cannon and 1 anchor, which have been retrieved and are on display in various hotels. One 15’ anchor presently remains in about 20' to 25' of water, and one cannon remains in about 12’ of water. The beach area at Rocky Point is littered with many broken bottles dating from 1750’s. Small ballast rocks can be found on the beach, along with chisel headed bronze nails and drifts encrusted in the exposed rocks. Unverified reports indicate there may be a large ballast pile in 40’ to 60' of water off the point. An English chart of the area dated 1792 states that some years prior a Spanish galleon named *Santa Yaga* was lost off the Three Brothers, which are several small keys off the northeastern tip of Ambergris Key.

ILLUSTRATION 16:

Archaeological Sites Of The Bacalar Chico Area, Ambergris Caye

Adapted From BCES (1993)

UTM Zone 16 - NAD 27 Datum



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In Chetumal Bay, Mexico, there are also three islands called Three Brothers. There are unverified reports of anchors around these islands as well. Since it is unlikely that a large galleon could have entered the waters of Chetumal Bay, the possibility remains that the anchors and cannon found at Rocky Point came from the Santa Yaga.

Other accounts of ship-wrecks in the BCNP/MR region reported by Woods 1998 include unverified reports of ballast rock being found immediately south of Rocky Point and two anchors being found in Basil Jones Channel in 40 to 60 feet of water, one of which may have been removed to the Belizean Hotel on Ambergris Caye. If such wrecks exist and can be found and verified, they would considerably enhance the historical and tourism value of BCNP/MR.

Contemporary Use

- *Fishing* has been important source of income for the communities of San Pedro and Sarteneja for some time. The main catches are conch, lobster and finfish, and a range of methods including free-diving, fish weirs, gill nets and seine nets are used by fishers to reap their catch. There are six permanent fishing camps within the BCNP, one on the southern side of Boca Bacalar Chico, one further south and four on the west side of the Park. Two boats from San Pedro make regular day trips to fish the eastern side of the BCMR for lobster and conch, while Fishermen from Corozal and Sarteneja usually stay in the area for 1-2 weeks while fishing. Two families from Sarteneja and one from Corozal Town use the area, setting traps for reef fish from May to September. Since the declaration of the BCMR's zoning regulations, no additional traps have been allowed within the reserve. A substantial amount of illegal fishing has taken place in the area by Belizean and Mexican fishers alike, but the impact of these activities has never been quantified.

- *Tourism* Fishing remains an important economic activity within the BCMR. Fishermen from Sarteneja and Corozal continue to use the BCMR for extractive commercial fishing, while most of the fishing activity by San Pedro-based users is increasingly centered around extractive sport or tourism-related fishing. Both groups of fishers recognize the declining economic return of extractive fishing, and the increasing economic potential of tourism-related activity, and so have eagerly enlisted in programs that promise to enhance their capacity for more sustainable and economically viable livelihoods.

  Capacity building alone, however, is not sufficient to assist these fishers with a successful transition to sustainable livelihoods in the absence of a dedicated area for their practice. To this end, the BCNP/MR can offer a wide range of opportunities for tourism-related activities, including picnicking, camping, sport fishing, snorkeling, SCUBA diving, birding, wildlife viewing, and archaeological explorations. The newly established Visitor Centre created by the Mesoamerican Barrier Reef System (**MBRS**) Programme constitutes an important first step in this regard, but further developments are needed within the BCNP/MR to accommodate and increase tourist visitation before fishers can more fully abandon extractive fishing and practice their newly acquired tourism skills as an alternative livelihood.

3. EXISTING MANAGEMENT FRAMEWORK

3.1 Administration

Oversight

The Forestry Department in the Ministry of Natural Resources is responsible for the BCNP, and the Fisheries Department in the Ministry of Fisheries and Agriculture is responsible for the BCMR, with day-to-day management being the responsibility of the Fisheries Department as per agreement between the two Ministries. A Bacalar Chico Advisory Committee (**BCAC**) was established in 1995 to address all matters pertaining to the BCNP/MR. The committee consists of a Chairman (BFD), Secretary (CZMI), a representative of ITCF, and representatives of key community groups from San Pedro and Sarteneja. The BCAC meets every 6 weeks, with the location alternated between San Pedro Town, Sarteneja and Belize City. The committee composition is as follows:

- *Chair – BFD*
- *Secretary – CZMI*
- *Representative – ITCF*
- *Representative – San Pedro Town Board*
- *Representative – San Pedro Tour Guide Association*
- *Representative – Caribeña Fishermen Cooperative Society Ltd.*
- *Representative – Sarteneja Village Council*
- *Representative – Sarteneja Tour Guide Association*
- *Representative – Forest Department*
- *Representative – North Ambergris Land Owners Association*
- *Manager – BCNP/MR*

The Fisheries Department has been discussing co-management with the *Green Reef Environmental Institute*, a non-governmental organization from the San Pedro Community, in order to build capacity for both organizations. A Memorandum of Understanding (MOU) has been drafted (Cf. **Addenda 8**) and is anticipated to be signed as soon as the master policy guidelines for the National Protected Area System Plan for Belize are finalized in 2004. In the meantime, a letter of intent will be given to Green Reef so that this organization can seek funds to assist primarily in the monitoring programs for the protected areas.

Personnel

A Manager, Biologist and 2 Rangers are based at the Bacalar Chico Field Station at San Juan on the western side of the BCNP, and are responsible for the day-to-day function of the BCNP/MR (Cf. **Addenda 9**). Routine operating procedures currently in place require the Manager to address issues concerning administration to the Marine Protected Areas Coordinator (**MPAC**) of the BFD in Belize City (who also acts as Chair of the BCAC); and issues concerning logical support to the Hol Chan Marine Reserve office on the southern end of Ambergris Caye, in San Pedro Town. Staff appraisals are completed at the end of each year, and submitted to the MPAC for approval and processing

Training is a very important tool for strengthening the capacity of the BCNP/MR, and staff receive training (locally and regionally) in a range of areas every year as opportunities arise. Topical coverage of these programs have to date included:

- *Reserve Management*
- *Sustainable Marine Biodiversity Conservation*
- *Management Effectiveness Evaluation Of Protected Areas*
- *Co-Management Of Protected Areas*
- *Dive Safety*
- *Data Collection and Analysis Methods For Study Of Corals, Conch, Lobster and Fish*
- *Sea Turtle Conservation*
- *Exploration And Plotting Of Sea Grass Hardness And Roughness*
- *SeaWIFS Satellite Imagery Analysis*

Staff turn-over in the BCNP/MR has been very high, with new one or more of the 4 staff positions being filled by new personnel on virtually an annual basis. Staff leaving the BCNP/MR have typically resigned to further their educations abroad, but the temporal distribution of these replacements, although affording some transfer of institutional knowledge at the staff level over time, clearly undermines the capacity building value derived from accruing training staff as a team. Consequently, present conditions predispose BCNP/MR staff to a continuous process of retraining, rather than advancement to higher training.

Infrastructure

A headquarters building was constructed in the San Juan area of the BCNP with funds made available by ITCF, and a ranger station was constructed by Raleigh International volunteers on the eastern side of the BCNP on land belonging to ITCF with funds donated by the British High Commission. A new building, which will include staff quarters, a Visitor Center and a storage area, has recently be constructed with funds from the MBRS Programme (Cf **Illustraton 17**). The BCNP/MR is presently equipped with three boats, SCUBA equipment and an assortment of items necessary for the staff to conduct research, monitoring, patrols and environmental education (Cf. **Addenda 10**).

Budget

The CZMA/I has funded the basic operating expense of the BCNP/MR from 1998 - 2003, including salaries, per diems and fuel in the amount of approximately Bz $ 120,000 per annum, from dedicated UNDP/GEF Program resources (Cf. **Addenda 11**). The BCAC has developed proposed operating budgets for 2004/5 (Cf. **Table 9**), the resources for which are anticipated to be obtained from a combination of visitor fees and/or the newly proposed Financing System for Coastal and Marine Resource Mangement (**FSCMRM**) planned by CZMA/I (2003). Gap funding is anticipated from the Government of Belize (**GOB**) until either or both financial resource become available.

ILLUSTRATION 17: BCNP/MR Administration Facilities

Existing Headquarters (above) and Visitors Center (Below)

TABLE 9

PROPOSED 2004/5 BUDGETS FOR THE BCNP/MR[1]

ACCT NO	EXPENSE ACCOUNT TITLE	2004 TOTAL (Proposed)	2005 TOTAL (Proposed)
701	Boat Repair and Maintenance	$ 15,000	$ 20,000
702	Building Repairs and Maintenance	$ 8,000	$ 10,000
703	Employee Benefits	$ 5,000	$ 7,000
704	Equipment Rental	$ 2,000	$ 3,000
705	Freight and Transportation	$ 2,000	$ 3,000
706	Fuel and Lubricants	$ 80,000	$ 90,000
707	Insurance	$ 3,000	$ 4,000
708	Office Supplies	$ 2,000	$ 3,000
709	Office Equipment Repairs and Maintenance	$ 2,000	$ 3,000
710	Publicity	$ 5,000	$ 4,000
711	Salaries	$ 100,000	$ 105,000
712	Social Security	$ 8,000	$ 8,000
713	Training / Workshops	$ 10,000	$ 15,000
714	Travel and Subsistence	$ 10,000	$ 15,000
715	Ticket Printing	$ 4,000	$ 6,000
716	Utilities	$ 3,000	$ 4,000
717	Advisory Committee Meetings	$ 3,000	$ 4,000
718	Petty Cash	$ 2,000	$ 4,000
719	Other	$ 2,000	$ 2,000
	TOTAL EXPENSES	**$ 266,000**	**$ 310,000**

[1]For years after 2005, add 10% per annum

Existing Permits, Licenses and Fees

Statutory Instrument 68 of 2001 (Cf. **Addenda 3**) authorized the BFD to issue non-transferable licenses and assess fees for dive boat registration (Bz $ 30), commercial and sport fishing (Bz $ 50), and research (Bz $ 500) within the BCMR on an annual basis, the regulations and guidelines for which are described as follows:

- *Research* All persons intending to conduct research within the reserve must obtain approval from the BFD. Permits are granted based on research priorities of the BCNP/MR. Research permits the geographic boundary for which permission is granted, as well as guidelines, which include (but are not limited to) the types and quantities of flora and/or fauna allowed for extraction. Regulations and guidelines for each permit may be tailored on a case-by-case basis. Licensees should carry their permit at all times while conducting research in the BCMR.

- *Boat Operators* All persons seeking to operate a boat within the reserve must obtain a license from the BFD. In order to qualify for a license, a person should be a Belizean, age eighteen or older, with first preference given to traditional fishers, or former fishers conducting tourism activities. Licensees should carry their permit at all times while operating a boat in the BCMR.

- *Fishing* All persons seeking to undertake commercial or sport fishing within the reserve must obtain a license from the BFD. Licenses will only be issued to persons whom have traditionally fished within the BCMR for livelihood. Licensees should carry their permit at all times while fishing in the BCMR.

Proposed Activity Fees

Entry and activity-based fees have been proposed by the BFD to offset administrative, operational and maintenance costs associated with routine, onsite management of the BCNP/MR. Two collection mechanisms have been proposed (but not yet approved), which include a BFD-based licensing system wherein users pay annual entrance and activity-based fees, and a CZMA/I-based system proposed by FSCMRM (CZMA/I 2003). Entrance fees are primarily designed to capture revenue from general admissions, while activity fees are anticipated to capture revenue from discriminate or selective use of the BCNP/MR for sport fishing, recreational fishing, subsistence fishing and general activities such as: sightseeing, canoeing, swimming, snorkeling, and scuba diving. A fee schedule system required to meet management cost for the BCNP/MR has not yet been integrated within the context or assumptions of a visitation-based financial model for the BCNP/MR by either the BFC or FSCMRM.

3.2 Conservation Management

Key Goals and Objectives

The following goals and objectives for the BCNP/MR were developed by the BFD in collaboration with all those involved in the protected area and through the meetings of the BCAC and are based on those of other existing national parks and marine reserves:

- *Goal 1:* To provide protection to the physical and biological resources of north Ambergris Caye, which includes a wide range of inter-dependent habitats in a region targeted for extensive further development.

  Objectives:

  - To preserve the outstanding beauty of the area;
  - To preserve the uniqueness of geological and biological features at Rocky Point;
  - To preserve the naturalness of/and protection for representative examples of all habitats found within the area;
  - To preserve areas of critical habitat for endangered species; and
  - To ensure that proposed development plans do not threaten the biological integrity of the area.

- *Goal 2:* To provide an area for education and research.

  Objectives:

  - To encourage the use of the area for scientific study; and
  - To foster interest in and knowledge of the coastal and marine environment through educational and interpretive programmes for schools and other educational establishments, local and foreign visitors, and local communities.

- *Goal 3:* To preserve the value of the area for fisheries and other important genetic resources.

  Objectives:

  - To provide protection for all habitats of commercially important species; and
  - To provide undisturbed areas that will ensure good 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:

  - To provide an undisturbed and well managed area for tourism and recreation; and
  - To promote uses compatible with conservation and sustainable development objectives, primarily through zoning.

Terrestrial Component

The legislative basis for conservation of national lands within BCNP is defined by the Forest and Wildlife Conservation Acts. The Forest Act (Laws of Belize Chapter 213, Revised 2000) provides for the protection and conservation of all mangrove forests on both private and national lands, any alterations to which require evaluation and permit by the Forestry Department. The Wildlife Protection Act (Laws of Belize Chapter 220, Revised 2000) prohibits the hunting of endangered species such as cetaceans, freshwater turtles and crocodiles. A formal conservation zoning scheme for the BCNP has yet to be developed and recommended to Cabinet for legislative enactment. Several key localities of particular conservation interest, and therefore potential suitability for legislative zoning and protection, have been identified by the BCAC. These include the following:

- *All Known or Found Marine Bird Nesting Sites*
- *The Marine Turtle Nesting Beach Between Robles Point And Rocky Point*
- *The Exposed Pleistocene Reef Along The Rocky Point Shoreline*
- *The Littoral Forest Along Both The Eastern and Western Coast*
- *All Crocodile Nesting Sites*
- *All Cenotes And Sink Holes Having Perennial Freshwater Availability For Wildlife*
- *All Salt Marsh Habitat*
- *The Bacalar Lagoon*
- *All Known or Found Archaeological Sites*

The legislative basis for conservation of private lands within BCNP is administered by the Central Housing and Planning Authority (**CHPA**) and the North Ambergris Caye Development Committee (**NACDC**) in accordance with the zoning regulations stipulated in the Master Plan for Ambergris Caye (**ACMP**). The ACMP was developed for the Bacalar Chico region prior to legislative declaration of the BCNP, and has yet to be reconciled with the above-referenced conservation zoning and protection recommendations developed by the BCAC. The zoning regulations of the ACMP therefore include:

- *A Low Density General Residential Land Use Zone For The Eastern Shoreline Extending Back To The Shore Of Laguna De Cantena, From The Bacalar Chico Channel South To Rocky Point*
- *A Conservation Area From Rocky Point South To Robles Point*
- *A Special Coordinated Development Area Encompassing The Former Pinkerton Estate*

Revision requirements for the ACMP concern the need to develop sustainable environmental guidelines for the *General Residential Land Use Zone* which are consistent with the conservation objectives of the BCNP; and elimination of the *Special Coordinated Development Area Encompassing the Former Pinkerton Estate,* which now exists as the national land component (and terrestrial wildlife refuge) of the BCNP.

Marine Component

The legislative basis for conservation of marine resources within BCMR is defined by Statutory Instrument 136 of 2001.

The Zoning Plan described therein was developed in consultation with the primary stakeholders in the BCMR. Reserve staff held various public forums in San Pedro Town, Sarteneja Village and Corozal Town meeting areas and schools to discuss zoning options, and these forums provided much needed feedback for developing a consensus the finalized zoning guidelines. The rationale, objectives and key enforcement and management needs of the BCMR's four management zones (which are not described in the SI 136) include the following (see also **Illustration 18**):

- *General Use Zones (1 and 2)* allow for the sustainable management of existing/traditional uses of the BCMR prior to declaration. This zone lies apart from areas in need of greater protection, and it is easily accessible to local fishers who use the area for commercial fishing. A combination of the zone's existing fishing banks and proximity to the adjacent Conservation Area (I) replenishment area offers fishermen fertile and potentially valuable fishing grounds. The key objectives of this zone are to provide opportunity for established uses and activities to be continued in a sustainable manner under a stringent monitoring scheme. The key enforcement and monitoring needs of the zone include intensive patrols to check for fisher compliance, specifically with respect to fishing gear, catch sizes etc. and to deter the potential for incursions into conservation and preservation zones.

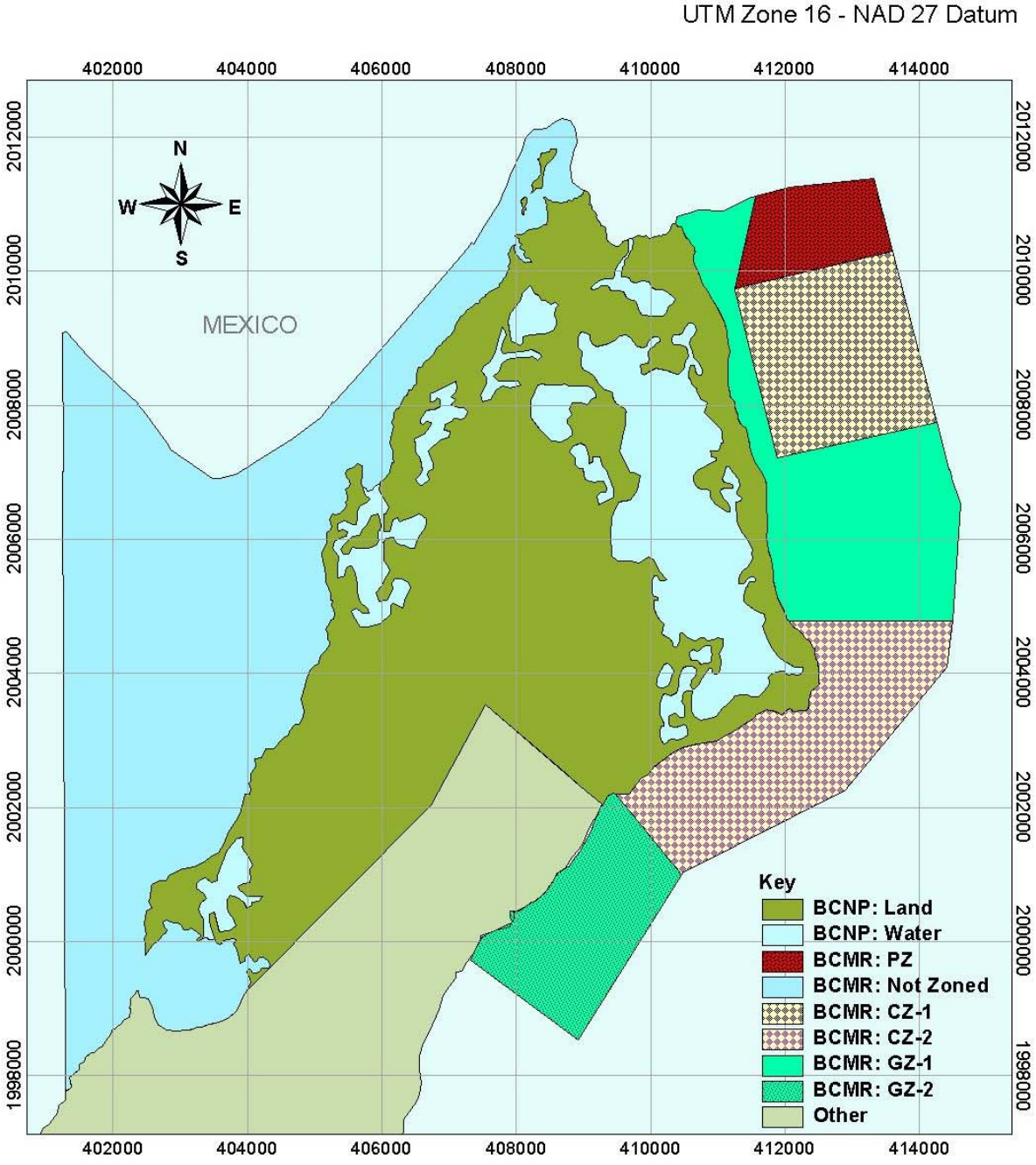
- *Conservation Zone (I)* is essentially a non-extractive zone, designed for baseline monitoring, research, education and limited recreational use. This zone represents a transverse section of the BCMR, which includes intertidal flats and grass flats, patch reefs, back reef and reef crest types and coraline grove formations in the outer reef. The zone serves as a replenishing and nursery area and provides habitats for threatened and endangered species such as the West Indian Manatee and marine turtles. The key objectives of this zone are to conserve a representative sample of certain habitats within the BCMR, to provide an undisturbed area for recruitment of species to adjacent areas, and to provide opportunities for research, education, and comparison with unprotected areas. The key enforcement and monitoring needs of the zone primarily concern control of Illegal fishing, particularly nighttime poaching.

- *Conservation Zone (II)* is a controlled extraction zone designed to accommodate subsistence fishing, recreation and tourism. The zone accommodates all of the different types of recreational activities permitted in the reserve, in affording beach areas for swimming, corals for diving and snorkeling, areas for canoeing and good areas for fishing. The key objectives of this zone are to prevent fishery stocks from overexploitation by commercial fishing and to enhance the value of the area for recreational and tourism activities. The key enforcement and monitoring needs of the zone include monitoring of catch and gear use, and recreational and tourism impacts.

- *Preservation Zone (PZ)* is closed to visitors, including researchers except under special permission. This zone includes fragile patch reefs, back reef, reef crest and fore reef areas, which comprise important habitats for commercial species such as the Queen Conch and Spiny Lobster. Human impact on this zone has been intense due to easy accessibility and the shallow back reef area, and its zoning protection has consequently been designed to restore the area to its original condition over time.

ILLUSTRATION 18:

Management Zones Within The BCNP/MR, Ambergris Caye



Prepared By: T Grimshaw / Ecoworks

The key objectives of the zone are to preserve an area within the BCMR in an entirely natural state, and to protect the areas habitat and threatened/rare species. The key enforcement and monitoring needs of the zone concern the reduction of illegal usage by Mexican visitors, which the area is vulnerable to as a result of its proximity to Belize/Mexico border.

Surveillance and Enforcement

Routine surveillance is the chief responsibility of BCNP/MR Rangers, who are occasionally assisted by other Fishery Officers, Forest Officers and HCMR Rangers. Patrols are conducted daily in both the western and eastern region of the BCNP/MR and Rangers are the first responders to any reported site of illegal activity. The Reserve Biologist and others persons working in the reserve also report any evidence of illegal activities. Tour guides and other regular users of the area also play a useful role in informal surveillance. Public consultation and education programmes continue to be important management tools in keeping offences to a minimum, developing trust with the staff and increasing stakeholder cooperation.

Regulatory enforcement is the also the chief responsibility of BCNP/MR Rangers, with assistance from other Fisheries Officers, Forestry Department staff, the Police and the Belize Defence Force. First-time offenders are educated on the objectives of the reserve and compliance to the regulations. BCNP/MR Rangers have made eight arrests since the area's designation, three of which were minor offences that resulted in written warnings, and four of which were successfully prosecuted.

Effective public education is essential to successful management of protected areas, and the public education program developed for the BCNP/MR has been updated and improved over time. The program includes:

- *Information materials and an educational display for the field station and Visitor Centre, including, posters, field guides, displays, reference collections, photographs and etc.*
- *An illustrated brochure about the BCNP/MR which includes maps, rules of the reserve, and other information* (Cf. **Addenda 12**).
- *Written guides to the flora and fauna of the area.*
- *Presentation of slide shows about the BCNP/MR for use in schools and public meetings in San Pedro, Sarteneja and other local communities throughout Belize.*
- *Development of nature trails, boardwalks and information boards.*

The BCMP/MR education program also involves collaboration with protected area initiatives in Mexico which have many conservation objectives in common with those of the BCNP/MR. This is particularly the case for Amigos de Sian Kann and ECOSUR in the Quintana Roo District of Mexico, which manage or otherwise contribute to conservation initiatives within the biological corridor that extends from Ambergris Caye through the Yucatan Peninsula.

3.3 Baseline Research And Monitoring Programs

Pre-Designation Baseline Research

There had been little research on either terrestrial or marine habitats about the Bacalar Chico area in particular prior to declaration of the BCNP/MR. Early baseline environmental studies of the area include three basic works, including a rapid environmental assessment (REA) of terrestrial habitats conducted BCES (1993), a 4-volume set of studies on terrestrial and marine wildlife by Dachary *et al* (1991), and a marine habitat classification study carried out by Raines *et al* (1995). A number of additional works include information about the Bacalar Chico area within wider topical contexts, addressing geology, marine geomorphology, and/or flora and fauna. Geological works include studies by Ebanks (1975) and Tebbutt (1975) as part of a series of reports by the American Association of Petroleum Geologists published in (Wantland and Pusey, 1975). Works on marine geomorphology include studies by Burke (1982), Stoddard *et al* (1982a), (Beulig, 1988), Gregg *et al* (1992), (Mazzullo *et al* 1992), McField (1999) and Kramer and Kramer (2000). Studies on flora and fauna include works by Stoddard (1974), Fossberg *et al* (1982), Stoddard *et al* (1982) and (Sedbury and Carter 1993).

Terrestrial Monitoring Programs

A complete and routine terrestrial monitoring program (**TMP**) has not yet been developed for the BCNP, because funding for the Terrestrial Biologist's post was unavailalbe after 1999. An appropriate TMP should include regular assessment of the 9 key terrestrial conservation targets previously described (Cf. **Pages 19 – 29, 39** and **47**), and should otherwise resemble programs developed for the Shipstern Nature Reserve and other terrestrial protected areas. The program should also be developed and executed in close coordination with the Forest Department and the Belize Audubon Society (**BAS**). Only 1 key conservation target of the above-reference suite are currently monitored within the BCNP.

- *The Marine Turtle Nest-Montoring Program* is designed to increase sea turtle hatching success, as well as understanding of the nesting, incubation and hatching processes within the BNCP. The program involves bi-weekly beach patrols by staff and volunteers, who look for crawl tracks in the sand. Turtle species can be identified from the crawl track and the shape of the nest. Found nests are carefully excavated, and a single egg is inspected for color to estimate the date that the nest was laid and the expected date of hatch, after which the egg is replaced. Egg incubation period is forty-fifty days. The position of the nest is subsequently marked and noted and labeled tags are placed exactly where the measurement was taken.

  The nest site is visited frequently around the expected date of hatching, and the beach between the nest and shore is cleared of any debris, which could obstruct hatchling journey to the sea. As staff encounter hatching events, nests are cleared of sand in order to assist the hatchlings exit the nest, and crabs and other threats are removed from the area in order to secure hatchling entry to the sea. Each nest is visited after all the eggs have hatched to count the number of hatched eggs, spoilt eggs and the number of hatchlings which died in the nest. Injured hatchling are taken for rehabilitation and released as soon as possible.

Marine Monitoring Programs

A complete and routine marine monitoring program (**MMP**) has not yet been developed for the BCMR, due to funding limitations. An appropriate MMP should include regular assessment of the several key marine conservation targets previously specified (Cf. **Pages 29 - 38, 41** and **48**), and should otherwise be consistent with strategies developed for coral monitoring by the MBRS Programme (2003), as well as those of the HCMR and Glovers Reef Marine Reserve (**GRMR**). Only 4 key conservation targets of the above-reference suite are currently monitored within the BCNP.

- *Conch* monitoring surveys entail periodic estimation of relative abundance between July and September, during the seasonal closure to fishing. Monitoring methods entail the counting of individual Queen Conch (*Strobus gigas*) along a total of 20 transects of 30 meters length and 2.5 meters width, distributed across 3 back-reef habitat types (sandy, moderate sea grass and dense sea grass) and the 4 management zones of the BCMR.

- *Spiny Lobster* monitoring surveys entail annual estimation of population size at the start of the fishing season in June, and at the end of the season in February. Monitoring methods entail counting of mature and juvenile Spiny Lobster (*Panulirus argus*) and Spotted Lobster (*Panulirus gutatus*) along a total of 96 snorkeling transects of 15 minutes duration, distributed across the 4 management zones of the BCMR.

- *Fin Fish of the Back Reef Habitat* are periodically monitored for relative abundance during December and January. Monitoring methods entail counting of fish species number and approximate length at a total of 15 sampling stations, distributed across 2 habitat types (back reef and reef crest), and the 4 management zones of the BCMR

  Data is collected by a stationary diver centered in randomly selected circular plots (Cf. Bohnsack and Bannerot 1986). Divers begin each sample by facing in one direction and listing all species seen within their field of view to a distance of 7.5 meters over a 5 minute interval. (A calibration ruler held out perpendicularly at the end of a meter stick was used to reduce apparent magnification errors in size estimates) When no new species are noted, new sectors are scanned in sequence by rotating in one direction for a subsequent five-minute period. Several complete rotations are made at each sampling station. The name and length of each fish seen within the viewing period and area are recorded for later computation of standardized percent abundance per habitat.

- *Fin Fish of the Fore Reef Habitat* are periodically monitored for spawning aggregation behaviour between December and February. Monitoring methods entail counting of fish species number, location, size, coloration, annotative accounts of courtship and spawning behaviour at Rocky Point and environmental conditions (including wind speed, wave height, current speed and diredction at surface and depth), during moring and afternoon dive sessions before and after full moon events, as described by Paz and Grimshaw (2001).

4. THREATS AND CONSTRAINTS TO MANAGEMENT EFFECTIVENESS

4.1 Critical Conservation Threats

Illegal Extraction

Poaching mortality of livestocks within the BCNP/MR has been primarly limted to marine resources, and has to a considerable extent been reduced following the formal designation of the BCNP/MR and the institution of onsite surveillance and enforcement capacity. BCNP/MR public relations have also contributed to a reduction in poaching mortality through animation of stakeholders to comply with and contribute to surveillance and enforcement efforts. Poaching mortality continues to threaten BCMR stocks however, as the existing surveillance program is limited in both duration and frequency (Cf. **Pages 57 - 59**). This limitation is in part linked to placement of the BCNP/MR administration facilities on the west coast of the BCMR, while the majority of the poaching occurs on the eastern portion of the BCMR. Consequently, existing surveillance efforts require review and enhancement.

Land Ownership and Development

Private development within or adjacent to the BCNP/MR will present a continuing and critical threat to the key conservation objectives of the BCNP/MR, until such time as ACMP guidelines can be re-drafted into accordance with these objectives (Cf. **Pages 3, 8** and **61**). The present variance exacts this threat on two levels, the first of which concerns the specific threat that unrestricted private land development presents to the continued integrity of the *Littoral Forest* habitats within their domain, and the second of concerns the more general threat which the unresolved sutation presents to BCNP/MR's capacity to obtain funding, and hence, manage those wildlife conservation targets which lie outside of private lands, within the BNCP/MR's domain. Consequently, resolution of this planning variance should constitute an important first task for the newly evolving BCNP/MR.

Transboundary Development and Pollution Risk

Advancing development in the southern Quintana Roo District of Mexico across the border from the BCNP/MR presents a series of potential impact risks. The first of these concern a recently constructed deep water canal established to service cruise ships, which presents a significant obsticale to wildlife migrations through the transboundary corridore system between the BCNP and Yucatan (Cf. **Page 33**).

The second transboundary development impact risk is presented by the potential construction of a bridge over Boca Bacalar Chico, to convey tourism ground traffic to/from Ambergris Caye and Xcalak/Majahual region of the southern Yucatan coast. This development would require a thorough environmental impact assessment before implementatoin, but would otherwise undoubtedly increase human occupancy in the Bacalar Chico area as well as the potential for numerous carrying-capacity related impacts over time that would considerable management presence and cost to mitigate. The third development risk is presented by the outfall of sewage pollution from the city of Chetumal Mexico (population 300,000) into the Chetumal/Corozal Bay, which will require significant trans-national cooperation through the Belize/Mexico Bilateral Agreement to mitigate.

4.2 Coordination And Funding

Inter-Ministerial Coordination

The joint administration of the BCNP/MR by the Fisheries Department (Ministry of Agriculture and Fisheries) and the Forest Department (Ministry of Natural Resources) among protected areas in Belize. While an clearly an advantage in the context of receiving the dual ministerial support, joint custody by the two ministries requires proportionately more administrative effort than other protected areas in order to keep both ministries abreast of needs and activities within the BCNP/MR.

Staff Effectiveness

Staff turn-over remains a key constraint on BCNP/MR staff capacity, and hence, effectiveness (Cf. **Page 52**). Turn-over is also effected by salary schedules, in as much as the continuing provisional status of the BCNP/MR's financial base precludes staff consideration of their positions in the context of a career, which can provide opportunities for professional and income advancement over time and in respect of performance (see also McField 2000). Supporting infrastructure for research is also a factor in this regard, as the present minimum resource capacity of the BCNP/MR, fails to convey significant potential for professional or intellectual advancement.

Funding

The long-term success of the BCNP/MR is entirely dependent on procurement of financial sustainability. Protected areas have traditionally relied on grant resources, which in some cases are supplemented with governmental support, as has the BCNP/MR. This practice, however, is not sustainable, particularly in light of contemporary public administration trends to reduce the cost of government through privatization. Consequently, and in light of the end of funding at the close of 2003, the BCNP/MR urgently needs to evolve into financially solvent enterprise with the capacity to generate and invest retained earnings in the responsible management of its select portfolio of critical conservation targets as a first priority. This capacity can only result through improvement of the BCMR's potential to generate income from usage/visitation fees.

Accomplishment of this objective will, of necessity, also require procurement of funding to invest in: (1) tourism infrastructure with which to support increased tourism visitation and other forms of usage, (2) marketing the BCNP/MR as a tourism/research destination; and (3) operating cost, at least until the BCNP/MR is financially sustainable on the strength of gate receipts. This latter investment category points to the BCNP/MR's further need to develop an appropriate mechanism for collection of usage fees and revenue administration. The FSCMRM being proposed by CZMA/I (2003) constitutes one option in this regard. Alternatively, the Protected Areas Conservation Trust (**PACT**) offers related financial service, without the flat fee requirement proposed by FSCMRM, and so constitutes a second option in this regard. A third option, would of necessity, include the possibility of affording the BCNP/MR self-administration of gate fees and revenue expenditure.

4.3 Stakeholder Perspective

Independent Stakeholder Characteristics

A total of 28 independent, fisher/tour-guide stakeholders who use the reserve for gainful employment and/or recreational activity were asked a series of questions to help provide a general description of how they utilize the BCNP/MR (Cf. **Illustrations 19** – **24** and **Addenda 13**).

More than half of these independent stakeholders have been utilizing the BCNP/MR for longer than 10 years, and most spent more than 50 days in the BCNP/MR per year.

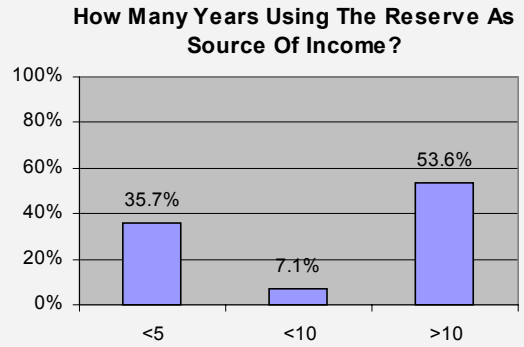
Rocky Point was by far the most utilized site of the 5 top localities queried, followed by Robles Point and San Juan. The Basil Jones and Cantena Lagoon areas were the least utilized of the top 5, but more utilized than all other sites not among the top 5.

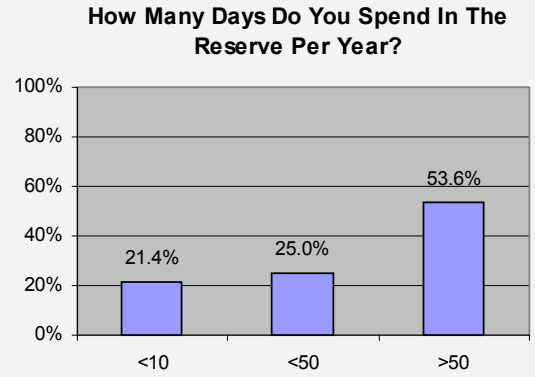
The majority of this group of stakeholders utilized the BCNP/MR for commercial and/or sport fishing. Less frequent, but still common activities included recreational fishing, tour-guiding, research and other activities.

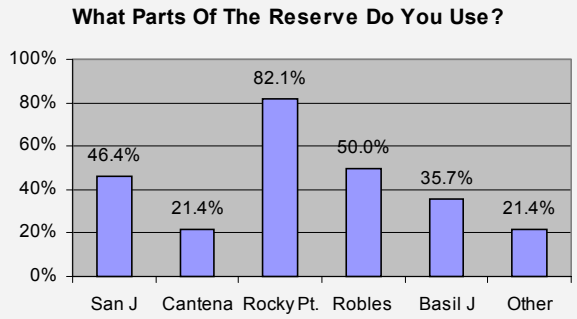
The findings suggest that independent fisher/tour-guide stakeholders comprise a diverse mosaic of users who are likely to require differential training and other forms of assistance to capitalize on opportunities for BCNP/MR-based alternative livelihoods.

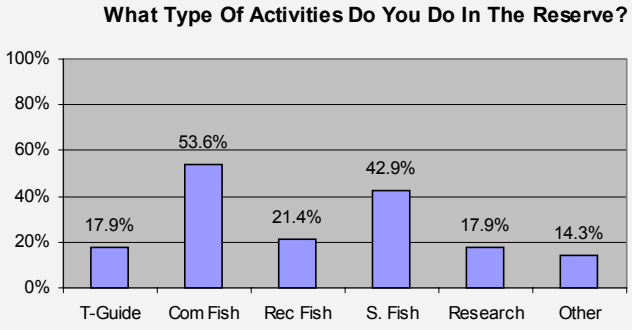
ILLUSTRATION 19:

Independent Stakeholder Characteristics









Tour Guide Activities and Income

Independent stakeholders were asked a series of specific questions about their usage of the BCNP/MR for tourism-related activities (Cf **Illustration 20**).

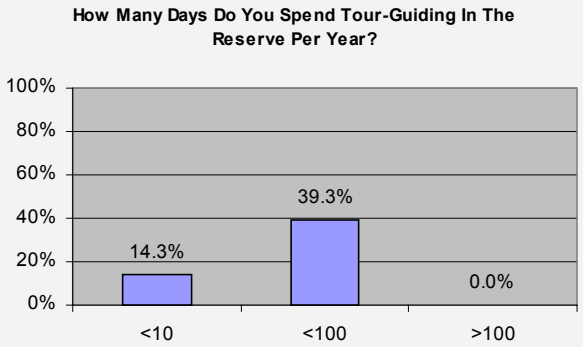
About 40 % of the independent stakeholders surveyed spent between 10 and 100 days in the BCNP/MR tour-guiding and about 15 % spent less than 10 days tour-guiding. About 28 % of the independent stakeholders carried between 100 and 500 tourists to the BCNP/MR per year, and about 21 % carried less than 100 tourists to the BCNP/MR per year.

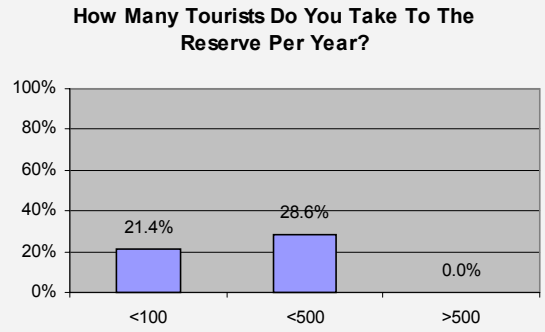
The majority of tour-guiding stakeholders offered sport fishing, swimming/snorkelling and picnicking (i.e. primarly water-based activities) to tourists, while bird and Manatee watching were less commonly offered activities. Kayaking and star-gazing activities were not offered to tourists. Tourists were reported to generally consider their experience in the BCNP/MR as very good to excellent.

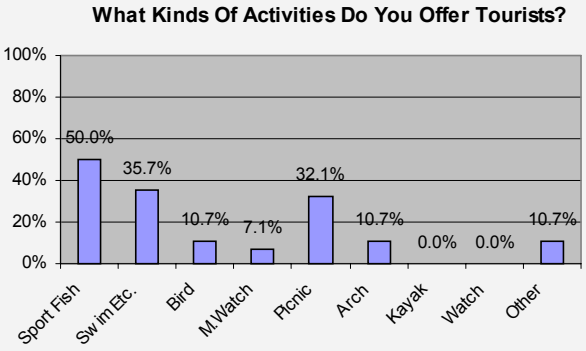
Earnings by tour-guiding stakeholders were about equally divided between amounts of < $5,000/year and < $25,000 per year, which together with the above findings suggest tour-guiding stakeholders comprise two basic groups based on their usage of and income from the BCNP/MR.

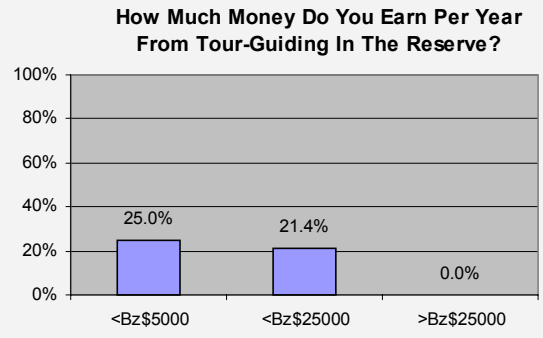
ILLUSTRATION 20:

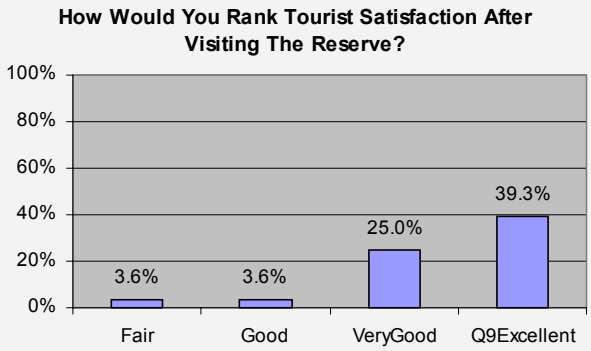
Tour Guide Stakeholder Characteristics











Fisher Activities and Income

Independent stakeholders were also asked a series of specific questions about their usage of the BCMR for fishing activities (Cf. **Illustratoin 21**).

Fisher-stakeholders varied in the amount of time spent in the BCMR, but generally spent more time in the BCMR than tour guides, with approximately 1/3rd spending more than 100 days in the BCMR per year.

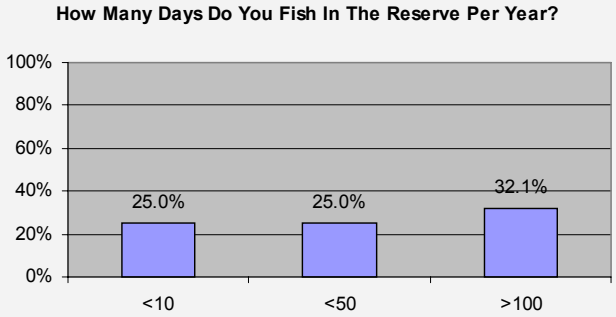
About 2/3rds of the fisher-stakeholders used commercial fishing gear, and a slightly greater proportion used sport fishing gear.

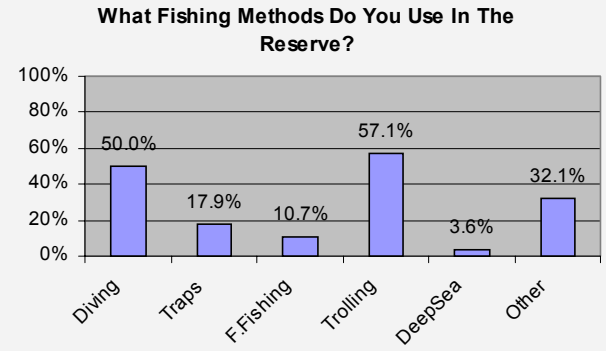
Most fisher stakeholders were content with continuing their present fishing activities, but those interested in new activites were primarily interested in research (~57 %) and tour-guiding ~40 %).

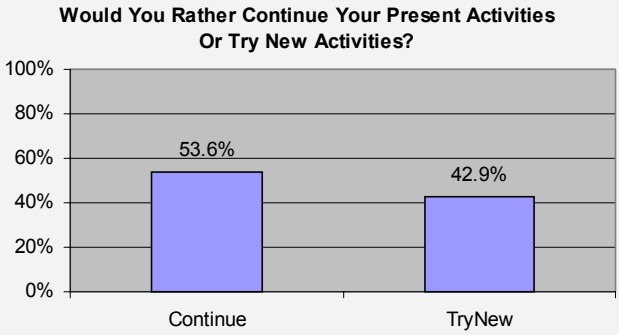
Fewer fisher-stakeholders (~10 %) earned <$25,000 per year than tour guide-stakeholers (21 %), which in conjunction with their slightly greater reluctance to change livelihood activity, suggests that other benefits from fishing the BCMR may appreciated by fisher-stakeholders than financial reward alone.

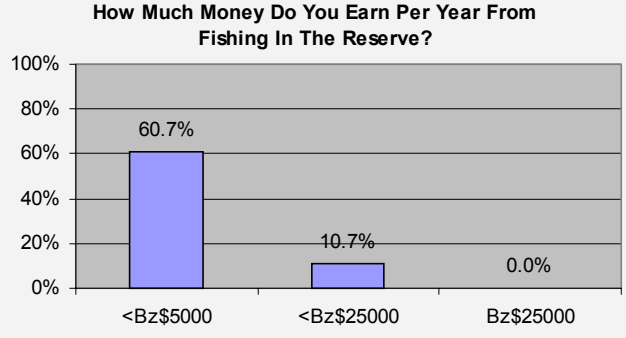
ILLUSTRATION 21:

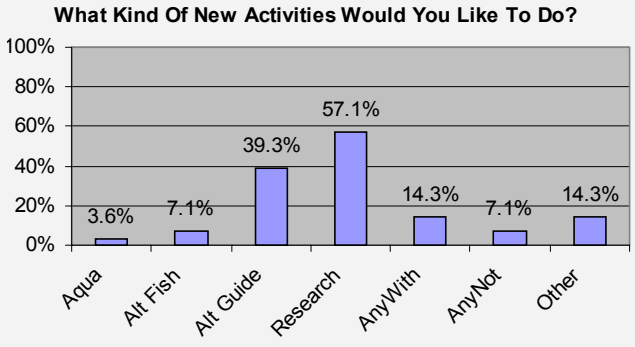
Fisher Stakeholder Characteristics











Fisher/Tour-Guide Training and Skills

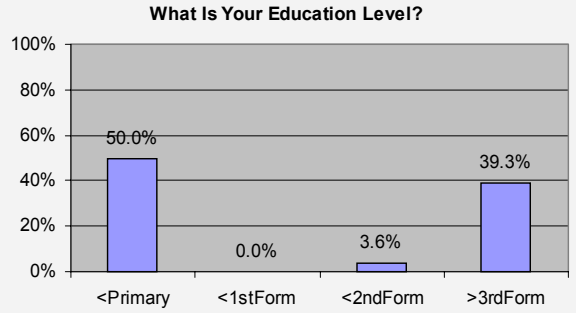
Half of the independent stakeholders interviewed had less than primary school education, and about 1/3rd indicated that training did not confer the anticipated benefit (Cf. **Illustration 22**).

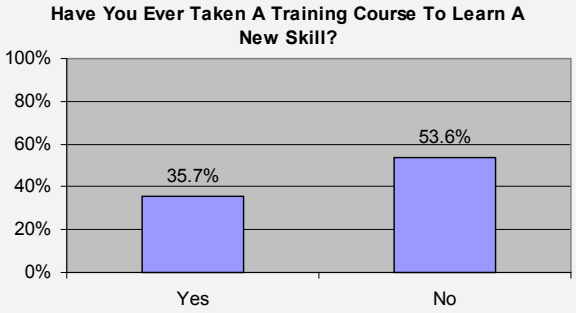
The clear majority felt they had adequate skills (i.e. captioning, swimming, biology, ecology and sport fishing) to participate in new activities. About 43 % of the independent stakeholders indicated they would be able to afford an investment of <$5,000 in new activity, but about 30 % felt they would be able to invest 2 - 3 times that amount.

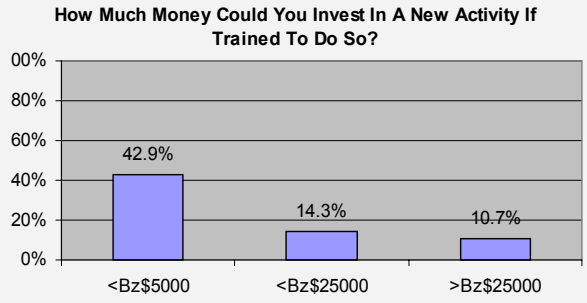
Taken together, the findings suggest there are two types of independent users of the BCNP/MR: a larger group (perhaps 40 – 50 %) with limited financial capacity that feels adequately prepared to stay the same or participate in a few new activities, and a smaller group (perhaps 20-30%) with greater financial capacity and interest to undertake new activities.

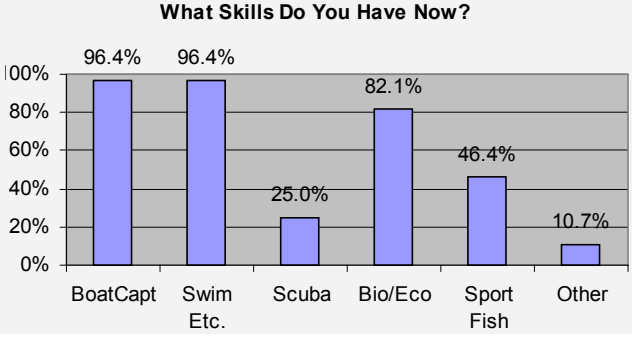
ILLUSTRATION 22:

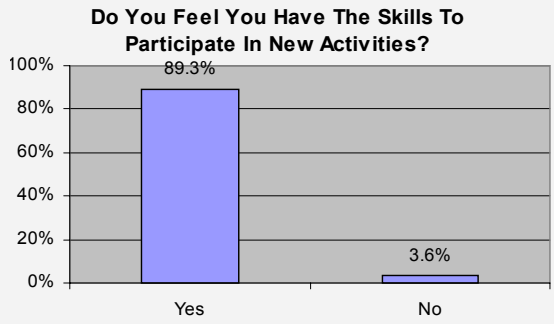
Stakeholder Education, Training And Skills











Fisher/Tour-Guide Stakeholder Impressions About Management Effectiveness

Independent stakeholders were subsequently asked a series of specific questions about management of the BCNP/MR. (Cf. **Illustratoin 23**).

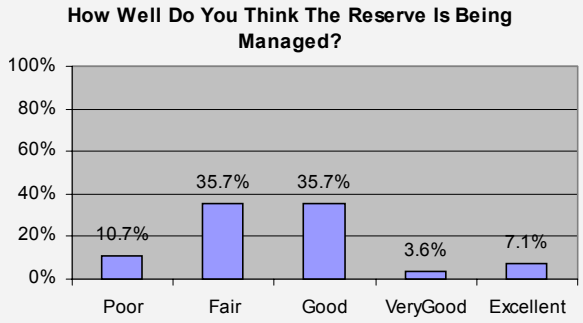
Most independent stakeholders interviewed (>70 %) felt BCNP/MR management is fair to good, but also felt management was weak at marketing (75 %), enforcement (61 %) and public relations with stakeholders (50%).

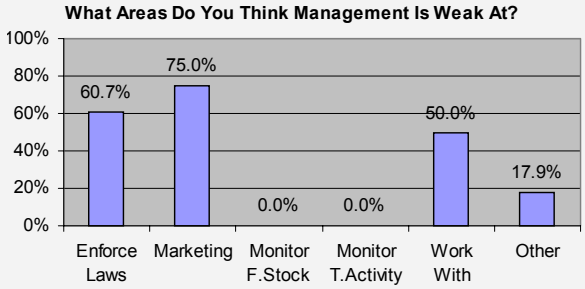
About 57 % of fisher/tour-guide stakeholders felt that BCNP/MR management should be improved by increasing the number of Rangers (46 %), and/or changing some of the staff (25 %).

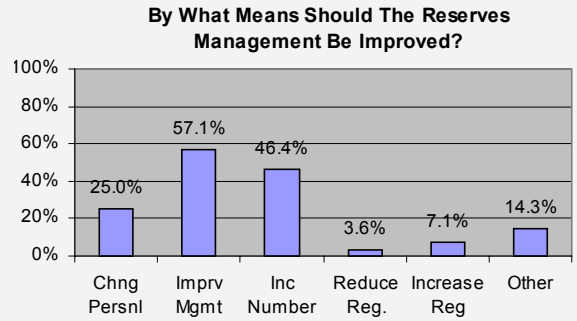
These findings suggest that independent stakeholders attribute at least a portion of their dissatisfaction with BCNP/MR-based livelihood with deficiencies in management, particularly as it regard to increasing tourist visitation, and illegal use of the BCMR/NP.

ILLUSTRATION 23:

Stakeholder Impressions About Management Effectiveness







Fisher/Tour-Guide Impressions About Fee Schedules and Income Allocation

Independent stakeholders were finally asked a series of specific questions about BCNP/MR user fees (Cf. **Illustration 24**).

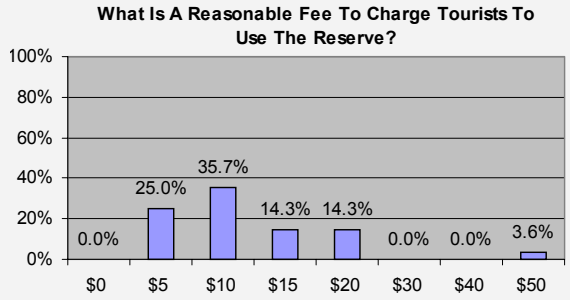
Most independent stakeholders (~71 %) felt, in general, that user fees should be between $5 and $10 per visit, and most stakeholders (68 %) also felt, more specifically, that fishers should not be charged any fees to use the BCMR. Conversely, most independent stakeholders (32 %) felt that researchers should pay relatively more to use the BCNP/MR that fishers, by a factor of 2.

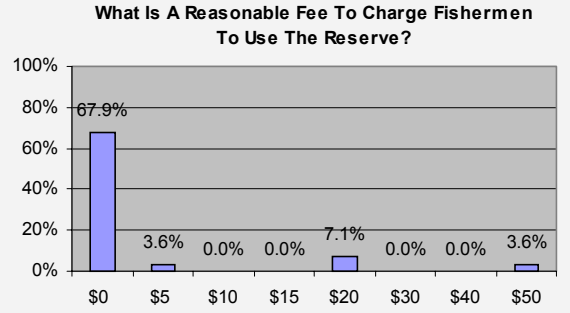
When queried as to how entrance fees should be used, independent stakeholders strongly recommended use of fees for tourim activity-based infrastructure and marketing (85 and 75 %, respectively), second to more Surveillance (43 %) and tourist accommodations (36 %). Surprisingly, independent stakeholders did not recommend changing any of the BCNP/MR regulations, or further investment in other stakeholder training initiatives.

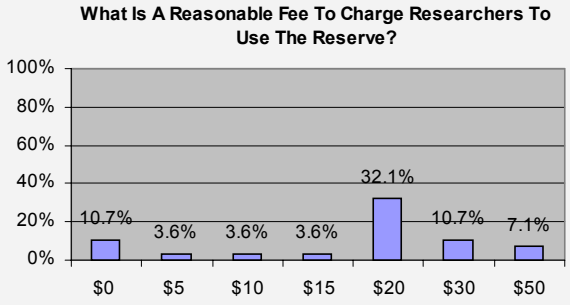
Taken together, the independent stakeholder survey clearly indicated user subgroups may be differentiated by their relative interest in training and capacity for investment in alternative livlihoods, but more importantly perhaps, tour-guide/fisher stakeholder interest in further capacity building, is in general, subordinate to their interest in BCNPMR management building greater tourist visitation, and reducing illegal use of the BCNP/MR.

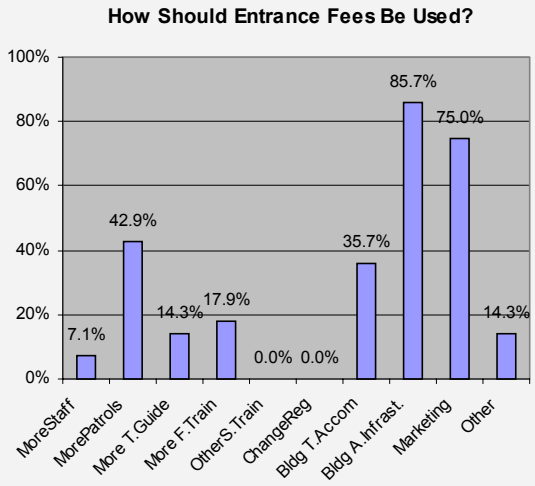
ILLUSTRATION 24:

Stakeholder Impressions About User Fees









Hotelier Impressoins About Tourist Visitation and Awareness

A total of 19 hotel owners/managers in San Pedro were asked a series of questions to help provide a general understanding of how they utilize the BCNP/MR (Cf. **Illustrations 25** – **26** and **Addenda 14**).

The hoteliers interviewed maintain various scales of operation, with tourist visitations ranging from <1,000 guests/year to > 5,000 guests/year.

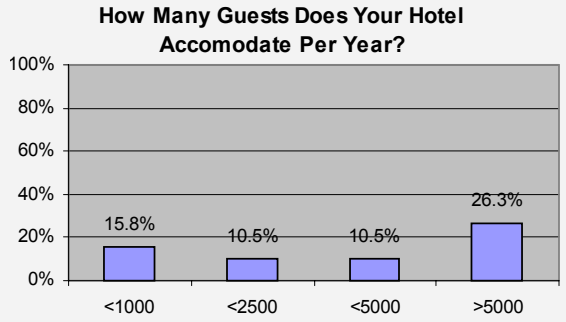
Most hoteliers (79 %) indicated they offered tours to the BCNP/MR, but only 1/3rd told more than half their guests about the BCNP/MR, and nearly half (~48 %) indicated they told ≤ 10 % of their guests about the BCNP/MR. The majority (58 %) of hotel owners further indicated they arrange < 100 guest trips to the BCNP/MR per year.

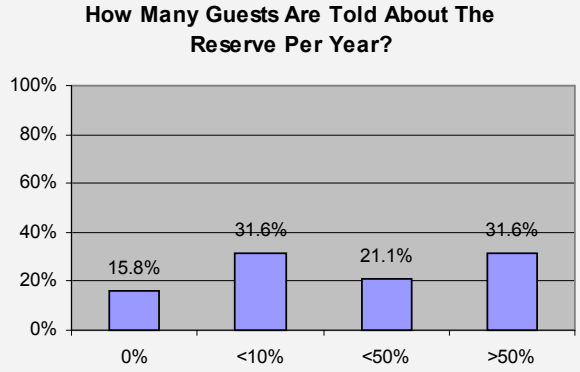
Most of the interviewees (53 %) indicated that less than 10 % of the their guests inquired about the BCNP/MR.

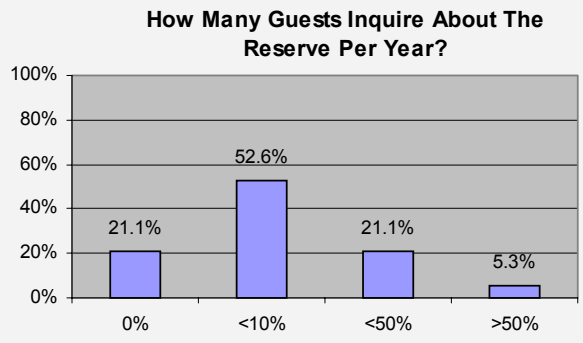
The findings clearly indicate that the BCNP/MR is not well marketed to tourists staying in San Pedro accomodations, and hence, visitation to the BCNP/MR might be considerably enhanced through local marketing in San Pedro, alone.

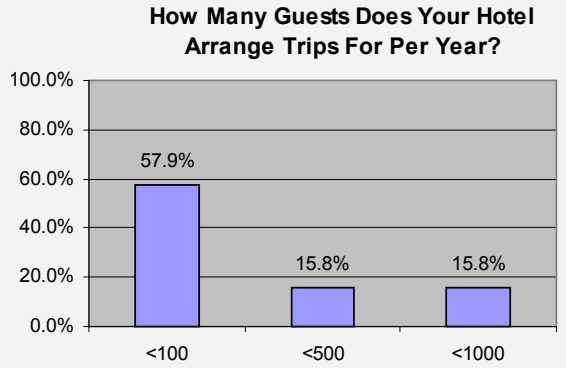
ILLUSTRATION 25:

Hotelier Impressions About Tourist Visitation and Awareness









Hotelier Impressions About User Fees

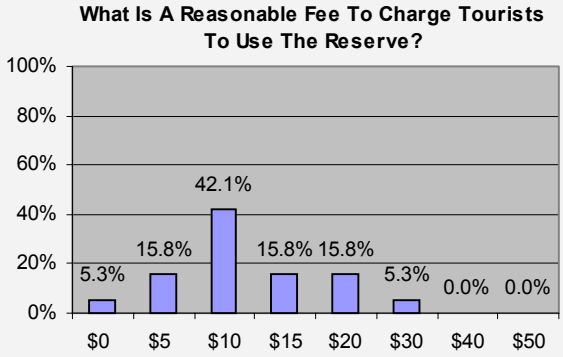
Hoteliers were subsequently asked a series of questions about user fees for the BCNP/MR. Most hoteliers suggested an entrance fee for tourist of $10, and no entrance fee for fishers using the BCNP/MR (Cf **Illustration 26**).

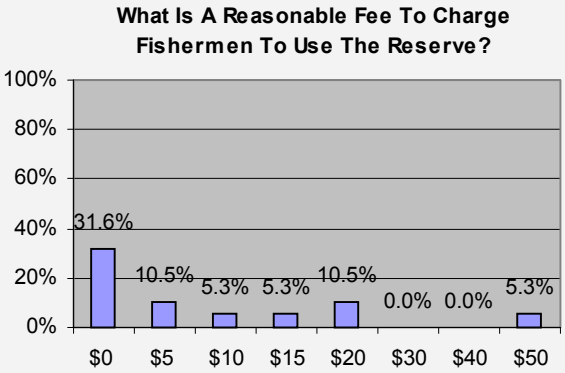
Most hoteliers most told their guests the cost of visitation to the BCNP/MR would be in excess of $150; but most hoteliers also indicated that entrance fees were not a factor in tourists choice about whether or not to visit the BCNP/MR.

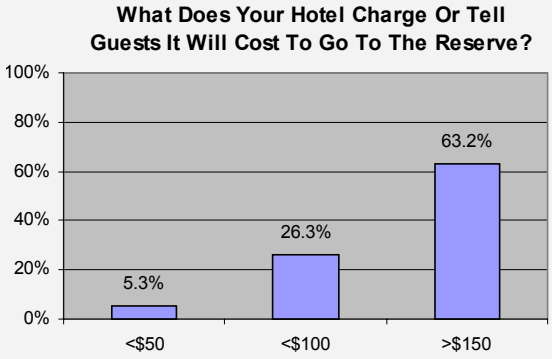
Most interviewees felt that the BCNP/MR had lower visitation than the HCMR because it was poorly marketed, and lacked sufficient tourst accomdations and infrastructure in compensation for the long travel time required to vist the BCNP/MR.

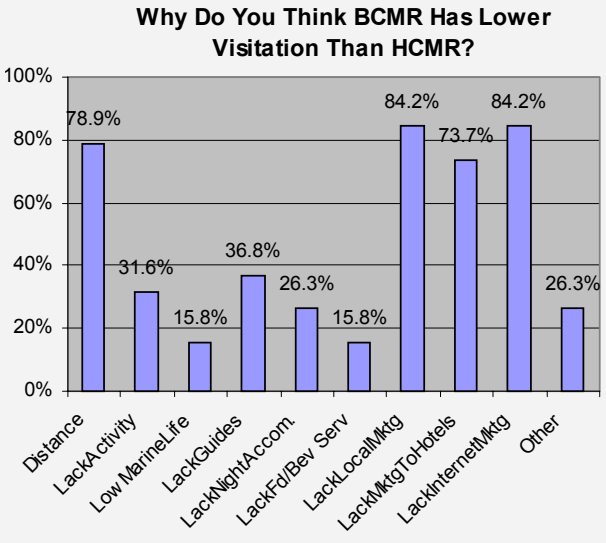
ILLUSTRATION 26:

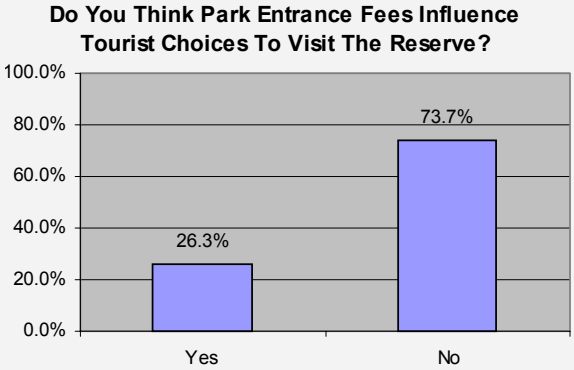
Hotelier Impressions About User Fees











Staff Background and Training Needs

The 6 staff of the BCNP/MR were asked a series of questions to help understand their impressions about BCNP/MR needs and function (Cf. **Illustrations 27 – 28** and **Addenda 15**).

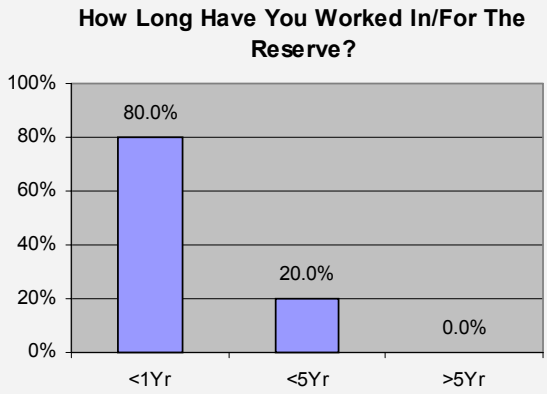
Most staff have worked in the BCNP/MR for less than 1 year. Staff were closely divided in their familial relationship to the BCNP/MR, but most elected to work in the BCNP/MR by way of persuing of a career in the field of conservation.

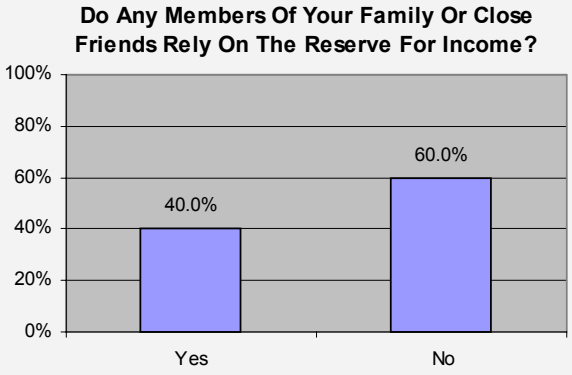
Most staff felt they were adequately trained for their posting, but also ranked training in communications on a par with academics.

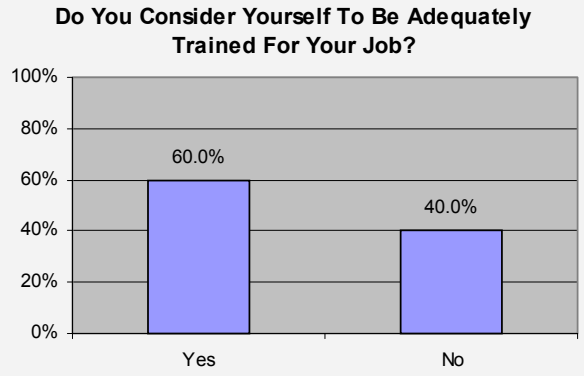
This latter finding suggest that staff recognize the importance and utility of communication as a skill, and this type of training should be offered to staff in future training exercises.

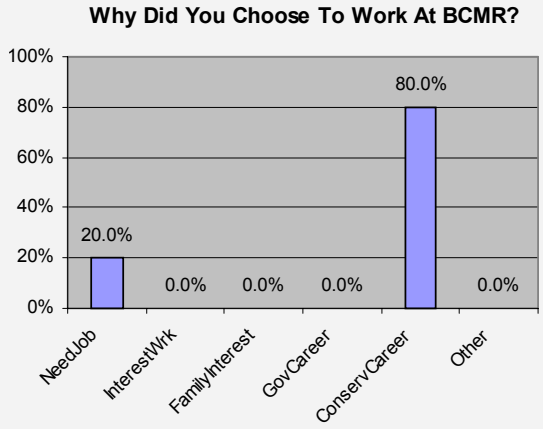
ILLUSTRATION 27:

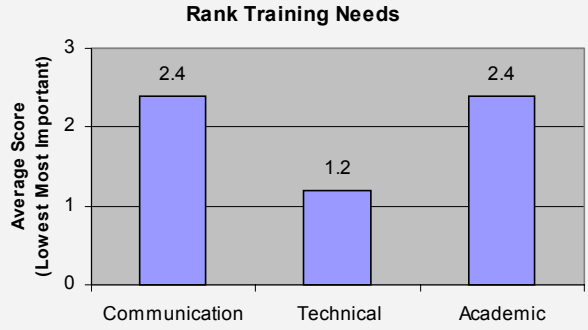
Staff Background And Training Needs

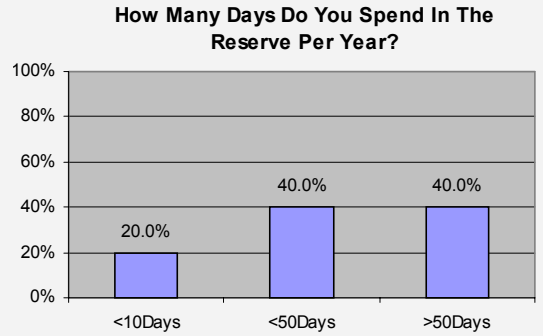












Management and Staff Impressions About User Fees

Staff were subsequently asked about user fees for the BCNP/MR (Cf. **Illustration 28**). Most respondents held similar nottions as fishers, tour-guides and hoteliers with respect to a $10 fee for tourist use of the BCNP/MR, and zero cost usage by fishers. Staff however felt that researchers shold pay relatively more than any other group.

When queried about needs of the BCNP/MR, staff, also like fishers, tour-guides and hoteliers, felt that greater increasing visitation to the BCNP/MR through investments in marketing and tourist accommodations and infrastructure was important.

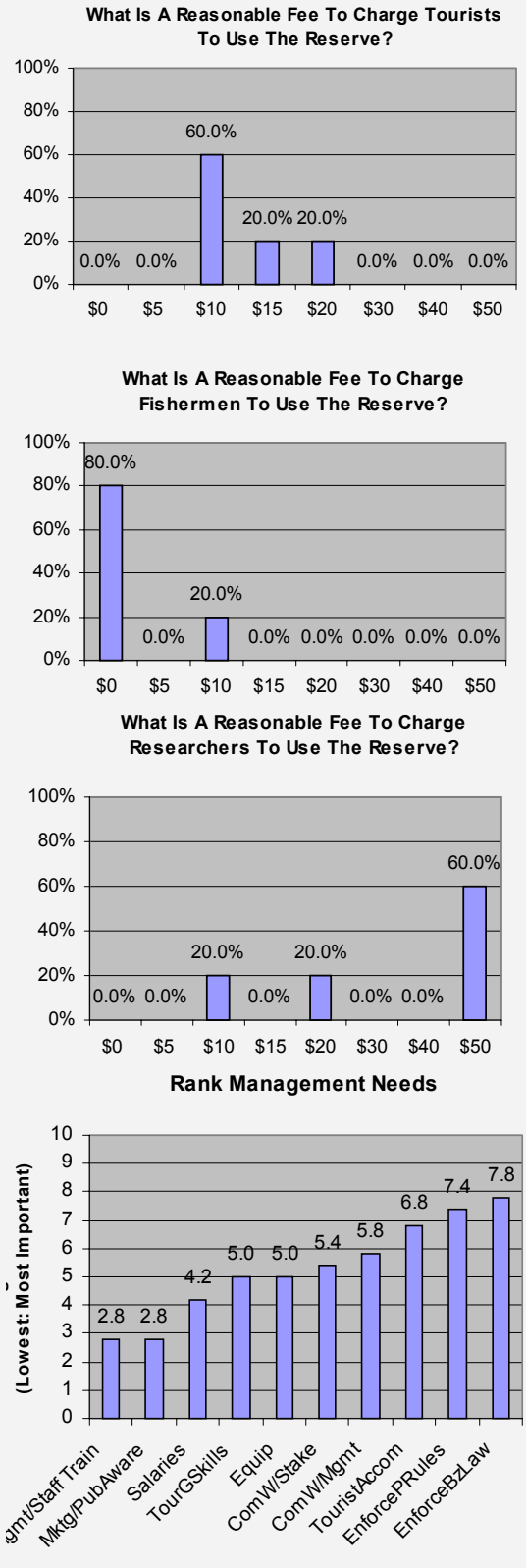
Conversely however, staff placed a higher priority on training than these investments, and a much lower priority on enforcement that suggested by fishers and tour-guides.

Staff priorities for training in advance of other investments by management clearly indicate the need for staff attitudes to change from temporal commitment to the BCNP/MR as a career stage, to a longer term commitment to building BCNP/MR sustainability as a career opportunity in and of itself.

The indicated variance with independent stakeholders impressions about illegal extraction suggests an important component of stakeholder support for management of the BCNP/MR is strongly influenced by fisher/tour-guide confidence in management's control of poaching.

ILLUSTRATION 28:

Management And Staff Impressions About User Fees



4.3 Zoning Effectiveness

Introduction and Methodology

In June of 2002, COMPACT funded a 12 month project to facilitate fisher participation and decision making in the Management of the Bacalar Chico Marine Reserve. The project was conducted by Caribeña Fishermen's Cooperative with technical support provided by Green Reef Environmental Institute. The key technical objective of the project was to evaluate Bacalar Chico's management zoning effectiveness in relation to Fisheries Management and Conservation Objectives

BCMR's zoning effectiveness was evaluated by having Caribeña fishermen count the number of key commercial species seen within 16 sampling zones each month for a period of 12 months (Cf. **Illustration 29**). Data on landed catches by snorkel-fisher teams working in BCMR's General Use Zones were reported and collected by fishers and recorded by Green Reef observers. Snorkel-fishers then swam through BCMR's Preservation and Conservation Zones and reported counts of commercial species that were not legal to capture. Data and counts were collected on more than 20 commercial species were collected during the course of the 12 month survey evaluation. Each species counted was recorded as being from: Fore-Reef or Back Reef Habitats; and The total number of micro-habitats (rocks and caves) were counted in each zone. Reported here are the counts for: Groupers, Snappers, Lobster; Conch, Parrot Fish, and Habitats.

Survey Findings

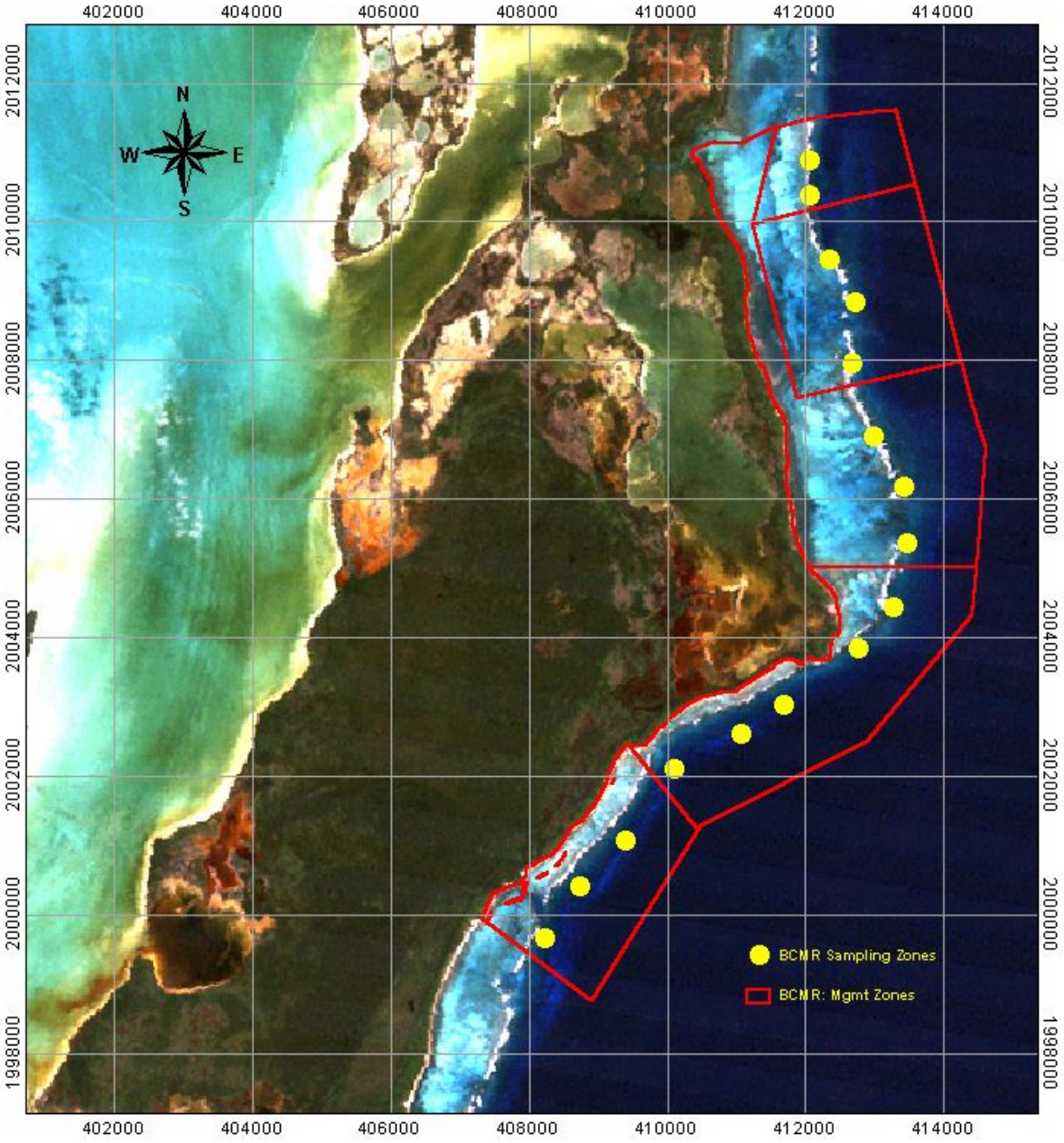
Black, Nassau and Goliath Groupers were generally found to be more abundant in the southern portion of the Reserve (Cf. **Illustration 30**). Black, Nassau and Goliath Groupers were generally found to be more abundant in the southern portion of the reserve. Cuberra and Yellowtail Snappers kept to the fore reef zone in the north and south (respectively), while Mutton, Dog and Black Snappers were intermingled across the southern back reef zone. Fore-reef Snappers (Cuberra and Yellowtail) were generally less abundant during the middle and end of the year; and back reef Snappers (Mutton, Dog and Black) were only less abundant during the middle of the year. Lobsters were more common on the fore reef than back reef zones, and in the southern portion of the BCMR.

Lobsters were also more common between July and January than between February and June. Legal-sized Conch were more common in the southern back-reef habitat of the reserve; and juvenile Conch were more common in the northern back-reef of the Reserve. Legal-sized Conch were more common in the southern back-reef habitat of the reserve; and juvenile Conch were more common in the northern back-reef of the reserve. Parrot Fish were counted as indicators of coral health, and found to be more common in the southern back reef, southern fore reef and northern fore reef habitats than any other location. Parrot Fish were least common during the middle and latter portions of the year than at any other time. Micro-habitat distribution within the BCMR was relatively even, but was significantly less common in the southern fore-reef region of the reserve.

ILLUSTRATION 29:

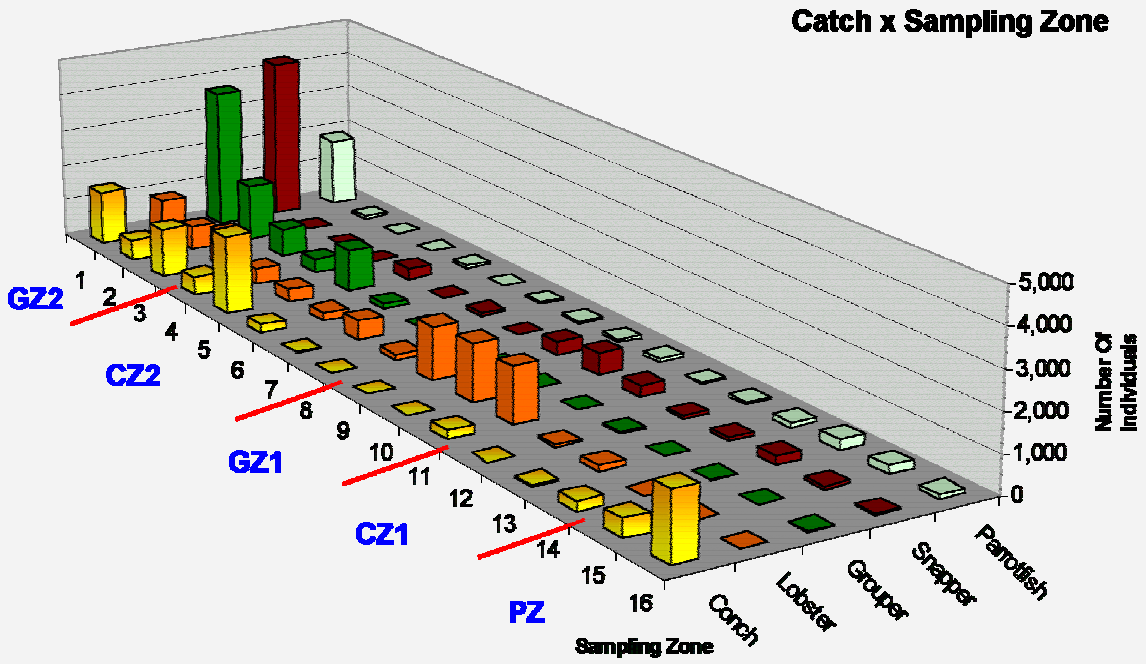
Sampling Sites Within The Bacalar Chico Marine Reserve, Ambergris Caye

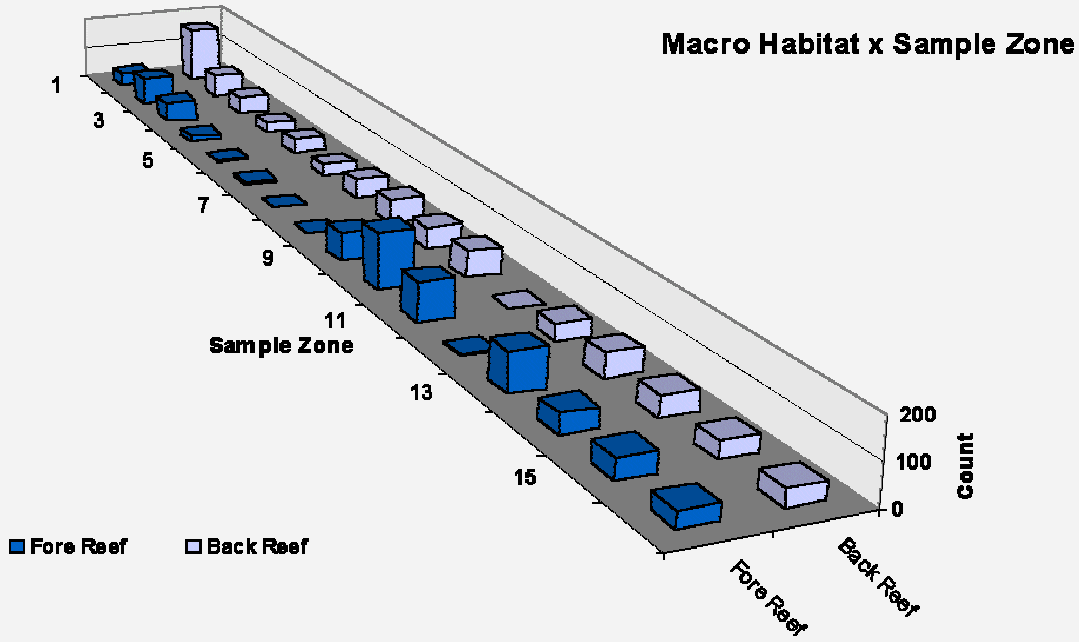
UTM Zone 16 - NAD 27 Datum



Prepared By: T Grimshaw / Ecoworks

ILLUSTRATION 30: Zoning Survey Results





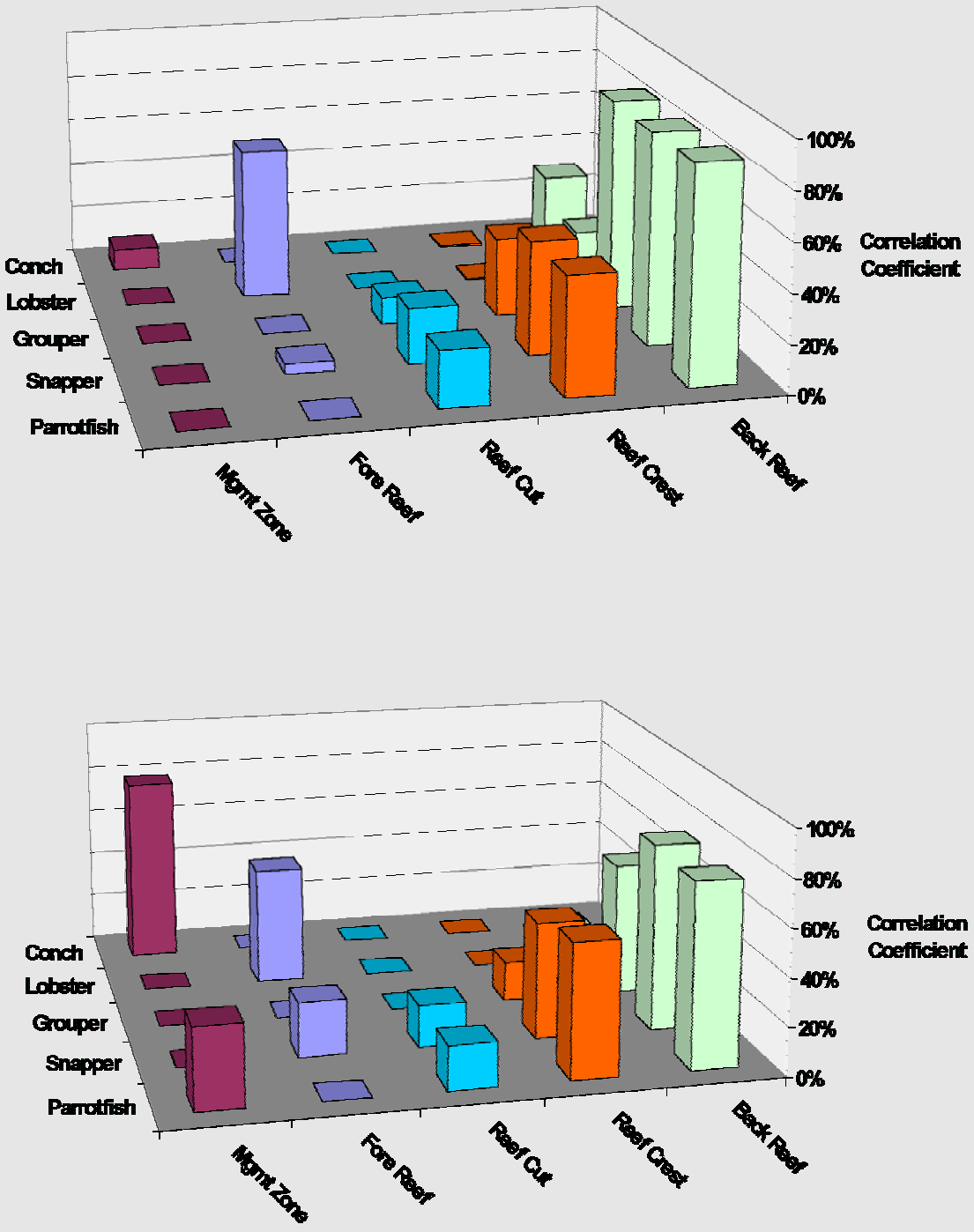
Most commercial species were more common in the southern region of the BCMR. Correlation analysis establishes species distribution is more closely linked to habitat distribution than management zone distribution. Correlation analysis establishes catch per unit effort (CPUE) is more closely linked to habitat distribution than management zone distribution.

Conclusions and Recommendations

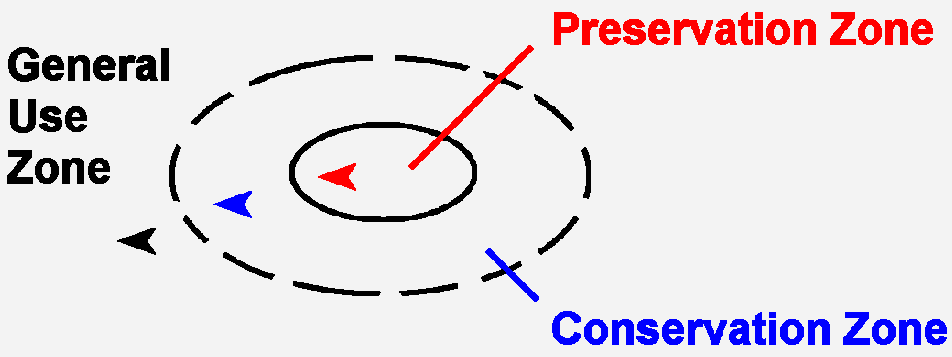
The observed species distributions, CPUE results and correlations establish that the northern conservation and preservation zones are not functioning (**Illustration 31**). The reason for the poor function of the northern conservation and preservation zones is not directly related to habitat distribution. Common knowledge reports of illegal fishing in the northern protected zones by both local and Mexican fishers, indicate the present zoning structure in the northern region of BCMR is probably being compromised by poaching mortality.

The fisheries management zoning concept is to nest successive layers of conservation and use so that extracted resources can be replenished (Cf **Illustration 32**). The present BCMR zoning plan does not strictly follow the fisheries management concept because of the preservation zones placement next to a general use zone, under poor enforcement. An alternative arrangement of fisheries management zones may be needed to improve BCMR management zoning effectiveness. (This may be a particularly relevant structure for transboundary zones with differing zoning schemes and limited enforcement capacity.) The finding established three options as being available to mitigate the present zoning dysfunction: Leave the existing zoning structure and improve enforcement; Alter the existing zoning structure until such time as enforcement can be improved; or Make no changes, and suffer the consequences. Fisheries Department Recommendations were to leave the present zoning structure in place and increase enforcement.

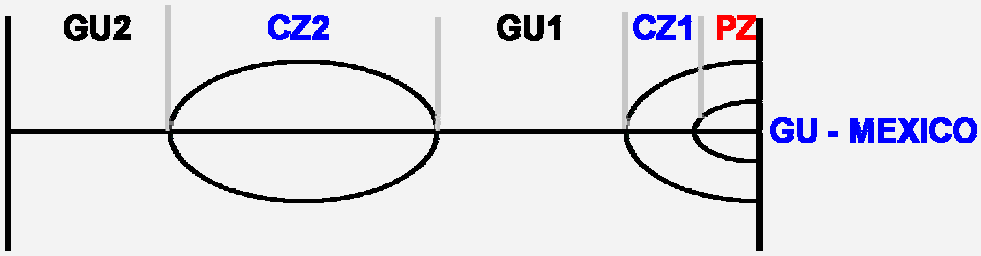
ILLUSTRATION 31: Zoning Study Correltion Analysis



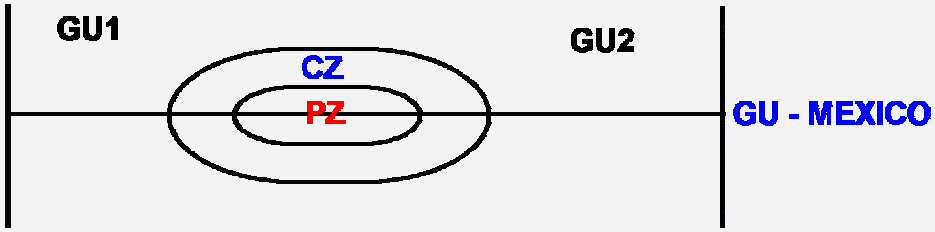
ILLUSTATION 32: Conservation Zoning Relationships



CURRENT BCMR ZONING STRUCTURE



ALTERNATE BCMR ZONING STRUCTURE



5. THE REVISED MANAGEMENT PLAN

5.1 Strategic Goals And Objectives

Overview

The critical challenge before the BCNP/MR, as with many protected areas in Belize and elsewhere, is the metamorphosis from designation to self-sufficiency. A complex process, successful transformation to this end remains wholly dependent on the achievement of multiple independent objectives. The first objective in this process, which is to develop and test a series of key operational measures for function and dysfunction, although some 10 years under development, has more than adequately been examined in the preceding sections of the RMP.

Subsequent objectives in this process describe the essential measures that must now be taken in sustainable defence of the BCNP/MR's constituency, which includes both its wildlife charge and the stakeholders dependent on the BCNP/MR for livelihood. This further represents the over-arching strategic goal before the BCNP/MR. The means for implementing these measures are entirely dependant on the potential of tourism visitation to provide the revenue needed by traditional users to change from extractive to sustainable use of the BCNP/MR's wildlife resources, as well as the revenue needed for responsible administration of the process itself. In light of these considerations, and the preceding review of BCNP/MR characteristics and operation, the key strategic goals and objectives critically necessary to BCNP/MR's long-term sustainability may be outlined as follows:

Short Term Strategic Goal: Years 1 - 5

Continuance Of Critical Conservation Measures:

Objective 1: Continuation of management presence in the short term with public/available resources until basic operational cost of the BCNP/MR can be fully realized from user fees;

Objective 2: Concurrent solicitation of donor investment in marketing, basic infrastructure and operational expense as needed to raise tourist visitation and reduce illegal extraction;

The two objectives of this strategic goal address the important need for the BCNP/MR to continue its management presence as a first priority, while instituting measures to secure the means for financial self sufficiency. Three potential sources for short-term or *bridge* funding for the BCNP/MR include the GOB, PACT and/or the FSCMRM, but the former two may be able to offer more immediate relief than the planned, but not as yet implemented FSCMRM. Funding from either of these sources cannot in any case be anticipated as open ended or long term, owing in part to the fact that none of the parties identified are likely to undertake such commitment, but more importantly perhaps to underscore to the impetus for BCNP/MR to secure funding which is dedicated to, and contingent upon use of donor resources for increasing tourist visitation and achieving self sufficiency.

The minimum financial requirement for the indicated *bridge*-funding of the BCNP/MR should not be less than the amount contributed by CZMA/I from UNDP/GEF resources for basic operational support (surveillance and enforcement), or approximately BZ $120,000/year for a period of not more than 3 years (i.e. Bz $ 360,000 total) in order to afford the BCNP/MR sufficient time to apply for, secure and invest donor sponsored tourism development funding, and begin realizing income from the investment. Donor resources needed to achieve the second objective under this strategic goal are more flexible, but are assumed to replace the *bridge*-funding support described above, as well as provide support for infrastructure development, marketing and enhancement of surveillance and enforcement capacity to the extent of approximately Bz $ 2.2 M (Cf. **Page 106**).

Medium Term Strategic Goal: Years 3 - 10

Expansion of Critical Conservation Measures:

Objective 1: Reinvestment of user fees for necessary conservation monitoring actions and further augmentation of tourist visitation; and

Objective 2: Continued solicitation of donor investment in baseline research and stakeholder/staff capacity building as necessary for improvement of conservation management effectiveness.

The two objectives of this strategic goal address the need for the BCNP/MR to reinstate its key wildlife-monitoring activities, and to fill outstanding gaps in baseline research at the earliest possible opportunity. Gate receipts are assumed to be sufficient after Year-3 to begin offsetting an increasing portion of donor-supported operational/monitoring cost, but allocations for baseline research are anticipated to continue being entirely supported with donor resources to the extent of approximately Bz $ 0.65 M (Cf. **Page 98**).

Long Term Strategic Goal: Years 5 - 10

Reinvestment In Critical Conservation Measures:

Objective 1: Reinvestment of user fees for monitoring actions as needed to management/mitigate the potential for visitor/carrying capacity impacts.

The single objective of this strategic goal addresses the need for the BCNP/MR to diversify and expand its key monitoring activities in order to regularly monitor and evaluate visitor/carrying capacity impact (Cf. Paz *et al* 2003). Gate receipts are assumed to be sufficient by Year-5 to completely offset all operational/monitoring cost as well as remaining cost for infrastructure expense, such that no further donor support for these activities is anticipated (Cf. **Page 107**).

Conservation and Business Model Development:

The following sections of the RMP describe the programs and cost allocations required in support of BCNP/MR's conservation objectives (**Section 5.2**: The Conservation Model), and how these fundamental requirements are met through donor support for and income from tourism visitation development (**Section 5.3**: The Business Model).

5.2 The Conservation Model

The terrestrial, aquatic and marine program components, which make up the conservation model for the BCNP/MR are outlined in **Table 10** along with component actions, duration and cost. A summary description of each component action rationale is presented in the following sections.

Terrestrial Component

Terrestrial conservation measures are estimated to cost approximately $208,000 for the baseline research subcomponent, and approximately Bz $ 230,000 for the monitoring/education component over the 10-year term to which the conservation model applies.

- *Baseline Research* requirements for the terrestrial component of the conservation model entail 7 key target assessments. The proposed vegetation study will address the need for a comprehensive ground assessment of the BCNP's various forest assemblages, which to date have only been described by remote sensing analysis and/or annotative observations of plant species (Cf. **Page 21**). The vegetation study is to be based on comprehensive ground-truthing of high (0.6 meter) resolution, orthorectified LandSat 7 imagery that can now be tasked for specific areas of interest, and which in turn can be used for detailed mapping and annotation of trails to be established for tourism use.

  The primary consumer study proposed will address the need for basic taxonomic description of the BCNP's terrestrial micro-fauna, inclusive of insects and other invertebrates (Cf. **Page 28**). The objective of this study will, in addition to basic description, be to determine the specific conservation needs and significance of the BCNP's micro-fauna, in respect of species commonness and rarity, as well as representation elsewhere in Belize. Suitable information from this study will be incorporated into presentations for tourists participating in land trail excursions.

  The bird and mammal studies proposed are designed to provide a more authoritative and contemporary update of earlier faunal lists, which were determined sporadically, prior to the availability of support facilities for such investigations (Cf. **Pages 28** - **33**). These studies will be used to establish conservation requirements as well as presentations for tourists participating in land trail excursions. The archaeology study proposed will to provide an update of known site conditions, preservation needs, and an analysis of suitability for and cost of development for tourism use.

  The preceding studies will be used to develop a conservation zoning plan for the BCNP, wherein specific areas will be set aside for preservation, conservation research and general/tourism use (Cf. **Page 59**). The land use study proposed will address the specific needs of the BCNP to establish an environmental management for private land use within the BCNP, and hence resolve the longstanding variance between BCNP conservation objectives and the less well defined development guidelines of the ACMP (Cf. **Pages 59** and **65**).

TABLE 10

CONSERVATION PROGRAM COMPONENTS

Conservation Program	Action	Period	Frequency	Cost
Terrestrial Component				
Baseline Research				
Vegetation	Update Vegetation Map	12 Months	---	$35,000
Primary Consumers	Invertebrate Survey	8 Months	---	$25,000
Birds	Update List	4 Months	---	$24,000
Mammals	Update List	4 Months	---	$24,000
Archaeology	Update List	12 Months	---	$50,000
Zoning Plan Development	Identify / Establish	8 Months	---	$25,000
Land Use	Development Guidelines	8 Months		$25,000
Subtotal, Baseline Research Cost				$208,000
Monitoring and Education				
Hunting Abatement	Signs and Education	12 Months	Continuous	$200,000
Zoning Effectiveness	Wildlife Abundance	12 Months	5 Year Intervals	$30,000
Subtotal, Monitoring Cost				$230,000
Aquatic Component				
Baseline Research				
Primary Producers	Algae / Plankton Survey	12 Months	---	$25,000
Primary Consumers	Zooplankton Survey	12 Months	---	$25,000
Secondary Consumers (Fish)	Fish Abundance and Breeding Survey	12 Months	---	$25,000
Zoning Plan Development	Identify / Establish	12 Months	---	$25,000
Subtotal, Baseline Research Cost				$100,000
Monitoring and Education				
Fishing Abatement	Signs and Education	12 Months	Continuous	$200,000
Zoning Effectiveness	Wildlife Abundance	6 Months	5 Year Intervals	$100,000
Visitor Impact	Sport Fishing Impact	6 Months	5 Year Intervals	$30,000
Subtotal, Monitoring Cost				$330,000
Marine Component				
Baseline Research				
Coral Cover	Map Ground-Truthing	8 Months	5 Years Sequential	$150,000
Primary Producers	Algae / Plankton Survey	8 Months	---	$35,000
Primary Consumers	Zooplankton Survey	8 Months	---	$35,000
Currents and Recruitment	Map Current Characteristics	8 Months	---	$120,000
Subtotal, Baseline Research Cost				$340,000
Monitoring and Education				
Conch	Pop Demographics	4 Months	3 Year Intervals	$75,000
Lobster	Pop Demographics	4 Months	3 Year Intervals	$105,000
Turtles	Nesting Success	4 Months	Continuous	$120,000
SPAGS	Attendance and Pop Characteristics	6 Months	3 Year Intervals	$75,000
Manatee	Habitat Use	6 Months	3 Year Intervals	$60,000
Fishing Abatement	Signs and Education	12 Months	Continuous	$200,000
Visitor Impact	Management Effectiveness	4 Months	3 Year Intervals	$60,000
Subtotal, Monitoring Cost				$695,000
SUBTOTAL, CONSERVATION				**$1,903,000**

- *Monitoring and Education* requirements for the terrestrial component of the conservation model encompass 2 key target exercises. The first of these exercises involves a wildlife protection initiative involving surveillance and enforcement, public education as to what constitutes illegal extraction, and the placement and maintenance of signage informing the public of park boundaries, and conservation rules, in English and Spanish, around the entire periphery of the BCNP. The second of these exercises involves routine zoning effective assessment, as defined in and required by the zoning plan to be developed in the above-described baseline research subcomponent.

Aquatic Component

Aquatic conservation measures are estimated to cost approximately $100,000 for the baseline research subcomponent, and approximately Bz $ 330,000 for the monitoring/education component over the 10-year term to which the conservation model applies.

- *Baseline Research* requirements for the aquatic component of the conservation model entail 4 key target assessments. The proposed primary and secondary producer studies will address the need for basic taxonomic description of the BCNP's aquatic flora and fauna, inclusive of plants, phytoplankton, macro-invertebrates and zooplankton (Cf. **Page 35**). The objective of these studies will, in addition to basic description, be to determine the specific conservation needs and significance of the BCNP's aquatic macro/micro flora and fauna, in respect of species commonness and rarity, as well as representation elsewhere in Belize. Suitable information from these studies will also be incorporated into presentations for tourists participating in lagoon excursions.

  The fish studies proposed are designed to reconcile conflicting information about the ichthyologic fauna of the BCNP lagunal systems (Cf. **Pages 36**), and hence provide an authoritative and contemporary update of earlier faunal lists,s which can then be integrated with a zoning plan for these unique ecosystems. The conservation zoning plan proposed for development will identify specific areas to be set aside for preservation, conservation research and general/tourism use (Cf. **Page 59**).

- *Monitoring and Education* requirements for the aquatic component of the conservation model encompass 3 key target exercises. The first of these exercises involve an aquatic wildlife protection initiative involving surveillance and enforcement, public education as to what constitutes illegal extraction, and the placement and maintenance of signage informing the public of park boundaries, and conservation rules, in English and Spanish, around the main lagoon systems of the BCNP. The second of these exercises involves routine zoning effective assessment, as defined in and required by the zoning plan to be developed in the above-described baseline research subcomponent. The third exercise is designed to evaluate sport fishing impacts, with particular emphasis to be placed on catch and release method compliance as well as fish mortality/recovery associated with the level of compliance observed.

Marine Component

Marine conservation measures are estimated to cost approximately Bz $340,000 for the baseline research subcomponent, and approximately Bz $ 695,000 for the monitoring/education component over the 10-year term to which the conservation model applies.

- *Baseline Research* requirements for the marine component of the conservation model entail 4 key target assessments. The coral studies recommended are designed as a continuance of earlier efforts to map coral distribution within the BCMR, but also are intended to include evaluation of coral cover within the context of sensitivity to tourism visitation. This latter aspect of the study will require investigators to recommend areas as best/least suited to visitor use, perhaps with sub-classifications according to visitor skills (Cf. **Page 40**). The proposed primary and secondary producer studies are similar to those described for the aquatic component, and hence will address the need for basic taxonomic description of the BCMR's aquatic flora and fauna, inclusive of plants, phytoplankton, macro-invertebrates and zooplankton (Cf. **Page 40**). The objective of these studies will, in addition to basic description, be to determine the specific conservation needs and significance of the BCMR's aquatic macro/micro flora and fauna, in respect of species commonness and rarity, as well as representation elsewhere in Belize. Suitable information from these studies will also be incorporated into presentations for tourists participating in lagoon excursions.

  The fish studies proposed are designed to fill existing gaps in information about the ichthyologic fauna of the BCMR (Cf. **Page 44**), and hence provide an authoritative and contemporary update of earlier faunal lists, which can then be integrated with the existing zoning plan. The current and recruitment study proposed are designed to fill existing gaps in information about current patterns within the BCMR in relation to recruitment of select commercial species, including conch, lobster and finfish (Cf. **Page 40**). The findings of this study will be use to update the existing zoning plan for the BCMP, as needed in defence of areas within the BCMP supporting the greatest levels of recruitment.

- *Monitoring and Education* requirements for the marine component of the conservation model encompass 7 key target exercises. The first 4 of these exercises concern conch, lobster, sea turtles and finfish spawning aggregations, and essentially constitute a continuance of monitoring programs developed over the preceding several years (Cf. **Page 44**), perhaps with some modifications based experiential considerations. The 5th exercise constitutes a new monitoring activity designed to evaluate the relative importance of manatee use of the BCNP/MR, as well as the location and expanse of habitats important to manatee, and hence provide the information necessary to any recommended modifications to existing zoning regulations.

  The 6th exercise affords some expansion of basic surveillance and enforcement monitoring capacity to include the monitoring and evaluation of sport fishing impacts, with particular emphasis to be placed on catch and release method compliance as well as fish mortality/recovery associated with the level of compliance observed. The 7th and final exercise will entail monitoring of visitor usage and impacts apart from those associated with sport fishing, particularly on coral cover and other potentially sensitive habitats within general use zones.

5.3 The Business Model

The cost components, which make up the business model for the BCNP/MR are outlined in **Tables 11 - 15**. A summary description of each component rationale is presented in the following sections.

Capital Expenditures

Expenditures for infrastructure and equipment are outlined in **Table 11**, and include allocations for organizational expense, an administration complex, a research complex, a range of tourism activity centers to be implemented in three phases, baseline research expenditures (capitalized here because they represent a non-recurrent/revenue-linked expenditure for intellectual property), and the accessories, machines, tools vehicles and equipment (collectively **AMTVE**) associated with operations to be based out of each complex or center. Approximate values for existing infrastructure and equipment are shown in the capital cost table in column '0' to bring forward capital investment to date.

- *Organizational Expense* includes expenditure for past planning studies (i.e. this RMP) and land acquisition (Cf. **Page 90**). This latter category is for the purchase of 3 – 5 acres of land the east side of the BCNP/MR in Year-3 for placement of 3 marine surveillance and enforcement stations, and tourism support and activity facilities. Also included in this category is cost for incorporation for the BCNP/MR as a not-for-profit company, and arrangement of 501C3 US non-profit status to make the BCNP/MR eligible for endowments and/or donations from US corporations. Placement 24/7 ranger stations on the eastern side of the BCMR will increase available surveillance time and afford considerable savings on fuel expense from reduced travel to/from the western BCMR (Cf. **Illustration 33**), as well as through opportunity for ground-based monitoring (from towers). Land expenditure is estimated at Bz $262,500.

- *The Administration Complex* includes past investment in existing facilities (i.e. the headquarters and visitors gateway), and placement of a new headquarters building, managers/rangers residences, a visitors gateway and freshwater supply facilities on the east side of the BCNP/MR (Cf. **Pages 90** and **93**). Total cost for this additional infrastructure is estimated at Bz $ 1.1 Million in Year-4. AMTV expense in support of these facilities includes a power plant, office equipment, kitchen equipment, 4 boat and engine sets, security and enforcement equipment (radios, megaphones, etc.), fire and first aid equipment, dormitory accessories and assorted land management equipment, which collectively are estimated cost Bz $ 0.46 Million in Year-4 (allowing 6 months time for building design, construction and outfitting with equipment).

- *The Research Complex* includes a laboratory, staff dormitory, lecture hall, freshwater system, dive gear storage and compressor area, animal rehabilitation facilities (holding pools and cages for livestock) on the eastern side of the BCNP/MR (Cf. **Pages 90** and **94**). Total cost for these infrastructure is estimated at Bz $ 762,500 in Year-5. AMTV expense in support of these facilities includes assorted laboratory equipment, communication equipment, 2 boat and dive equipment sets, fire and first aid equipment and dormitory accessories, which collectively are estimated to cost Bz $ 286,250 in Year-5 (allowing 12 months time for building design, construction and outfitting with equipment).

TABLE 11

CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

Period Number / End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
ORGANIZATIONAL EXPENSE	[EXISTING]																				
Planning Studies																					
Mgmt Plan	$16,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000
Subtotal, Planning Studies	$16,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000
Land Acquisition																					
Acreage	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Purchase Price @ $10,000/Ac	$0	$0	$0	$0	$250,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Title Transfer @ 5 %	$0	$0	$0	$0	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Land Acquisition Cost	$0	$0	$0	$0	$262,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BCNP/MR & 501C3 Status Desig.	$0	$0	$50,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Organizational Expense	**$16,000**	**$0**	**$50,000**	**$0**	**$262,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$25,000**
ADMINISTRATION COMPLEX																					
Headquarters Office (West Side)																					
Square Footage	1,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$120,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Visitors Gateway Center (West Side)																					
Square Footage	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$60,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Headquarters Office (East Side)																					
Square Footage	0	0	0	0	0	0	2,400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$360,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mangers Residence (East Side)																					
Square Footage	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Staff Residence (East Side)																					
Square Footage	0	0	0	0	0	0	2,400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$360,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
FW Systems (East Side)																					
Capacity (Persons)	10	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $2,500/Person	$25,000	$0	$0	$0	$0	$0	$37,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Visitors Gateway Center (East Side)																					
Square Footage	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Square Footage	1,600	0	0	0	0	0	7,215	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal, Admin Facilities Cost	**$205,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,117,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
RESEARCH COMPLEX																					
Laboratory: Microscope & Tank Sectors																					
Square Footage	0	0	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Staff Dormitory																					
Square Footage	0	0	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lecture Hall																					
Square Footage	0	0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$120,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
FW System																					
Capacity (Persons)	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $2,500/Person	$0	$0	$0	$0	$0	$0	$0	$0	$37,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Dive Gear Storage & Compressor Room																					
Square Footage	0	0	0	0	0	0	0	0	600	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$90,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Animal Re-habilitation Center																					
Holding Pools																					
Square Footage	0	0	0	0	0	0	0	0	2,500	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $50/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$125,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Holding Cages																					
Square Footage	0	0	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $25/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Research Facilities Sq Ftg	0	0	0	0	0	0	0	0	7,500	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal, Research Facilities Cost	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$762,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

TABLE 11: CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

(Continued)

Period Number / End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
PHASE I ACTIVITY CENTERS																					
Campsites & Picnic Areas	[EXISTING]																				
Site Preparation																					
Area (Ac)	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $1,500/Ac	$0	$0	$0	$0	$22,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bathroom & Shower Facilities																					
Square Footage	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
FW System																					
Capacity (Persons)	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $2,500/Person	$0	$0	$0	$0	$62,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Palapa - Common Area																					
Square Footage	0	0	0	0	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$45,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Locker Facility																					
Square Footage	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $50/Sq Ft	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Laundry Facility																					
Square Footage	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $50/Sq Ft	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite & Picnic Areas	$0	$0	$0	$0	$200,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Nature Trails																					
Site Preparation																					
Area (Km)	0	0	0	0	25	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $1,500/Km (Inc Clear & Mark)	$0	$0	$0	$0	$37,500	$0	$22,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Observation Towers																					
Quantity Each	0	0	0	0	10	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $3,500/Ea	$0	$0	$0	$0	$35,000	$0	$17,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bridges																					
Quantity Each	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $15,000/Ea	$0	$0	$0	$0	$0	$0	$45,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Trails	$0	$0	$0	$0	$72,900	$0	$85,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fishermen's Exhibit																					
Display Center																					
Square Footage	0	0	0	0	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $50/Sq Ft	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Turtle Exhibit																					
Visitors Gazebo																					
Square Footage	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $50/Sq Ft	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Display Tanks																					
Quantity	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $1,500/Ea	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Crocodile Exhibit																					
Visitors Gazebo																					
Square Footage	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Display Tanks & Ponds																					
Quantity	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $1,500/Ea	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water-Sports Center																					
Square Footage	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$90,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Square Footage	0	0	0	0	4,400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal, Phase I Cost	$0	$0	$0	$0	$472,900	$0	$85,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

TABLE 11: CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

(Continued)

Period Number End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
PHASE II ACTIVITY CENTERS																					
Hummingbird Garden																					
Site Preparation																					
Area (Ac)	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Cost @ $3,500/Ac	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$17,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Landscaping																					
Cost @ $10,000/Ac	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$50,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Visitors Gazebo																					
Square Footage	0	0	0	0	0	0	0	0	0	0	1,400	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$105,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Butterfly Pavilion																					
Square Footage	0	0	0	0	0	0	0	0	0	0	2,500	0	0	0	0	0	0	0	0	0	0
Cost @ $1000/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$250,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Canopy Tour																					
Qty Zip Lines	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Cost @ $15,000 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$75,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maya Site Restoration																					
Site Preparation																					
Area (Ac)	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
Cost @ $3,500/Ac	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$35,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Restoration																					
Cost @ $10,000/Ac	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Visitors Gazebo																					
Square Footage	0	0	0	0	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial Center																					
FW System - (Public)																					
Capacity (Persons)	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0
Cost @ $2,500/Person	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$250,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Restaurant																					
Square Footage	0	0	0	0	0	0	0	0	0	0	1,200	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gift Shop																					
Square Footage	0	0	0	0	0	0	0	0	0	0	600	0	0	0	0	0	0	0	0	0	0
Cost @ $75/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$45,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Square Footage	0	0	0	0	0	0	0	0	0	0	6,900	0	0	0	0	0	0	0	0	0	0
Subtotal, Phase II Cost	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,107,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
PHASE III ACTIVITY CENTERS																					
Eco-Village Resort																					
Cabins (Qty)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0
Square Footage Each	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,200	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0
Restaurant & Bar																					
Square Footage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,200	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0
Office																					
Square Footage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	800	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$120,000	$0	$0	$0	$0
FW System																					
Capacity (Persons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0
Cost @ $2,500/Person	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$187,500	$0	$0	$0	$0
Laundry Facility																					
Square Footage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,000	$0	$0	$0	$0
Staff Quarters																					
Square Footage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,200	0	0	0	0
Cost @ $150/Sq Ft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$180,000	$0	$0	$0	$0
Subtotal, Square Footage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33,875	0	0	0	0
Subtotal, Phase III Cost	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$937,500**	**$0**	**$0**	**$0**	**$0**

TABLE 11: CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

(Continued)

Period Number / End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
ACCESSORIES, MACHINES, TOOLS, VEHICLES & EQUIPMENT (AMTVE)																					
ADMINISTRATIVE COMPLEX	[EXISTING]																				
Power Supply																					
Generator Sets																					
Power Output (KVA)	10	50	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $100/KVA	$2,000	$10,000	$0	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Distribution System																					
Distance (Km)	0.1	0.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost @ $10,000/Km	$1,000	$5,000	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Power Supply	$3,000	$15,000	$0	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Office Equipment																					
Computer Sets (Qty Sets)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $5,000 Ea	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Furniture (Qty Pieces)	20	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $350 / Piece	$7,000	$0	$0	$0	$0	$0	$0	$14,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accessories (Qty Pieces)	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 1,500 Ea	$1,500	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Office Equipment	$18,500	$0	$0	$0	$0	$0	$0	$21,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Kitchen Equipment																					
Appliances	5	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $1,500 Ea	$7,500	$0	$0	$0	$0	$0	$0	$18,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Furniture (Qty Pieces)	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $350 / Piece	$0	$0	$0	$0	$0	$0	$0	$7,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Equipment (Qty Pieces)	1	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 1,500 Ea	$1,500	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Laboratory Equipment	$9,000	$0	$0	$0	$0	$0	$0	$40,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Communication Equipment																					
Radio Sets (Qty Units)	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $2,000 Ea	$0	$0	$0	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boat & Engine Sets																					
Sets (Qty)	3	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost @ $35,000 Ea	$105,000	$0	$0	$0	$0	$0	$0	$140,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accessory Equipment (Qty Pieces)	10	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 25,000 Ea	$250,000	$0	$0	$0	$0	$0	$0	$125,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Dive Equipment (Qty Pieces)	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$12,500	$0	$0	$0	$0	$0	$0	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Security & Enforcement Equip																					
No Pieces	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$12,500	$0	$0	$0	$0	$0	$0	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fire & First Aid Equipment																					
First Aid Kits (Qty)	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 500 Ea	$500	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fire & Safety Equipment (Qty Pieces)	10	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$25,000	$0	$0	$0	$0	$0	$0	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Fire & First Aid Equipment																					
Dormitory Accessories																					
No Sets	5	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$12,500	$0	$0	$0	$0	$0	$0	$25,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Land Mgmt Tools																					
Qty Pieces	15	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$37,500	$0	$0	$0	$0	$0	$0	$37,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, ADMINISTRATION AMTVE	**$483,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$459,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

TABLE 11: CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

(Continued)

Period Number End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
RESEARCH AMTVE	[EXISTING]																				
Laboratory Equipment																					
Computer Sets (Qty Sets)	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Cost @ $5,000 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Furniture (Qty Pieces)	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0
Cost @ $350 / Piece	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accessories (Qty Pieces)	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0
Cost $ 1,500 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$37,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Laboratory Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$62,750	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Communication Equipment																					
Radio Sets (Qty Units)	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Cost @ $2,000 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boat & Engine Sets																					
Sets (Qty)	0	0	0	0	0	0		0	0	2	0	0	0	0	0	0	0	0	0	0	0
Cost @ $35,000 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$70,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accessory Equipment (Qty Pieces)	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Cost $ 25,000 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Dive Equipment (Qty Pieces)	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fire & First Aid Equipment																					
First Aid Kits (Qty)	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Cost $ 500 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fire & Safety Equipment (Qty Pieces)	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Fire & First Aid Equipment																					
Dormitory Accessories																					
Qty Sets	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Cost $ 2,500 Ea	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, RESEARCH AMTVE	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$286,250**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
PHASE I AMTVE	[EXISTING]																				
Campsite Equipment																					
Lighting	$0	$0	$0	$0	$4,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Picnic Tables & Grills	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply Equipment	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lockers	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Palapa Kitchen Equipment	$0	$0	$0	$0	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Laundry Equipment	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bathroom Equipment	$0	$0	$0	$0	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$42,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Nature Trail Equipment																					
Signs	$0	$0	$0	$0	$0	$0	$3,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Rest Palapa	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bathroom Equipment	$0	$0	$0	$0	$0	$0	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$0	$0	$26,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fishermen's Exhibit Materials																					
Signs	$0	$0	$0	$0	$0	$0	$3,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$0	$0	$13,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Turtle Exhibit Materials																					
Signs	$0	$0	$0	$0	$0	$0	$3,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply Equipment	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$0	$0	$11,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Crocodile Exhibit Materials																					
Signs	$0	$0	$0	$0	$0	$0	$3,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fencing	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$0	$0	$16,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Sports Center Equipment																					
Equipment For Rentals	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Miscellaneous Office Equipment	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Campsite Equipment	$0	$0	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, PHASE I EQUIPMENT	**$0**	**$0**	**$0**	**$0**	**$62,000**	**$0**	**$66,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

TABLE 11: CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

(Continued)

Period Number End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
PHASE II AMTVE	[EXISTING]																				
Hummingbird Garden																					
Signs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Hummingbird Garden	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Butterfly Pavilion																					
Signs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Butterfly Pavilion	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Canopy Tour																					
Signs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displays	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Canopy Tour	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial Center																					
Signs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Display Cabinets	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Restaurant Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cashiers Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gift Shop Inventory	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Canopy Tour	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$38,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, PHASE II AMTVE	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$83,500**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
PHASE III AMTVE																					
Room, Restaurant, Bar & Office Furniture	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$150,000	$0	$0	$0	$0
Restaurant & Bar Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$75,000	$0	$0	$0	$0
Inventories	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$50,000	$0	$0	$0	$0
Subtotal, PHASE III AMTVE	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$275,000**	**$0**	**$0**	**$0**	**$0**
BASELINE RESEARCH																					
Terrestrial Component																					
Vegetation	$0	$0	$0	$0	$0	$0	$0	$0	$17,500	$17,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Primary Consumers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,000	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Birds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,000	$12,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Mammals	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,000	$12,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Archaeology	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000	$25,000	$0	$0	$0	$0	$0	$0	$0
Zoning Plan Development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,000	$5,000	$0	$0	$0	$0	$0
Land Use	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,000	$5,000	$0	$0	$0	$0	$0
Subtotal, Terrestrial Component	$0	$0	$0	$0	$0	$0	$0	$0	$17,500	$17,500	$44,000	$29,000	$25,000	$25,000	$40,000	$10,000	$0	$0	$0	$0	$0
Aquatic Component																					
Primary Producers	$0	$0	$0	$0	$0	$0	$0	$0	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Primary Consumers	$0	$0	$0	$0	$0	$0	$0	$0	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Secondary Consumers (Fish)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Zoning Plan Development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0
Subtotal, Baseline Research Cost	$0	$0	$0	$0	$0	$0	$0	$0	$25,000	$25,000	$12,500	$12,500	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0
Marine Component																					
Coral Cover	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
Primary Producers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$20,000	$0	$0	$0	$0	$0	$0	$0	$0
Primary Consumers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$15,000	$20,000	$0	$0	$0	$0	$0	$0
Currents & Recruitment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$60,000	$60,000	$0	$0	$0	$0
Subtotal, Baseline Research Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$30,000	$35,000	$30,000	$35,000	$75,000	$75,000	$15,000	$15,000	$15,000	$15,000
TOTAL, BASELINE RESEARCH	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$42,500**	**$42,500**	**$56,500**	**$71,500**	**$72,500**	**$67,500**	**$75,000**	**$85,000**	**$75,000**	**$15,000**	**$15,000**	**$15,000**	**$15,000**

TABLE 11

SUMMARY CAPITAL COSTS FOR THE BACALAR CHICO MARINE RESERVE SUSTAINABILITY PROJECT

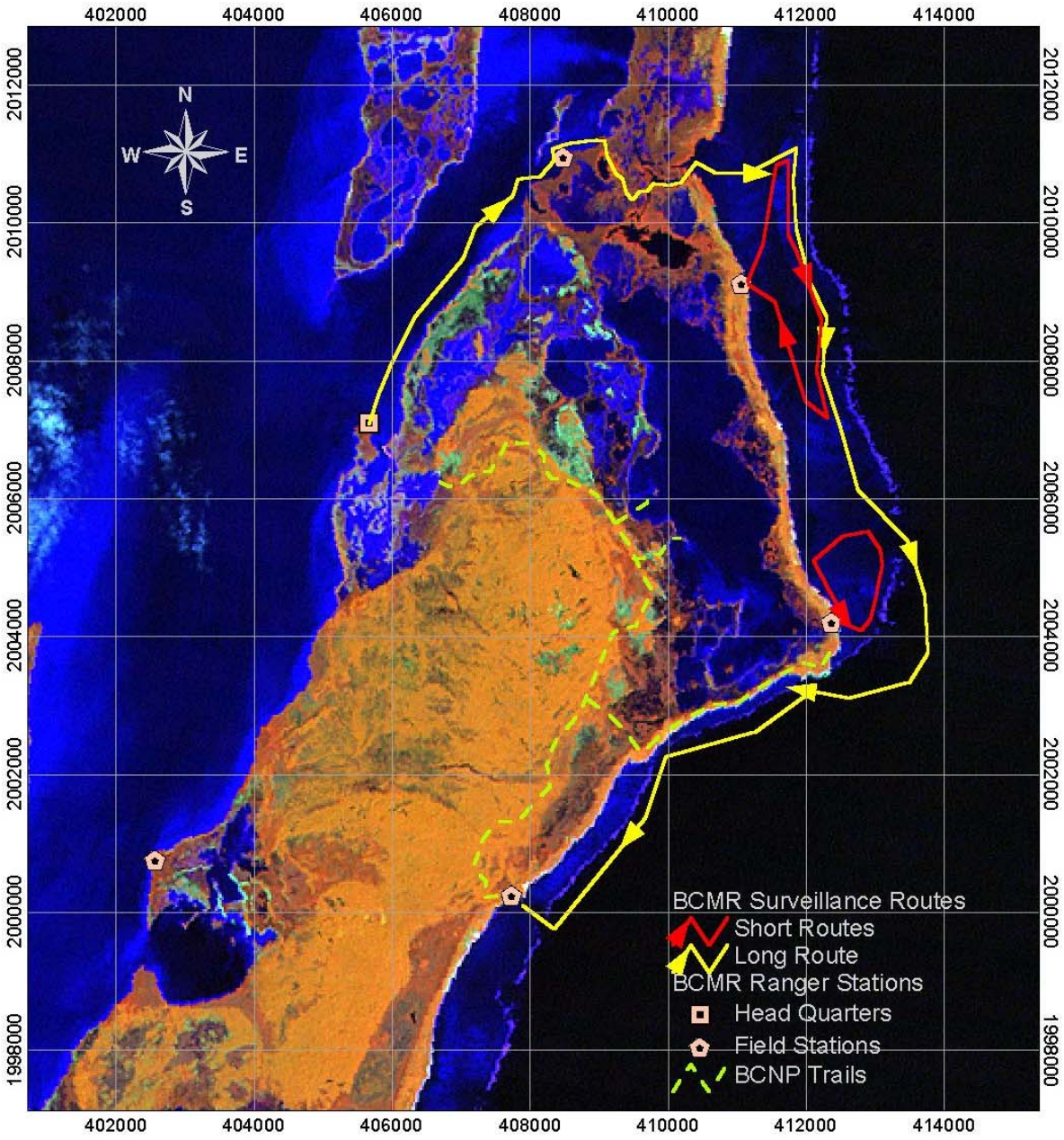
(Continued)

Period Number End Period Date	0 Jun-03	1 Dec-03	2 Jun-04	3 Dec-04	4 Jun-05	5 Dec-05	6 Jun-06	7 Dec-06	8 Jun-07	9 Dec-07	10 Jun-08	11 Dec-08	12 Jun-09	13 Dec-09	14 Jun-10	15 Dec-10	16 Jun-11	17 Dec-11	18 Jun-12	19 Dec-12	20 Jun-13
PARK MANAGEMENT FACILITIES	[EXISTING]																				
ADMIN COMPLEX	$221,000	$0	$50,000	$0	$262,500	$0	$1,117,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000
RESEARCH COMPLEX	$0	$0	$0	$0	$0	$0	$0	$0	$762,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AMTVE	$483,000	$0	$0	$0	$0	$0	$0	$459,000	$0	$286,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ADMIN & RESEARCH AMTVE																					
PHASE I																					
ACTIVITY CENTERS	$0	$0	$0	$0	$472,900	$0	$85,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AMTVE	$0	$0	$0	$0	$62,000	$0	$66,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PHASE II ACTIVITY CENTERS																					
ACTIVITY CENTERS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,107,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AMTVE	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$83,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
PHASE III																					
ACTIVITIES CENTERS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$937,500	$0	$0	$0	$0
AMTVE	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$275,000	$0	$0	$0	$0
BASELINE RESEARCH	$0	$0	$0	$0	$0	$0	$0	$0	$42,500	$42,500	$56,500	$71,500	$72,500	$67,500	$75,000	$85,000	$75,000	$15,000	$15,000	$15,000	$15,000
TOTAL, CAPITAL COST	**$704,000**	**$0**	**$50,000**	**$0**	**$797,400**	**$0**	**$1,269,000**	**$459,000**	**$805,000**	**$328,750**	**$1,164,000**	**$155,000**	**$72,500**	**$67,500**	**$75,000**	**$85,000**	**$1,287,500**	**$15,000**	**$15,000**	**$15,000**	**$40,000**

ILLUSTYRATION 33:

Trails & Surveillance Routes Within The Bacalar Chico NP/MR, Ambergris Caye

UTM Zone 16 - NAD 27 Datum



NOTE: Yellow arrows indicate existing surveillance route conducted twice per day. Red arrows indicate proposed surveillance routes based out of newly sited ranger stations. Stations without arrow-routes are monitored from towers. Prepared By: T Grimshaw / Ecoworks)

- *Phase I Activity Centers* include a campsite(s) and picnic area, nature/hiking/mountain-bike trails (Cf. **Illustration 34**), a fishermen's exhibit, sea turtle and crocodile exhibits, and a water sports center. (Cf. **Pages 91** and **94**). The campsite(s), picnic area and nature trails are to be established on appropriate lands within the BCNP, and the remaining exhibits are to be established on the newly acquired land on the eastern side of the BCNP/MR. Total cost for these infrastructure is estimated at Bz $ 557,900 in Years-3 and 4. AMTV expense in support of these facilities includes assorted campsite equipment, (lighting, picnic tables, water supply, lockers, a kitchen palapa, and laundry/bathroom equipment), signs, displays, bathrooms and rest palapas for the nature trails, and signage and other materials for the three exhibits and water sports center, which are collectively estimated to cost Bz $ 128,500 in Year-4 (allowing a total of12 months time for land preparation, facilities construction and outfitting with equipment).

- *Phase II Activity Centers* include a hummingbird/garden exhibit, a butterfly exhibit, a canopy tour exhibit, restoration of one of the BCNP Mayan sites as an exhibit, and commercial center for sale of food, beverages and gifts. (Cf. **Pages 92** and **95**). The Mayan site exhibit is to be established on appropriate lands within the BCNP, and the remaining exhibits are to be established on the newly acquired land on the eastern side of the BCNP/MR. Total cost for this infrastructure is estimated at Bz $ 1.1 Million in Year-6. AMTV expense in support of these facilities includes signage, displays, lighting and water supply equipment for each of the facilities to be developed, which collectively are estimated to cost Bz $ 83,500 in Year-6 (allowing 6 months time for land preparation, facilities construction and outfitting with equipment).

- *Phase III Activity Centers* are include a modest (25-cabin) eco-village resort complex (optional) to be established on the eastern side of the BCNP/MR in order to accommodate tourists interested in visiting the BCNP/MR for longer periods of time than a single day (Cf. **Pages 92** and **95**). Total cost for this facility is estimated at Bz $ 937,500 in Year-9, and AMTV expense in support of these facilities includes assorted room, office, restaurant and bar equipments estimated at Bz $ 275,000 in Year-9 (allowing 6 months time for land preparation, facilities construction and outfitting with equipment).

- *Baseline Research* encompasses the range of research activities identified in **Table 10**, which are implemented between Years 5 to 10, at an average expenditure rate of approximately Bz $ 108,000/Year, and a total cost of Bz $648,000 (Cf. **Page 95**).

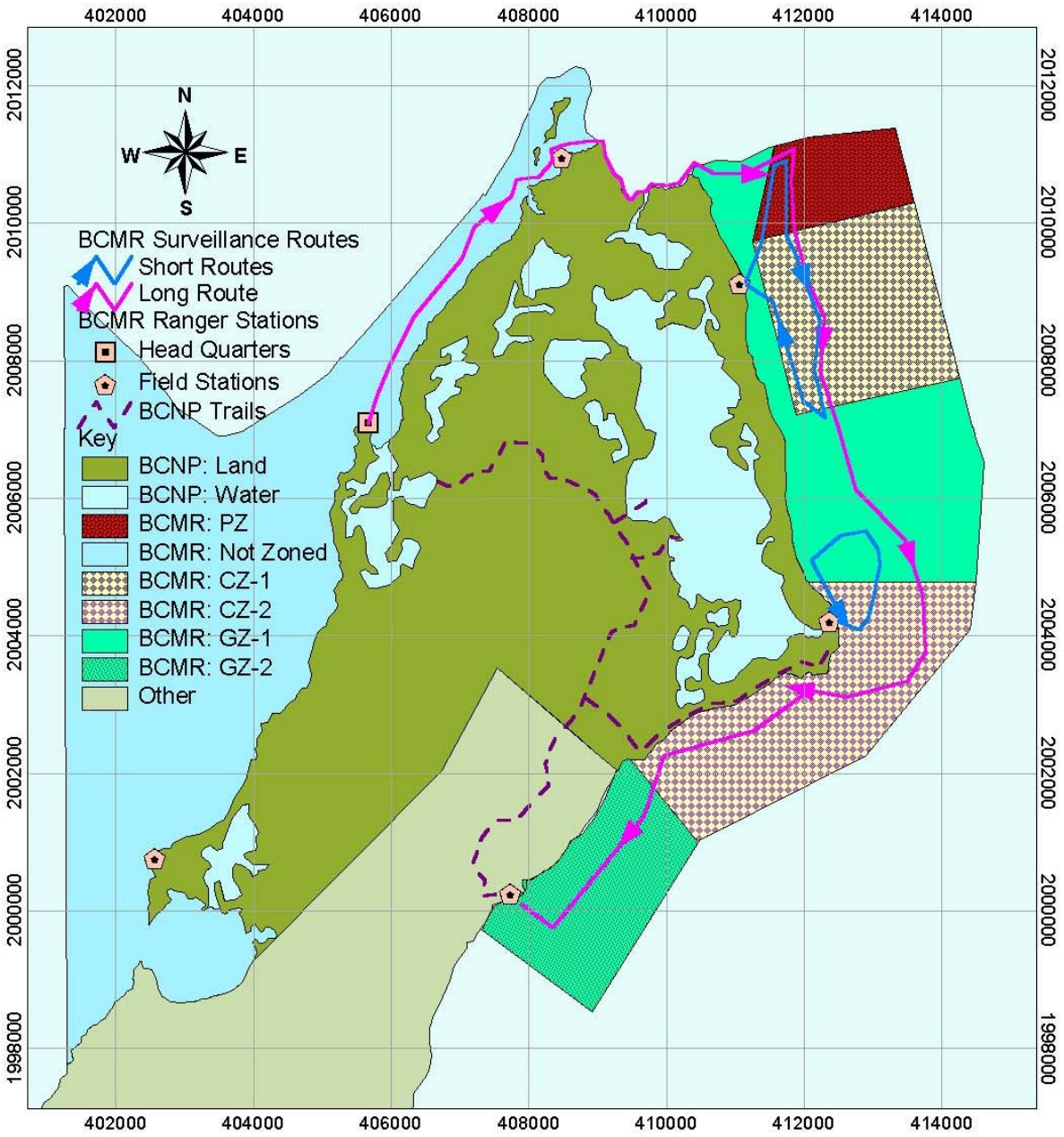
Depreciation

Depreciation expense has been calculated against capital cost (Cf. **Table 12**) as a proxy for maintenance expenditure at a rate of 5% per annum for buildings and 15 % per annum for AMTVE (Cf. **Page 100**) and is deducted as a line item cost under general and administrative expense (Cf. **Page 102**).

ILLUSTYRATION 34:

Trails & Surveillance Routes Within The Bacalar Chico NP/MR, Ambergris Caye

UTM Zone 16 - NAD 27 Datum



NOTE: Purple arrows indicate existing surveillance route conducted twice per day. Blue arrows indicate proposed surveillance routes based out of newly sited ranger stations. Stations without arrow-routes are monitored from towers. Prepared By: T Grimshaw / Ecoworks)

TABLE 12

DEPREICATION COSTS FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

(Base Case)

Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
End Period Date	**Jun-03**	**Dec-03**	**Jun-04**	**Dec-04**	**Jun-05**	**Dec-05**	**Jun-06**	**Dec-06**	**Jun-07**	**Dec-07**	**Jun-08**	**Dec-08**	**Jun-09**	**Dec-09**	**Jun-10**	**Dec-10**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**
BUILDINGS (5%)		$5,125	$5,125	$5,125	$5,125	$13,500	$13,500	$43,000	$43,000	$57,250	$57,250	$71,750	$71,750	$71,750	$71,750	$71,750	$71,750	$90,500	$90,500	$90,500	$90,500
AMTVE (15 %)		$36,225	$36,225	$36,225	$36,225	$40,875	$40,875	$45,863	$80,288	$80,288	$101,756	$101,756	$108,019	$108,019	$108,019	$108,019	$108,019	$128,644	$128,644	$128,644	$128,644
TOTAL		**$41,350**	**$41,350**	**$41,350**	**$41,350**	**$54,375**	**$54,375**	**$88,863**	**$123,288**	**$137,538**	**$159,006**	**$173,506**	**$179,769**	**$179,769**	**$179,769**	**$179,769**	**$179,769**	**$219,144**	**$219,144**	**$219,144**	**$219,144**

Operating Cost

Expenditures for operating cost are outlined in **Table 13**, and include allocations for general and administrative expense, management salaries, monitoring and education programs, marketing, and other recurrent costs (e.g. ticket printing and distribution). Approximate values for the previously described baseline operating expense (Cf. **Pages 83** - **84** and **Addenda 11**) are shown in column '0' (Cf. **Page 102**).

- *General and Administrative Expense* includes property insurance, accounts and audits, legal services, telephone, power and light (fuel for headquarters and boasts), maintenance (depreciation), travel expense, food expense and miscellaneous expense (Cf. **Page 102**). Annual general and administration expense for Years 1 and 2 is Bz $ 37,000, and thereafter increases to approximately Bz $ 0.6 Million per year.

- *Management Salaries* include annual salaries for rangers (only in Years 1 and 2), and thereafter include additional salaries for a park manager, terrestrial biologist, land rangers (4), a land maintenance team (2), sea rangers (12), a marine/aquatic biologist, and an exhibit manager (Cf. **Page 102**). Annual salary expense for Years 1 and 2 is Bz $ 80,000, and thereafter increases to approximately Bz $ 0.5 Million per year.

- *Monitoring and Education Programs* encompass the range of terrestrial, aquatic and marine monitoring activities identified in **Table 10**, which are omitted in Years 1 and 2, but thereafter implemented at an average expenditure rate of approximately Bz $ 130,000/Year, and a total cost of Bz $ 1.2 Million (Cf. **Page 103**).

- *Marketing and Advertising* includes internet marketing, printed and magazine advertisements, familiarization (FAM) tours of the BCNP/MR for tourist marketers and travel agents, trade show presentations, billboard advertisement, a central reservation marketing and global distribution marketing (electronic marketing and/or incentive payment for ticket sales). Marketing and advertising expense is initially focused on the San Pedro tourist market, but later is expanded to engage wider access. Cost allocation for marketing and advertising is estimated at approximately Bz $ 46,000 per year by Year-7 (Cf. **Page 103**).

- *Recurrent Cost* includes expenditure for ticket printing and miscellaneous cost. Recurrent cost is estimated at approximately Bz $ 43,000 per year after Year 7 (Cf. **Page 103**).

- *Inventories* include all routine operating expense, with all incremental amounts being deducted and capitalized in the cash flow statement, and the balance being reported as the adjusted operating cost (Cf. **Page 103**). Inventory deductions and accruals vary annually in response to cyclic monitoring expense. Annual operating cost is approximately Bz $ 2.3 Million after adjustment for inventories, which are shown in **Table 14**, and are estimated at approximately Bz $700,000 (Cf. **Page 105**).

TABLE 13

OPERAING COSTS FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
End Period Date	**Jun-03**	**Dec-03**	**Jun-04**	**Dec-04**	**Jun-05**	**Dec-05**	**Jun-06**	**Dec-06**	**Jun-07**	**Dec-07**	**Jun-08**	**Dec-08**	**Jun-09**	**Dec-09**	**Jun-10**	**Dec-10**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**
GENERAL & ADMINSTRATIVE EXPENSE																					
Insurance Principal:																					
Buildings	$205,000	$205,000	$205,000	$205,000	$540,000	$540,000	$1,720,000	$1,720,000	$2,290,000	$2,290,000	$2,870,000	$2,870,000	$2,870,000	$2,870,000	$2,870,000	$2,870,000	$3,620,000	$3,620,000	$3,620,000	$3,620,000	$3,620,000
Equipment	$36,225	$72,450	$108,675	$144,900	$185,775	$226,650	$272,513	$352,800	$433,088	$534,844	$636,600	$744,619	$852,638	$960,656	$1,068,675	$1,176,694	$1,305,338	$1,433,981	$1,562,625	$1,691,269	$1,691,269
Subtotal, Insurance Principal	$241,225	$277,450	$313,675	$349,900	$725,775	$766,650	$1,992,513	$2,072,800	$2,723,088	$2,824,844	$3,506,600	$3,614,619	$3,722,638	$3,830,656	$3,938,675	$4,046,694	$4,925,338	$5,053,981	$5,182,625	$5,311,269	$5,311,269
Ins. Premiums: @ US$15/$1,000	$2,500	$2,500	$2,500	$2,500	$5,443	$5,750	$14,944	$15,546	$20,423	$21,186	$26,300	$27,110	$27,920	$28,730	$29,540	$30,350	$36,940	$37,905	$38,870	$39,835	$39,835
Accounts & Audits	$0	$0	$0	$0	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
Legal Services (Corporate)	$0	$0	$0	$0	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Telephone	$0	$0	$0	$0	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Power & Light																					
Fuel For Headquarters Camp	$0	$0	$0	$0	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Fuel For Boats	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
Maintenance (Depreciation As Proxy To)	$0	$0	$0	$0	$41,350	$54,375	$54,375	$88,863	$123,288	$137,538	$159,006	$173,506	$179,769	$179,769	$179,769	$179,769	$179,769	$219,144	$219,144	$219,144	$219,144
Travel Expenses	$0	$0	$0	$0	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Food Supplies	$6,000	$6,000	$6,000	$6,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Miscellaneous	$0	$0	$0	$0	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Subtotal, Gen. & Admin. Exp.	**$18,500**	**$18,500**	**$18,500**	**$18,500**	**$102,793**	**$116,125**	**$165,319**	**$200,409**	**$239,711**	**$254,724**	**$281,306**	**$296,616**	**$303,689**	**$304,499**	**$305,309**	**$306,119**	**$312,709**	**$353,049**	**$354,013**	**$354,978**	**$354,978**
MANAGEMENT SALARIES																					
Park Manager	$0	$0	$0	$0	$15,000	$15,000	$17,500	$17,500	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Terrestrial Biologist	$0	$0	$0	$0	$15,000	$15,000	$17,500	$17,500	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Land Rangers (4 Max)	$0	$0	$0	$0	$25,000	$25,000	$30,000	$30,000	$45,000	$45,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000
Land Maintenance Team (2)	$0	$0	$0	$0	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Sea Rangers (12 Max)	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$50,000	$50,000	$75,000	$75,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
Aquatic/Marine Biologist	$0	$0	$0	$0	$17,500	$17,500	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Exhibit Manager	$0	$0	$0	$0	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Subtotal, Mgmt. Salaries	**$40,000**	**$40,000**	**$40,000**	**$40,000**	**$142,500**	**$142,500**	**$165,000**	**$165,000**	**$210,000**	**$210,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**
TOTAL, OVERHEAD EXPENSE	**$58,500**	**$58,500**	**$58,500**	**$58,500**	**$245,293**	**$258,625**	**$330,319**	**$365,409**	**$449,711**	**$464,724**	**$531,306**	**$546,616**	**$553,689**	**$554,499**	**$555,309**	**$556,119**	**$562,709**	**$603,049**	**$604,013**	**$604,978**	**$604,978**

TABLE 13

OPERAING COSTS FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

(Continued)

Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
End Period Date	Jun-03	Dec-03	Jun-04	Dec-04	Jun-05	Dec-05	Jun-06	Dec-06	Jun-07	Dec-07	Jun-08	Dec-08	Jun-09	Dec-09	Jun-10	Dec-10	Jun-11	Dec-11	Jun-12	Dec-12	Jun-13
MONITORING & EDUCATION PROGRAMS																					
Terrestrial Component	$0	$0	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$30,000	$30,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$30,000	$30,000	$15,000
Aquatic Component	$0	$0	$15,000	$15,000	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$27,500	$27,500	$12,500	$12,500	$12,500	$12,500	$12,500
Marine Component	$0	$0	$27,500	$12,500	$27,500	$12,500	$52,500	$37,500	$52,500	$37,500	$27,500	$32,500	$27,500	$12,500	$52,500	$37,500	$52,500	$37,500	$27,500	$32,500	$15,000
Subtotal, Management & Education	**$0**	**$0**	**$57,500**	**$42,500**	**$55,000**	**$40,000**	**$80,000**	**$65,000**	**$95,000**	**$80,000**	**$55,000**	**$60,000**	**$55,000**	**$40,000**	**$95,000**	**$80,000**	**$80,000**	**$65,000**	**$70,000**	**$75,000**	**$42,500**
MARKETING & ADVERTISING																					
Internet Marketing	$0	$0	$0	$0	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
Printed Advertisements	$0	$0	$2,500	$2,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
Magazine Advertisement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
FAM Trips	$0	$0	$0	$0	$0	$0	$0	$0	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
Tade Show Presentations	$0	$0	$0	$0	$0	$0	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Billboard Advertisements	$0	$0	$0	$0	$0	$0	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500	$3,500
Central Reservation System (CRS)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Global Distribution System (GDS)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Subtotal, Marketing & Advertising	**$0**	**$0**	**$2,500**	**$2,500**	**$7,000**	**$7,000**	**$13,000**	**$13,000**	**$16,500**	**$16,500**	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$23,000**	**$23,000**	**$23,000**	**$23,000**	**$23,000**	**$23,000**	**$23,000**
RECURRENT COSTS																					
Ticket Printing & Distribution @ $1/Visitor	$1,500	$1,500	$2,500	$3,500	$4,500	$5,500	$6,500	$7,500	$8,500	$9,500	$10,000	$11,500	$13,000	$15,000	$18,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
All Other Items	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Subtotal, Recurrent Costs	**$3,000**	**$3,000**	**$4,000**	**$5,000**	**$6,000**	**$7,000**	**$8,000**	**$9,000**	**$10,000**	**$11,000**	**$11,500**	**$13,000**	**$14,500**	**$16,500**	**$19,500**	**$21,500**	**$21,500**	**$21,500**	**$21,500**	**$21,500**	**$21,500**
TOTAL OPERATING COST	**$61,500**	**$61,500**	**$122,500**	**$108,500**	**$313,293**	**$312,625**	**$431,319**	**$452,409**	**$571,211**	**$572,224**	**$617,806**	**$639,616**	**$643,189**	**$630,999**	**$692,809**	**$680,619**	**$687,209**	**$712,549**	**$718,513**	**$724,478**	**$691,978**
< TO INVENTORIES >	($61,500)	$0	($61,000)	$14,000	($204,793)	$668	($118,694)	($21,090)	($118,802)	($1,013)	($45,582)	($21,810)	($3,573)	$12,190	($61,810)	$12,190	($6,590)	($25,340)	($5,965)	($5,965)	$32,500
ADJUSTED OPERATING COST	$0	$61,500	$61,500	$122,500	$108,500	$313,293	$312,625	$431,319	$452,409	$571,211	$572,224	$617,806	$639,616	$643,189	$630,999	$692,809	$680,619	$687,209	$712,549	$718,513	$724,478

TABLE 13

SUMMARY OPERAING COSTS FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

(Base Case - Continued)

Crop Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
End Period Date	**Jun-03**	**Dec-03**	**Jun-04**	**Dec-04**	**Jun-05**	**Dec-05**	**Jun-06**	**Dec-06**	**Jun-07**	**Dec-07**	**Jun-08**	**Dec-08**	**Jun-09**	**Dec-09**	**Jun-10**	**Dec-10**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**
GENERAL & ADMINISTRATIVE EXPENSE	$18,500	$18,500	$18,500	$18,500	$102,793	$116,125	$165,319	$200,409	$239,711	$254,724	$281,306	$296,616	$303,689	$304,499	$305,309	$306,119	$312,709	$353,049	$354,013	$354,978	$354,978
MANAGEMENT SALARIES	$40,000	$40,000	$40,000	$40,000	$142,500	$142,500	$165,000	$165,000	$210,000	$210,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
OPERATING COST	$61,500	$61,500	$122,500	$108,500	$313,293	$312,625	$431,319	$452,409	$571,211	$572,224	$617,806	$639,616	$643,189	$630,999	$692,809	$680,619	$687,209	$712,549	$718,513	$724,478	$691,978
<TO INVENTORIES>	($61,500)	$0	($61,000)	$14,000	($204,793)	$668	($118,694)	($21,090)	($118,802)	($1,013)	($45,582)	($21,810)	($3,573)	$12,190	($61,810)	$12,190	($6,590)	($25,340)	($5,965)	($5,965)	$32,500
TOTAL, ADJUSTED OP COST	**$58,500**	**$120,000**	**$120,000**	**$181,000**	**$353,793**	**$571,918**	**$642,944**	**$796,727**	**$902,119**	**$1,035,934**	**$1,103,530**	**$1,164,422**	**$1,193,304**	**$1,197,687**	**$1,186,307**	**$1,248,928**	**$1,243,328**	**$1,290,257**	**$1,316,562**	**$1,323,492**	**$1,329,457**

TABLE 14

INCOME AND CASHFLOW STATEMENTS FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

Period Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
End Period Date	**Jun-03**	**Dec-03**	**Jun-04**	**Dec-04**	**Jun-05**	**Dec-05**	**Jun-06**	**Dec-06**	**Jun-07**	**Dec-07**	**Jun-08**	**Dec-08**	**Jun-09**	**Dec-09**	**Jun-10**	**Dec-10**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**
INCOME STATEMENT																					
VISITATION INCOME																					
Park Attendence Assumptions		**Organizational Period**					**Phase I**						**Phase II**						**Phase III**		
Visitation / Period	1,500	1,500	2,500	3,500	4,500	5,500	6,500	7,500	8,500	9,500	10,000	11,500	13,000	15,000	18,000	20,000	20,000	20,000	20,000	20,000	20,000
Entrance Fees																					
General Admittance: Sea/Trails (No Overnight)	$7,500	$7,500	$12,500	$17,500	$67,500	$82,500	$97,500	$112,500	$127,500	$142,500	$150,000	$172,500	$195,000	$225,000	$270,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
Activity Package 1: Sea, Trails Phase I Exhibits	$0	$0	$0	$0	$56,250	$68,750	$81,250	$93,750	$106,250	$118,750	$125,000	$143,750	$162,500	$187,500	$225,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
Activity Package 2: Pkg 1 + Phase II Exhibits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$175,000	$201,250	$227,500	$262,500	$315,000	$350,000	$350,000	$350,000	$350,000	$350,000	$350,000
Camping Fees	$0	$0	$0	$0	$33,750	$41,250	$48,750	$56,250	$63,750	$71,250	$75,000	$86,250	$97,500	$112,500	$135,000	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
Subtotal, Entrance Fees	$7,500	$7,500	$12,500	$17,500	$157,500	$192,500	$227,500	$262,500	$297,500	$332,500	$525,000	$603,750	$682,500	$787,500	$945,000	$1,050,000	$1,050,000	$1,050,000	$1,050,000	$1,050,000	$1,050,000
Watersport Income	$0	$0	$0	$0	$45,000	$55,000	$65,000	$75,000	$85,000	$95,000	$100,000	$115,000	$130,000	$150,000	$180,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
Restaurant Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$175,000	$201,250	$227,500	$262,500	$315,000	$350,000	$350,000	$350,000	$350,000	$350,000	$350,000
Gift Shop Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$87,500	$100,625	$113,750	$131,250	$157,500	$175,000	$175,000	$175,000	$175,000	$175,000	$175,000
Resort Income																					
Occupancy @ 50 %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,000	2,000	2,000	2,000
Net Revenue At $100/Bed-Day	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$500,000	$500,000	$500,000	$500,000
SUBTOTAL, VISITATION INCOME	**$7,500**	**$7,500**	**$12,500**	**$17,500**	**$202,500**	**$247,500**	**$292,500**	**$337,500**	**$382,500**	**$427,500**	**$887,500**	**$1,020,625**	**$1,153,750**	**$1,331,250**	**$1,597,500**	**$1,775,000**	**$1,775,000**	**$2,275,000**	**$2,275,000**	**$2,275,000**	**$2,275,000**
GRANTS																					
Terrestrial Baseline Studies	$0	$0	$0	$0	$0	$0	$0	$0	$17,500	$17,500	$44,000	$29,000	$25,000	$25,000	$40,000	$10,000	$0	$0	$0	$0	$0
Aquatic Baseline Studies	$0	$0	$0	$0	$0	$0	$0	$0	$25,000	$25,000	$12,500	$12,500	$12,500	$12,500	$0	$0	$0	$0	$0	$0	$0
Marine Baseline Studies	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$30,000	$35,000	$30,000	$35,000	$75,000	$75,000	$15,000	$15,000	$15,000	$15,000
Subtotal, Grants	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$42,500**	**$42,500**	**$56,500**	**$71,500**	**$72,500**	**$67,500**	**$75,000**	**$85,000**	**$75,000**	**$15,000**	**$15,000**	**$15,000**	**$15,000**
GROSS INCOME	**$7,500**	**$7,500**	**$12,500**	**$17,500**	**$202,500**	**$247,500**	**$292,500**	**$337,500**	**$425,000**	**$470,000**	**$944,000**	**$1,092,125**	**$1,226,250**	**$1,398,750**	**$1,672,500**	**$1,860,000**	**$1,850,000**	**$2,290,000**	**$2,290,000**	**$2,290,000**	**$2,290,000**
Less, Adjusted Op Expense	$0	($61,500)	($61,500)	($122,500)	($108,500)	($313,293)	($312,625)	($431,319)	($452,409)	($571,211)	($572,224)	($617,806)	($639,616)	($643,189)	($630,999)	($692,809)	($680,619)	($687,209)	($712,549)	($718,513)	($724,478)
NET INCOME	**$7,500**	**($54,000)**	**($49,000)**	**($105,000)**	**$94,000**	**($65,793)**	**($20,125)**	**($93,819)**	**($27,409)**	**($101,211)**	**$371,776**	**$474,319**	**$586,634**	**$755,561**	**$1,041,501**	**$1,167,191**	**$1,169,381**	**$1,602,791**	**$1,577,451**	**$1,571,487**	**$1,565,522**
CASHFLOW STATEMENT																					
SOURCE OF CASH																					
Endowments	$280,077	$2,687	$65,917	$34,937	$339,573	$758	$525,390	$170,873	$340,160	$132,370	$299,840	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Income	$7,500	($54,000)	($49,000)	($105,000)	$94,000	($65,793)	($20,125)	($93,819)	($27,409)	($101,211)	$371,776	$474,319	$586,634	$755,561	$1,041,501	$1,167,191	$1,169,381	$1,602,791	$1,577,451	$1,571,487	$1,565,522
Loans	$543,679	$5,216	$127,957	$67,818	$659,171	$1,470	$1,019,874	$331,695	$660,310	$256,954	$582,042	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest	$0	($19,029)	($19,029)	($19,029)	($19,029)	($16,650)	($14,272)	($11,893)	($9,514)	($7,136)	($4,757)	($2,379)	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Source	$831,257	($65,126)	$125,845	($21,274)	$1,073,716	($80,216)	$1,510,867	$396,856	$963,547	$280,978	$1,248,900	$471,941	$586,634	$755,561	$1,041,501	$1,167,191	$1,169,381	$1,602,791	$1,577,451	$1,571,487	$1,565,522
USE OF CASH																					
Organization	$16,000	$0	$50,000	$0	$262,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,000
Administrative Complex	$205,000	$0	$0	$0	$0	$0	$1,117,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Research Complex	$0	$0	$0	$0	$0	$0	$0	$0	$762,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AMTVE	$483,000	$0	$0	$0	$0	$0	$0	$459,000	$0	$286,250	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Intellectual Property	$0	$0	$0	$0	$0	$0	$0	$0	$42,500	$42,500	$56,500	$71,500	$72,500	$67,500	$75,000	$85,000	$75,000	$15,000	$15,000	$15,000	$15,000
Phase I Activities	$0	$0	$0	$0	$534,900	$0	$151,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Phase II Activities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,107,500	$83,500	$0	$0	$0	$0	$0	$0	$0	$0	$0
Phase III Activties	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,212,500	$0	$0	$0	$0
Inventories	$61,500	$0	$61,000	($14,000)	$204,793	($668)	$118,694	$21,090	$118,802	$1,013	$45,582	$21,810	$3,573	($12,190)	$61,810	($12,190)	$6,590	$25,340	$5,965	$5,965	($32,500)
Debt Principal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal, Use	$765,500	$0	$111,000	($14,000)	$1,002,193	($668)	$1,387,694	$480,090	$923,802	$329,763	$1,209,582	$176,810	$76,073	$55,310	$136,810	$72,810	$1,294,090	$40,340	$20,965	$20,965	$7,500
End Period	$65,757	($65,126)	$14,845	($7,274)	$71,523	($79,547)	$123,173	($83,233)	$39,745	($48,785)	$39,318	$295,131	$510,561	$700,251	$904,691	$1,094,381	($124,709)	$1,562,451	$1,556,487	$1,550,522	$1,558,022
Begin Period	$0	$65,757	$631	$15,476	$8,202	$79,725	$178	$123,351	$40,118	$79,863	$31,078	$70,396	$365,527	$876,088	$1,576,340	$2,481,031	$3,575,412	$3,450,703	$5,013,154	$6,569,641	$8,120,163
Balance Forward	$65,757	$631	$15,476	$8,202	$79,725	$178	$123,351	$40,118	$79,863	$31,078	$70,396	$365,527	$876,088	$1,576,340	$2,481,031	$3,575,412	$3,450,703	$5,013,154	$6,569,641	$8,120,163	$9,678,185

Income and Cash Flow

Three different sets of global assumptions regarding visitation, gate fees and infrastructure development were used to evaluate the feasibility of the previously described schedules of investment in infrastructure and operating activities. The forecast income and cash flow statement shown in **Table 14** (Cf. **Page 105**), is for Case-1 assumptions.

- *Visitation Assumptions* used in development of the business model were used to generate income estimates from entrance fees, water sports income, restaurant income, and gift shop income. Visitation assumptions varied between a maximum of 40,000 tourists per year in Case-1 (the present visitation rate of HCMR), and a minimum of 25,000 tourists per year in Cases 2 and 3.

- *Fee and Income Assumptions* Fee schedules were assessed for 4 types of entrance, including General Admission ($15); Activity Package I (General Admission + Phase I activities: $25); Activity Package II (General Admission + Phase II activities: $35) and Camping ($30/night); and were also varied between a maximum in Case 1 (as above), and a minimum in Cases 2 and 3 ($15, $20, $25, $30, respectively). Waterspouts, Restaurant and Gift Shop income assumptions are based on visitation assumptions, and similar earning expectations in each of the three cases of $30, $40 and $ 35 per person (respectively). Resort income is based is based on a flat visitation rate of 2,000 persons per year, for Years 9 $ 10 (only). Grant Income is based on expenditure requirements itemized in **Table 10** for baseline research (Cf. **Page 86**), and as such is revenue neutral.

- *Cash Flow* was constructed from 4 sources of cash, including endowments, net income, loans, and interest (as negative cash). Endowments reflect donor support requirements for investing and operating activities described in **Tables 11** and **13** (Cf. **Pages 90** – **96** and **102**, respectively) not met by income revenue, and vary across the three cases presented in proportion to visitation and fee assumptions. The total endowment requirement in Case I is Bz $ 2.22 Million, for Case II is Bz $ 2.35 Million, and for Case III is Bz $ 2.28 Million, before correction for existing facilities in the of Bz $ 704,000.

  Net income has been corrected for capitalization of inventories, and therefore has been determined by correction for adjusted operating expense (Cf. **Page 101**). Load capital, as with endowments, reflect the balance of cost for investing and operating activities described in **Tables 11** and **13** (Cf. **Pages 90** – **96** and **102**, respectively) not met by income revenue, and varies across the three cases presented in proportion to visitation and fee assumptions. The total loan requirement in Case I is Bz $ 4.30 Million, for Case II is Bz $ 4.57 Million, and for Case III is Bz $ 4.43 Million, before correction for existing facilities in the amount of Bz $ 704,000. Neither endowment nor loan capital requirements are influenced by elimination of expenditures for the eco-lodge complex in Case-III, as the revenue needed for this development is derived from retained earnings.

  Leverage and interest on debt is similar in the three cases examined at 66 % of capital requirement, and 7 % (**LIBOR** + 5 %) on the unpaid balance (respectively).

Investment Analysis

Analyses of the three investment Cases tested are shown in **Tables 15 – 17** (Cf. **Pages 108** – **110**). The internal rate of return (IRR) on endowment funding (after correction for existing infrastructure and equipment) for the 10-year period examined in the three cases is 24.76 % (Case I), 6.48 % (Case II), and 10.27 % (Case III). Net present value (NPV) of endowment capital at a discount rate of 15 % for the 10-year period examined is Bz $ 1.25 Million for Case-I, Bz -$ 0.69 Million for Case-II, and Bz -$ 0.38 Million.

The analysis presented indicates that the BCNP/MR investment under consideration is highly dependent on gate fees, and hence visitation rate and fee assumptions, in the short term, and is likely to become less sensitive to these assumptions if the eco-lodge is developed and the analysis is carried out over a longer period of time (e.g. 25 years).

The analysis presented further suggests that the visitation rates employed may be too conservative in light of the fact that the BCNP/MR is considerably larger than the HCMR, and yet can return an IRR comparable to other contemporary investments (say as in large scale commercial aquaculture) at an equivalent visitation rate coupled to a slightly higher fee schedule. The primary obstacle to higher visitation, and the feasibility of a lower gate fee schedule, however, is distance to the BCNP/MR, and as such, the success of the development may be more greatly insured by capitalizing on the newly developed airstrip located at the Nova Shrimp Hatchery just south of the BCNP/MR at Basil Jones.

These considerations are also important to the newly proposed FSCMRM, which anticipates revenue sharing between marine protected areas in return for administration services. The findings suggest that the BCNP/MR would only be able to participate in a fee sharing arrangement under the assumptions of either a higher visitation rate, higher fee schedule (or both), or at the tested schedules, after a 5 – 7 year period.

TABLE 15

CASE I MODEL FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

CASHFLOW CHARACTERISTICS

SOURCE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ENDOWMENTS	$280,077	$68,604	$374,510	$526,147	$511,033	$432,210	$0	$2,192,582	29%
NET INCOME	$7,500	($103,000)	($11,000)	($85,918)	($121,227)	$270,566	$1,060,953	$1,017,873	14%
DEBT	$543,679	$133,173	$726,990	$1,021,344	$992,005	$838,996	$0	$4,256,188	57%
INTEREST	$0	($38,058)	($38,058)	($30,922)	($21,407)	($11,893)	($2,379)	($142,716)	n/r
TOTAL	**$831,257**	**$60,720**	**$1,052,442**	**$1,430,651**	**$1,360,404**	**$1,529,879**	**$1,058,575**	**$7,323,927**	**100%**

USE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ORGANIZATION	$16,000	$50,000	$262,500	$0	$0	$0	$0	$328,500	5%
ADMIN COMPLEX	$205,000	$0	$0	$1,117,500	$0	$0	$0	$1,322,500	
RESEARCH COMPLEX	$0	$0	$0	$0	$762,500	$0	$0	$762,500	12%
AMTVE	$483,000	$0	$0	$0	$459,000	$286,250	$0	$1,228,250	
INTELLECTUAL PROP	$0	$0	$0	$0	$42,500	$99,000	$144,000	$285,500	
PHASE I	$0	$0	$534,900	$151,500	$0	$0	$0	$686,400	
PHASE II	$0	$0	$0	$0	$0	$1,107,500	$83,500	$1,191,000	
PHASE III	$0	$0	$0	$0	$0	$0	$0	$0	
INVENTORIES	$61,500	$61,000	$190,793	$118,026	$139,892	$46,595	$25,383	$643,189	10%
DEBT PRINCIPAL	$0	$0	$0	$0	$0	$0	$0	$0	0%
TOTAL	**$765,500**	**$111,000**	**$988,193**	**$1,387,026**	**$1,403,892**	**$1,539,345**	**$252,883**	**$6,447,839**	**27%**
BALANCE	**$65,757**	**($50,280)**	**$64,249**	**$43,626**	**($43,488)**	**($9,466)**	**$805,692**	**$876,088**	
BALANCE FORWARD	**$65,757**	**$15,476**	**$79,725**	**$123,351**	**$79,863**	**$70,396**	**$876,088**		

SENSITIVITY ANALYSIS

	Unit Cost
ENDOWMENT REQ	**$1,488,582**
REVENE ASSUMPTIONS / PERSON	
Gen Admission Fee	**$15**
Activity I Package Fee	**$25**
Activity II Package Fee	**$35**
Camping Fee	**$30**
Water Sport Income	**$40**
Restaurant Income	**$35**
Gift Shop Income	**$35**
Resort Income	**$250**
DEBT CONFIGURATION	
Interest Rate	**7.00%**
Leverage	**66.00%**
Cost Contingent	**5.00%**

YEAR	NPV At 0%
0	($1,488,582)
1	($50,280)
2	$64,249
3	$43,626
4	($43,488)
5	($9,466)
6	$805,692
7	$1,604,943
8	$969,672
9	$3,118,938
10	$3,108,543
Total	$8,123,846

$IRR_{endwmnt}$= 24.76%

$NPV_{15\%}$= $1,251,340

$IRR_{investment}$= 4.76%

$NPV_{15\%}$= ($3,061,867)

TABLE 16

CASE II MODEL FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

CASHFLOW CHARACTERISTICS

SOURCE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ENDOWMENTS	$280,077	$96,882	$406,728	$562,222	$528,784	$481,968	$0	$2,356,660	33%
NET INCOME	$7,500	($103,000)	($39,125)	($160,918)	($221,227)	$73,691	$686,578	$243,498	3%
DEBT	$543,679	$188,064	$789,531	$1,091,371	$1,026,463	$935,585	$0	$4,574,694	64%
INTEREST	$0	($38,058)	($38,058)	($30,922)	($21,407)	($11,893)	($2,379)	($142,716)	n/r
TOTAL	**$831,257**	**$143,888**	**$1,119,076**	**$1,461,753**	**$1,312,613**	**$1,479,350**	**$684,200**	**$7,032,136**	**100%**

USE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ORGANIZATION	$16,000	$50,000	$262,500	$0	$0	$0	$0	$328,500	5%
ADMIN COMPLEX	$205,000	$0	$0	$1,117,500	$0	$0	$0	$1,322,500	
RESEARCH COMPLEX	$0	$0	$0	$0	$762,500	$0	$0	$762,500	12%
AMTVE	$483,000	$0	$0	$0	$459,000	$286,250	$0	$1,228,250	
INTELLECTUAL PROP	$0	$80,000	$65,000	$30,000	$0	$42,500	$112,500	$330,000	
PHASE I	$0	$0	$534,900	$151,500	$0	$0	$0	$686,400	
PHASE II	$0	$0	$0	$0	$0	$1,107,500	$83,500	$1,191,000	
PHASE III	$0	$0	$0	$0	$0	$0	$0	$0	
INVENTORIES	$61,500	$61,000	$190,793	$118,026	$139,892	$46,595	$24,883	$642,689	10%
DEBT PRINCIPAL	$0	$0	$0	$0	$0	$0	$0	$0	0%
TOTAL	**$765,500**	**$191,000**	**$1,053,193**	**$1,417,026**	**$1,361,392**	**$1,482,845**	**$220,883**	**$6,491,839**	**27%**
BALANCE	**$65,757**	**($47,112)**	**$65,883**	**$44,727**	**($48,779)**	**($3,495)**	**$463,317**	**$540,298**	
BALANCE FORWARD	**$65,757**	**$18,645**	**$84,528**	**$129,255**	**$80,476**	**$76,981**	**$540,298**		

SENSITIVITY ANALYSIS

	Unit Cost
ENDOWMENT REQ	**$1,652,660**
REVENE ASSUMPTIONS / PERSON	
Gen Admission Fee	**$15**
Activity I Package Fee	**$15**
Activity II Package Fee	**$20**
Camping Fee	**$25**
Water Sport Income	**$40**
Restaurant Income	**$35**
Gift Shop Income	**$35**
Resort Income	**$200**
DEBT CONFIGURATION	
Interest Rate	**7.00%**
Leverage	**66.00%**
Cost Contingent	**5.00%**

YEAR	NPV At 0%
0	($1,652,660)
1	($47,112)
2	$65,883
3	$44,727
4	($48,779)
5	($3,495)
6	$463,317
7	$559,193
8	($690,328)
9	$1,258,938
10	$1,248,543
Total	$1,198,227

$IRR_{endwmnt}$= 6.48%

$IRR_{investment}$= -9.51%

$NPV_{15\%}$= ($689,289)

$NPV_{15\%}$= ($5,279,457)

TABLE 17

CASE III MODEL FOR THE BACALAR CHICO MARINE RESERVE MANAGEMENT PROJECT

CASHFLOW CHARACTERISTICS

SOURCE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ENDOWMENTS	$280,077	$96,882	$400,493	$546,749	$508,181	$447,720	$0	$2,280,101	31%
NET INCOME	$7,500	($103,000)	($22,250)	($115,918)	($161,227)	$171,816	$836,578	$613,498	8%
DEBT	$543,679	$188,064	$777,427	$1,061,337	$986,469	$869,103	$0	$4,426,079	60%
INTEREST	$0	($38,058)	($38,058)	($30,922)	($21,407)	($11,893)	($2,379)	($142,716)	n/r
TOTAL	**$831,257**	**$143,888**	**$1,117,612**	**$1,461,246**	**$1,312,015**	**$1,476,745**	**$834,200**	**$7,176,963**	**100%**

USE	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	TOTAL	% TOTAL
ORGANIZATION	$16,000	$50,000	$262,500	$0	$0	$0	$0	$328,500	5%
ADMIN COMPLEX	$205,000	$0	$0	$1,117,500	$0	$0	$0	$1,322,500	
RESEARCH COMPLEX	$0	$0	$0	$0	$762,500	$0	$0	$762,500	12%
AMTVE	$483,000	$0	$0	$0	$459,000	$286,250	$0	$1,228,250	
INTELLECTUAL PROP	$0	$80,000	$65,000	$30,000	$0	$42,500	$112,500	$330,000	
PHASE I	$0	$0	$534,900	$151,500	$0	$0	$0	$686,400	
PHASE II	$0	$0	$0	$0	$0	$1,107,500	$83,500	$1,191,000	
PHASE III	$0	$0	$0	$0	$0	$0	$0	$0	
INVENTORIES	$61,500	$61,000	$190,793	$118,026	$139,892	$46,595	$24,883	$642,689	10%
DEBT PRINCIPAL	$0	$0	$0	$0	$0	$0	$0	$0	0%
TOTAL	**$765,500**	**$191,000**	**$1,053,193**	**$1,417,026**	**$1,361,392**	**$1,482,845**	**$220,883**	**$6,491,839**	**27%**
BALANCE	**$65,757**	**($47,112)**	**$64,419**	**$44,221**	**($49,377)**	**($6,100)**	**$613,317**	**$685,125**	
BALANCE FORWARD	**$65,757**	**$18,645**	**$83,064**	**$127,285**	**$77,908**	**$71,808**	**$685,125**		

SENSITIVITY ANALYSIS

	Unit Cost
ENDOWMENT REQ	**$1,576,101**
REVENE ASSUMPTIONS / PERSON	
Gen Admission Fee	**$15**
Activity I Package Fee	**$20**
Activity II Package Fee	**$25**
Camping Fee	**$30**
Water Sport Income	**$40**
Restaurant Income	**$35**
Gift Shop Income	**$35**
Resort Income	**$250**
DEBT CONFIGURATION	
Interest Rate	**7.00%**
Leverage	**66.00%**
Cost Contingent	**5.00%**

YEAR	NPV At 0%
0	($1,576,101)
1	($47,112)
2	$64,419
3	$44,221
4	($49,377)
5	($6,100)
6	$613,317
7	$715,443
8	$684,202
9	$705,961
10	$696,031
Total	$1,844,904

$IRR_{endwmnt}$= **10.27%**

$IRR_{investment}$= **-7.96%**

$NPV_{15\%}$= **($382,642)**

$NPV_{15\%}$= **($4,843,580)**

REPORT

ADDENDA

Addenda 1

BELIZE:

STATUTORY INSTRUMENT

No. 89of 1996

ORDER made by the Minister of Natural Resources in exercise of the power conferred upon him by section 3 of the National Parks System Act Chapter 181A of the Laws of Belize, Revised Edition 1980-90, and all other powers thereunto him enabling.

(Gazetted 29th June, 1996)

1.This Order may be cited as the — Short title.

NATIONAL PARKS (BACALAR CHICO) ORDER,1996

2.The areas of land specified in the Schedule to this Order is hereby declared to be a National Park. — Declaration of National Park

3. A map of the said area may be seen at the office of the Chief Forest Officer, Ministry of Natural Resources, Belmopan. — Map of National Park

MADE by the Minister of Natural Resources this 14th date of June, 1996

(HON. EDUARDO JUAN)

Minister of Natural Resources

Printed in Belize by the Government Printer

SCHEDULE

BACALAR CHICO NATIONAL PARK

ALL THAT portion of the Caribbean Sea and Land being Ambergris Caye, in the Belize District, comprising approximately 28,148 acres and bounded on the North by the International Boundary between Belize and Mexico; on the East by a 1,207 metres (3/4 miles) buffer east of the reef crest; on the South by the Caribbean Sea, parts of Robles and parts of land now or formerly known as the Pinkerton Estate; and on the West by a north-south line between Ambergris Caye and Deer Caye and being more particularly described as follows:

Commencing at a point along the mean high water mark of the Eastern coast of Ambergris Caye near Robles, having the scaled UTM coordinates of 409289 East and 2002001 North;

Thence in a Southwesterly direction along the mean high water mark of the Eastern coast of Ambergris Caye approximately 1.98 miles (3,200 metres) from Robles to a point having the scaled UTM coordinates of 407341 East and 1999824 North;

Thence in a Southeasterly direction for an approximately distance of 1,945 metres to a point having the scaled UTM coordinates of 408852 East and 1998599 North;

Thence in a general Northerly direction, parallel to the reef and following the natural contour of the reef crest for an approximate distance of 9.63 miles to a point having the scaled UTM coordinates of 423277 East and 2011384 North;

Thence in a Westerly direction along the international boundary between Belize and Mexico, to a point having the scales UTM coordinates of 401293 East and 2009073 North;

Thence due South for an approximate distance of 6.58 miles (10,600 metres) to a point on the high water mark of the Santa Cruz Lagoon, having the scaled UTM coordinates of 401293 East and 1997748 North;

Thence in a northeasterly direction along the Santa Cruz lagoon to a point on the high water mark having the scaled UTM coordinates of 403960 East and 1999311 North;

Thence in a northeasterly direction for an approximate distance of 3,810 metres to a point having the scaled UTM coordinates of 406720 East and 2002015 North;

Thence in a North-Northeasterly direction for an approximate distance of 1,725 metres to a point having the scaled UTM coordinates of 407510 East and 2003550 North;

Thence in a Southeasterly direction for an approximate distance of 2,250 metres to the point of commencement.

But excluding the Marine Reserve described in Statutory Instrument No. 88 of 1996.

And excluding all private properties.

Addenda 2

BELIZE:

STATUTORY INSTRUMENT

No. 88 of 1996

ORDER made by the Minister of Agriculture and Fisheries in exercise of the powers conferred upon him by section 13A of the Fisheries Act, Chapter l74oftheLaws of Belize, Revised Edition 1980-1990, and all other powers thereunto him enabling,

(Gazetted 29th ***June,*** *1996.)*

1. This Order may be cited as the **FISHERIES (BACALAR CHICO MARINE RESERVE) ORDER, 19%.** Short title.

2. The area specified in the schedule to this Order is hereby declared to be a Marine Reserve for the purposes of the Fisheries Act. Declaration of Marine **Reserve.**

3. A map of the said area may be seen at the office of the Fisheries Administrator, fisheries Department, Belize City. Map of Marine Reserve.

MADE by the Minister of Agriculture and Fisheries this 14th day of June, 1996.

(HON, RUSSELL GARCIA)
Minister of Agriculture and Fisheries

SCHEDULE BACALAR CHICO

MARINE RESERVE

ALL THAT portion of the Caribbean Sea and Land being Ambergris Caye, in the Belize District, comprising approximately 28,148 acres and bounded on the North by the International Boundary between Belize and Mexico; on the East by a 1,207 metres (3/4 miles) buffer east of the reef crest on the South by the Caribbean Sea, parts of Robles and parts of land now or formerly known as the Pinkerton Estate; and on the West by a north-south line between Ambergris Caye and Deer Caye and being more particularly described as follows:

Commencing at a point along the mean high water mark of the Eastern coast of Ambergris Caye near Robles, having the scaled UTM coordinates of 409 289 East and 2002001 North;

thence in a Southwesterly direction along the mean high water mark of the Eastern coast of Ambergris Caye approximately 1.98 miles (3,200 metres) from Robles to a point having the scaled UTM coordinates of 407341 East and 1999824 North;

thence in a Southeasterly direction for an approximate distance of 1,945 metres to a point having the scaled UTM coordinates of 408 852 East and 1998599 North;

thence in a general Northerly direction parallel to the reef and following the natural contour of the reef crest for an approximate distance of 9.63 miles to a point having the scaled UTM coordinates of 413 277 East and 2011384 North;

thence in a Westerly direction along the international boundary between Belize and Mexico, to a point having the scaled UIM coordinates of 401293 East and 2009073 North;

thence due South for an approximate distance of 6.58 miles (10,600 metres) to a point on the high water mark of the Santa Cruz Lagoon, having the scaled UTM coordinates of 401 293 East and 1997 748 North;

thence in a Northeasterly direction along the Santa Cruz lagoon to a point on the high water mark having the scaled UTM coordinates of 403960 East and 1999311 North;

thence in a Northeasterly direction for an approximate distance of 3,810 metres to a point having the scaled UTM coordinates of 406 720 East and 2002 015 North;

thence in a North - Northeasterly direction for an approximate distance of 1,725 metres to a point having the scaled UTM coordinates of 407 *51*0 East and 2003550 North;

thence in a Southeasterly direction for an approximate distance of 2,250 metres to the point of commencement

Saving and excepting thereof and therefrom all land, cayes, islands, lagoons and waterways within the above described areas.

Addenda 3

CHAPTER 210

FISHERIES (BACALAR CHICO MARINE RESERVE) REGULATIONS

ARRANGEMENT OF REGULATIONS

PART I
PRELIMINARY

PART II
ESTABLISHMENT OF ZONES AND RULES FOR ZONES

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CHAPTER 210

68 of 2001.
Ch. 174.

FISHERIES (BACALAR CHICO MARINE RESERVE) REGULATIONS

(Section 13)

[5th May, 2001.]

PART I
PRELIMINARY

Short title.

1. These Regulations may be cited as the

FISHERIES (BACALAR CHICO MARINE RESERVE) REGULATIONS.

Interpretation.

2. In these Regulations, unless the context otherwise requires:-

"fish" includes all the varieties of marine or fresh water animals or plant life;

"Fisheries Administrator" means the Fisheries Administrator appointed under section 107 of the Belize Constitution for the purpose of the Fisheries Act and the regulations made thereunder;

CAP. 4.
CAP. 210.

"fishing" means fishing for, capturing, taking or killing fish, or attempting to do any of the above by any method;

"Reserve" means the Bacalar Chico Marine Reserve declared under the Fisheries (Bacalar Chico Marine Reserve) Order.

"Reserve Manager" means an officer appointed for the purpose of managing the Reserve;

Schedule.

"Schedule" means the Schedule to these Regulations;

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"sport fishing" means catch and release;

"recreational fishing" means fishing for enjoyment with the intention to eat the fish caught but not for the purpose of selling;

"subsistence fishing" means fishing conducted by those who reside within the Reserve for the purpose of consuming but not for selling such fish.

PART II
ESTABLISHMENT OF ZONES AND RULES FOR ZONES

Establishment of zones.

3. (1) For the purposes of the regulation and control of the Reserve, there shall be established four zones within the Reserves as follows:

(a) the General Use Zone;

(b) the Conservation I Zone;

(c) the Conservation II Zone;

(d) the Preservation Zone.

(2) The description of the Reserve shall be as set out in the Schedule of the Fisheries (Bacalar Chico Marine Reserve) Order.

Rules for General Use Zone.

4. (1) The General Use Zone shall be restricted for fishing only by fishermen who currently use this zone and such fishermen shall apply for a licence to fish in accordance with these Regulations.

(2) Only residents of the Bacalar Chico who have special licences to fish shall be allowed to fish solely for subsistence purposes, and such fishing shall be determined by the terms and conditions of each resident's licence;

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(3) No person shall be permitted to use long lines, spearguns or gill nets in the Bacalar Chico Marine Reserve.

(4) No person shall be permitted to use or erect beach traps other than beach traps that have been there during 1996.

(5) No traps shall be constructed with seine, cast nets, gillnets, trammel nets, or tangle nets.

(6) Nets may only be used to round up the fish within the beach trap.

(7) Each trap shall be monitored each day by the caretakers and birds, manatees, rays, turtles, crocodiles, nurse sharks and dolphins caught in or by the nets shall be released.

(8) No beach trap shall be allowed to trap fish beyond its capacity where such fish maim and kill each other. Persons removing fish from traps shall do so at least every three days. Juvenile fish shall be released.

(9) No person shall, within the General Use Zone, cast or drag any anchor in any manner which may damage coral.

Rules for Conservation I Zone.

5. There shall only be non-extractive recreational activities in the Conservation I Zone.

Rules for Conservation II Zone

6. In Conservation II Zone:

(a) sport fishing shall only be carried out under a licence issued in accordance with these Regulations and such fishing shall only be carried out on a catch-and-release basis;

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(b) spear fishing shall not be permitted;

(c) only trolling is allowed during the months of December to February in each year; and

(d) catch and release fishing tours may only remove fish for subsistence purposes during the tour.

Special Rules for Conservation I and II Zones.

7. (1) No person shall secure a boat to the seabed of the Conservation I and II Zones except by means of a mooring that is officially designated for this purpose, (save in the case of an emergency where life and property are endangered), or with the prior written permission of the Reserve Manager.

(2) All divers in the Conservation I and II Zones shall adhere to the following rules:-

(a) divers shall register with the Reserve Manager prior to entering any of the Conservation Zones;

(b) charter dives shall first obtain a licence in accordance with these Regulations before operating in any of the Conservation Zones and all dive boats shall fly the "divers down flag" when they have divers in the water;

(c) only certified scuba divers, or divers undergoing a training course conducted by a recognized instructor shall be allowed to use scuba equipment in the whole of the Reserve;

(d) dive guides shall be required to explain the rules of the Reserve to a diver within the Reserve;

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(e) all boats which need to operate in any of the zones shall first obtain registration from the Fisheries Administrator in accordance with these Regulations.

(3) For the purpose of this Regulation, "divers down flag" means a flag with a white diagonal stripe upon a red or blue background.

Rules for Preservation Zone.

8. (1) Subject to sub-regulation (2) below, no fishing, sport fishing, diving or any other water activity shall be permitted within the Preservation Zone.

(2) No motorized boats shall be permitted within the Preservation Zone except in cases of emergency or where written permission has first been obtained from the Fisheries Administrator.

PART III
COMMERCIAL FISHING, RESEARCH, SPORT FISHING LICENCES AND REGISTRATION OF DIVE BOATS

Commercial fishing licences. Form I. Schedule.

9. (1) Any person who is desirous of fishing within the reserve shall apply to the Fisheries Administrator for a commercial fishing licence in the form prescribed as Form I of the Schedule.

(2) The Fisheries Administrator may within fourteen (14) days of the receipt of an application under this Regulation grant a fishing licence in the form prescribed as Form II of the Schedule.

Form II. Schedule.

(3) Upon the expiry of a fishing licence granted under these Regulations, the licence holder may apply to the Fisheries Administrator for a renewal of the same in the form prescribed as Form I of the Schedule.

Form I. Schedule.

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(4) A fee of fifty dollars ($50.00) shall be payable upon the receipt of a fishing licence or for the renewal of the same.

Research licences. Form III. Schedule.

10. (1) Any person who is desirous of conducting research shall apply for a licence to do so to the Fisheries Administrator in the form prescribed as Form III in the Schedule.

(2) The Fisheries Administrator may within fourteen (14) days of the receipt of an application under this Regulation issue or grant a licence in writing to conduct research.

(3) The Fisheries Administrator shall set conditions for research licences issued under these Regulations.

(4) *(a)* A fee of five hundred dollars ($500.00) shall be payable upon the receipt of a research licence or for the renewal of same.

(b) The Fisheries Administrator may waive or vary at his discretion the fee payable for a research licence.

Sport fishing licences. Form IV. Schedule.

11. (1) *(a)* Any person who is desirous of conducting sport fishing within the Reserve shall apply to the Fisheries Administrator or the Reserve Manager for a sport fishing licence in the form prescribed as Form IV in the Schedule.

Form V. Schedule.

(2) The Fisheries Administrator or the Reserve Manager, as the case may be, may grant a sport fishing licence in the form prescribed as Form V of the Schedule.

(3) The licensee shall not kill any fish caught under a sport fishing licence.

Registration of dive boats.

12. (1) Any dive boat operator who is desirous of conducting scuba diving and snorkeling within the Reserve shall apply to the Fisheries Administrator

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Form IV. Schedule.

for registration in the form prescribed as Form VI of the Schedule.

(2) A fee of thirty dollars ($30.00) shall be payable upon registration of the boat.

(3) Boat registration under this section shall expire on the 31st December next, after the date of issue.

PART IV
GENERAL

Licences not transferable.

13. Licences issued under these Regulations shall not be transferable.

Duration and renewal of licences.

14. Licences issued under these Regulations, unless otherwise stated, shall be valid for a period of one year from the date of issue and may be renewed for a like period upon payment of the fees specified in these Regulations.

Cancellation of licences.

15. The Fisheries Administrator may cancel any licence granted under these Regulations if the licence holder breaches any conditions of the licence or contravenes any provision of these Regulations or the Fisheries Regulations.

Conditions for licences.

16. In issuing a licence under these Regulations, the Fisheries Administrator may attach conditions to such licences, as the case may be, having due regard, to the nature of the licence and the need to protect the environment and natural resources. All tour guides will need to have a valid tour guide licence issued by the Belize Tourist Board.

Duty to report accident or damage to property.

17. Any person involved in an accident which occasions personal injury or damage to property or the environment within the Reserve shall report such accident to the person in charge of the Reserve or to any officer of the Reserve or the Fisheries Administrator or at least within twelve (12) hours of the occurrence of the accident, or as soon as possible thereafter.

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Non-liability of Government.

18. The Government shall not be liable for any personal injury or damage to property occurring within the Reserve.

Application of Fisheries Regulations.

19. Notwithstanding the provisions of these Regulations, the Fisheries Regulations, shall apply within the Reserve.

Opening days of Reserve.

20. The Reserve Office shall be open daily to the public between the hours of 8:00 a.m. to 5:00 p.m.

Admission fees.

21. For all water recreational activities there shall be no fees for the time being.

Prohibition of certain activities within the Reserve.

22. Without prejudice to the activities prohibited by the Fisheries Act and the penalties prescribed therein, no person shall-

(a) remove, damage or have in his possession any flora, fauna or part thereof except under a licence issued by the Fisheries Administrator;

(b) deposit any material in or on the waters of the Reserve, except in the case where a licence to do so has been issued by the Fisheries Administrator;

(c) deface or tamper with any sign, buoy or notice which is installed in the Reserve.

Designation of certain areas by Fisheries Administrator.

23. (1) The Fisheries Administrator may designate areas for certain activities.

(2) No person shall within the Reserve engage in water activities outside of the designated areas.

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3. A detailed programme, in duplicate, of the purpose of the work or expedition including area of work.

I wish to conduct research/an investigation in Belize on my own behalf/ as leader of a group of ( ) students/on the behalf of the institution named above for the following purpose: (specify)

.....

.....

details of which are contained in the attached pages. I will wish to collect specimens for study in Belize and will/will not wish to export these specimens for further study at the end of my stay. I will want to collect

( ) specimen of species for study/and export.

Date: ..... Signed:.....

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SCHEDULE

FORM IV

APPLICATION FOR SPORT FISHING LICENCE TO FISH IN THE BACALAR CHICO MARINE RESERVE

For Official Use Only
Registration No. ___

Last Name: ..... First Name: .....
Address: .....
.....

Telephone: ( ) ..... Date of Birth: .....
(dd/mm/yy)

WORK STATUS
Full Time [ ]; Owner of Boat [ ]
Part Time [ ]; Crew Member [ ]
Other: .....; Captain [ ]

BOAT STATUS
Name of Boat: .....
Length: ..... width: .....
Engine Type: ..... HP .....

LICENCE TYPE
Recreational [ ]
Sports [ ]
Others:
Specify .....

IDENTIFICATION INFORMATION
National ID [ ] Passport [ ]
Drivers licence [ ] Co-operative ID [ ]
Valid Fisherman's Licence [ ]
Social Security No. .....

cut along this line

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RESIDENT FISHERMAN LICENCE

Licence No: .....

This licence is issued to .....
(Full name)

of .....
(address)

under provisions of the Fisheries Act, and the Fisheries (Bacalar Chico Marine Reserve) Regulations, 2001. This licence is not transferable and takes effect from the date of issue and remains in force (unless canceled) until .....
(Date)

Photograph of the Licensee	Fee paid: $ ..... Receipt No. .....
	_____ Signature of Licensee
affix official stamp to photograph	_____ Signature of Licensing officer

This is an official document of the Government of Belize and must be produced on demand to any police officer, customs officer, or fisheries officer. It should be carried at all times by the licensee during fishing activity.

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SCHEDULE

FORM V

SPORT FISHING LICENCE

This licence is issued to .....
(Full name)
of .....
(address)

This licence is valid for a period of one month. From ..... until .....

Photograph of Licensee with official stamp to photograph

Fee paid: $ .....

Receipt No. .....

This licence is subject to the following conditions:-

1. The holder of this licence shall comply with the Fisheries Act and all Regulations made thereunder.

2. The licensee shall not maim or kill any fish caught under this licence and all sport fishing activity shall only be carried out on a catch and release basis.

3. This licence may at any time be canceled if the licensee is in breach of any of the conditions stipulated above.

DATE _____ _____
Fisheries Administrator

NB This is an official document of the Government of Belize and must be produced on demand to any police officer, customs officer, or fisheries officer. It should be carried at all times by the licensee during sport fishing activities.

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Duties of fishermen.

24. All commercial, recreational, subsistence, and sport fishermen shall render the weight of fish caught within the reserve to the reserve rangers upon request.

Offences and penalties.

25. (1) Any person who contravenes any of the provisions of the Regulations commits an offence and shall be liable on summary conviction to a fine not exceeding one thousand dollars or to imprisonment for a term not exceeding six months, or to both such fine and imprisonment.

(2) Any person who damages corals commits an offence and is liable on summary conviction to a find not exceeding twenty five thousand dollars and to pay an additional penalty based on assessed value of the damage caused.

Commencement.

26. These Regulations shall come into force on the 26th day of April, 2001.

MADE by the Minister of Agriculture, Fisheries and Co-operatives this 26th day of April, 2001.

(DANIEL SILVA)
Minister of Agriculture, Fisheries and Co-operatives
Ministry responsible for Fisheries

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SCHEDULE

FORM I

APPLICATION FOR A COMMERCIAL FISHERMAN'S LICENCE OR RENEWAL THEREOF

Part A to be completed in full and accompanied by two full face photographs of the applicant not exceeding one half inches by one inch in size. For first issue, money should not be sent with the form. For first issue, proof of citizenship or valid work permit must be furnished with the application or at the time of actual issue of the licence.

To: The Fisheries Administrator.

PART A

I hereby apply for a first issue/renewal of a fisherman's licence.

Name ..... Age ..... years
(block capitals)
Fishing Experience ..... Years (Full time ..... yrs; Part time ..... yrs)

Home Address ..... I am a boat owner ..... (yes/no)
..... Boat operator ..... (yes/no)
..... Crewman ..... (yes/no)

I am/am not a member of a Fishermen's Co-operative Society.

Name of Co-operative (if a member) .....

Membership No. ..... Previous Fisherman's licence No. .....

Date Issued .....

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PART B

To be completed in full for the first issue and on renewal only if change in the details given in the first issue application have taken place.

Type of fishing in which engaged and methods used. Please enter a tick against the appropriate method and enter the number of units applicable in the spaces provided.

Lobster	Scale Fish	Conch	Other
Traps ( ) No. ( )	Seine nets ( ) No. ( )	Diving ( )	Product
Drums( ) No. ( )	Cast nets ( ) No.( )		
Beach			
Traps ( ) No. ( )	Set nets ( ) No. ( )		Method
Diving ( ) No. ( )	Tangle Nets ( ) No. ( )		_____
Other ( ) No. ( )	Gill Nets ( ) No. ( )		No. of
	Trammel net ( ) No.( )-1 or 2 wall		Units
	Beach traps ( )No. ( )-shore or open sea based		____
	Fish pots ( ) No.( )-any type		
	Drop fines ( )		
	Long lines ( ) No.( )-indicate hooks/100yards.		

Other methods (specify) .....
Approximate value of gear .....
Place of normal landing of catch .....
Date of application ..... Signature of Applicant .....

THIS PART FOR OFFICE USE ONLY: Passport No. ..... ( )
Received in Office .....Work Permit ..... ( )
Fee received .....( ) Birth Cert .....( )

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SCHEDULE

FORM II

FISHERMAN'S LICENCE

Licence No. .....

This licence is issued to .....
(full name)

of under the ..... under the
(address)
provisions of the Fisheries Act and Regulations made thereunder.

This licence is not transferable and takes effect from the date of issue and remains in force (unless canceled) until .....

Fee Paid ..... Receipt No. .....

(Licensing Officer and Office Stamp) This licence must be produced on demand to any police officer, customs officer or authorized fisheries officer and should be carried at all times.

PHOTOGRAPH

Note on Form II of Licence: It is intended that when circumstances permit that such licences be laminated or otherwise waterproof, but until such times the licences issued will be in printed or cyclostyled form, similar to the above and will contain the above information in all cases. The licences are to be made up in triplicate: original to licensee, duplicate to the records and the triplicate for reconciliation of accounts.

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FORM III

APPLICATION FOR LICENCE TO CONDUCT RESEARCH OR SCIENTIFIC INVESTIGATION WITHIN THE BACALAR CHICO MARINE RESERVE

Date of Application .....

Name of Applicant including title or designation .....

Address: Home Country .....
Whilst in Belize .....
Telephone .....

Name of person who is responsible for ensuring compliance with the conditions attached to the licence .....

Institution with whom connection or on whose behalf the work is to be carried out.....
.....

Period during which work is to be carried out .....

The following documents are to be attached to this application:

1. A list of the names and titles of persons who will be accompanying the licensee during the course of the work for whom the licensee shall be responsible.

2. A list of equipment, in triplicate, which the licensee wishes to bring into the country for the scientific purposes and for which a temporary import permit is requested.

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3. A detailed programme, in duplicate, of the purpose of the work or expedition including area of work.

I wish to conduct research/an investigation in Belize on my own behalf/ as leader of a group of ( ) students/on the behalf of the institution named above for the following purpose: (specify)

.....

.....

details of which are contained in the attached pages. I will wish to collect specimens for study in Belize and will/will not wish to export these specimens for further study at the end of my stay. I will want to collect

( ) specimen of species for study/and export.

Date: ..... Signed:.....

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SCHEDULE

FORM IV

APPLICATION FOR SPORT FISHING LICENCE TO FISH IN THE BACALAR CHICO MARINE RESERVE

For Official Use Only
Registration No. ___

Last Name: ..... First Name: .....
Address: .....
.....

Telephone: ( ) ..... Date of Birth: .....
(dd/mm/yy)

WORK STATUS
Full Time [ ]; Owner of Boat [ ]
Part Time [ ]; Crew Member [ ]
Other: .....; Captain [ ]

BOAT STATUS
Name of Boat: .....
Length: ..... width: .....
Engine Type: ..... HP .....

LICENCE TYPE
Recreational [ ]
Sports [ ]
Others:
Specify .....

IDENTIFICATION INFORMATION
National ID [ ] Passport [ ]
Drivers licence [ ] Co-operative ID [ ]
Valid Fisherman's Licence [ ]
Social Security No. .....

cut along this line

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RESIDENT FISHERMAN LICENCE

Licence No: .....

This licence is issued to .....
(Full name)

of .....
(address)

under provisions of the Fisheries Act, and the Fisheries (Bacalar Chico Marine Reserve) Regulations, 2001. This licence is not transferable and takes effect from the date of issue and remains in force (unless canceled) until .....
(Date)

Photograph of the Licensee	Fee paid: $ ..... Receipt No. .....
	_____ Signature of Licensee
affix official stamp to photograph	_____ Signature of Licensing officer

This is an official document of the Government of Belize and must be produced on demand to any police officer, customs officer, or fisheries officer. It should be carried at all times by the licensee during fishing activity.

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SCHEDULE

FORM V

SPORT FISHING LICENCE

This licence is issued to .....
(Full name)
of .....
(address)

This licence is valid for a period of one month. From ..... until .....

Photograph of Licensee with official stamp to photograph

Fee paid: $ .....

Receipt No. .....

This licence is subject to the following conditions:-

1. The holder of this licence shall comply with the Fisheries Act and all Regulations made thereunder.

2. The licensee shall not maim or kill any fish caught under this licence and all sport fishing activity shall only be carried out on a catch and release basis.

3. This licence may at any time be canceled if the licensee is in breach of any of the conditions stipulated above.

DATE _____ _____
Fisheries Administrator

NB This is an official document of the Government of Belize and must be produced on demand to any police officer, customs officer, or fisheries officer. It should be carried at all times by the licensee during sport fishing activities.

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SCHEDULE

FORM VI

APPLICATION FOR BOAT REGISTRATION FOR OPERATION IN THE BACALAR CHICO MARINE RESERVE

(1) Name of boat owner .....
(2) Name of captain .....
(3) Name of boat, if any .....
(4) Length of boat .....
(5) Width of boat .....
(6) Engine type and H.P. .....
(7) Passenger capacity .....
(8) Type of activity: (Tick for activity included)

(a) Snorkeling ( )
(b) Scuba Diving ( )
(c) Glass-bottom viewing ( )
(d) Sport fishing ( )

Date: .....…… Signature ……

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Registration Form

Name of boat owner .....
Name of captain .....
Name of boat .....

This boat is registered to carry up to ……..passengers and to conduct the following activities in the Bacalar Chico Marine Reserve. i.e.

……
……

Conditions of registration

If carrying passengers to dive in Reserve, the captain/guide is responsible for the following:

(i) To acquaint passengers with the rules of the Reserve.

(ii) To moor at the buoys provided when in the Conservation and General Use Zones.

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Addenda 4

CHAPTER 210

FISHERIES (BACALAR CHICO MARINE RESERVE) ORDER

ARRANGEMENT OF ORDERS

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CHAPTER 210

FISHERIES (BACALAR CHICO MARINE RESERVE) ORDER

136 of 2001.
Ch. 210.

(Section 14)

[22nd September, 2001.]

1. This Order may be cited as the **FISHERIES (BACALAR CHICO MARINE RESERVE) ORDER.** — Short title.

2. The area specified in the Schedule to this Order is hereby declared to be a Marine Reserve for the purpose of the Fisheries Act. — Declaration of Marine Reserve Schedule. CAP. 210.

3. A map of the Bacalar Chico Marine Reserve is set out in the Schedule to this Order, and may be seen at the Office of the Fisheries Administrator, Fisheries Department, Belize City. — Map of Marine Reserve Schedule.

4. The Fisheries (Bacalar Chico Marine Reserve) Order, 1996, shall stand repealed upon the commencement of this Order. — Repeals. S.I. No. 88 of 1996.

5. This Order shall come into force on the 18th day of September, 2001. — Commencement.

MADE by the Minister of Agriculture, Fisheries and Cooperatives this 18th day of September, 2001.

(DANIEL SILVA)
Minister of Agriculture, Fisheries and Cooperatives

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SCHEDULE
[Orders 2 and 3]

BACALAR CHICO MARINE RESERVE

PRESERVATION ZONE

Comprising of approximately 638 acres and commencing at the northeast most point of the Bacalar Chico Marine Reserve having scaled UTM coordinates of 413277 East and 2011384 North; thence in a Southeasterly direction for an approximate distance of 1,149 meters to a point having scaled UTM coordinates of 413566 East and 2010279 North; thence in a Southwesterly direction for a distance of approximately 2,380 meters to a point having scaled UTM coordinates of 411250 East and 2009724 North; thence in a Northeasterly direction for a distance of approximately 1,396 meters to a point where it meets the Northern boundary of the said marine reserving having scaled UTM coordinates of 411509 East and 2011078 North; thence in a Northeasterly direction for a distance of approximately 1,830 meters to the point of commencement.

CONSERVATION I ZONE

Comprising of approximately 1,573 acres and commencing at the southeastern most point of the Preservation Zone and having scaled UTM coordinates of 413566 East and 2010279 North; thence in a Southeasterly direction for a distance of approximately 2,675 meters to a point having the scale UTM coordinates of 414228 East and 2007 683 North; thence in a Southwesterly direction for a distance of approximately 2,424 meters to a point having scaled UTM coordinates of 411858 East and 2007178 North; thence Northwesterly for a distance of approximately 2,622 meters to a point having scaled UTM coordinates 411250 East and 2009725 North; thence Northeasterly along the southern boundary of the Preservation Zone for a distance of approximately 2, 380 meters to the point of commencement.

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CONSERVATION II ZONE

Comprising of approximately 1,987 acres commencing at a point along the eastern boundary of the Bacalar Chico Marine Reserve having scaled UTM coordinates of 414430 East and 2004758 North; thence in a Southerly direction along the eastern boundary of the Marine Reserve for a distance of approximately 725 meters to a point having scaled UTM coordinates of 4143 70 East and 2004035 North; thence in a Southwesterly direction along the eastern boundary of the Marine Reserve for a distance of approximately 2,373 meters to a point having scaled UTM coordinates of 412832 East and 2001141 North; thence in a Southwesterly direction continuing along the boundary of the Marine Reserve for a distance of approximately 2,683 meters to a point having scaled UTM coordinates of 410434 East and 2001013 North; thence in a Northwesterly direction for a distance of approximately 1,480 meters until it meets the Eastern boundary of Bacalar Chico National Park at a point having scaled UTM coordinates of 4095 10 East and 2002163 North; thence in a Northerly direction along the eastern boundary of the National Park for a distance of approximately 4,831 meters to a point having scaled UTM coordinates of 412015 East and 2004777 North; thence in an easterly direction for a distance of approximately 2,405 meters to the point of commencement.

GENERAL USE ZONE

All the area of the Marine Reserve except for the areas designated and described as Preservation Zone, Conservation I Zone and Conservation II Zone and comprising of approximately 11,379 acres.

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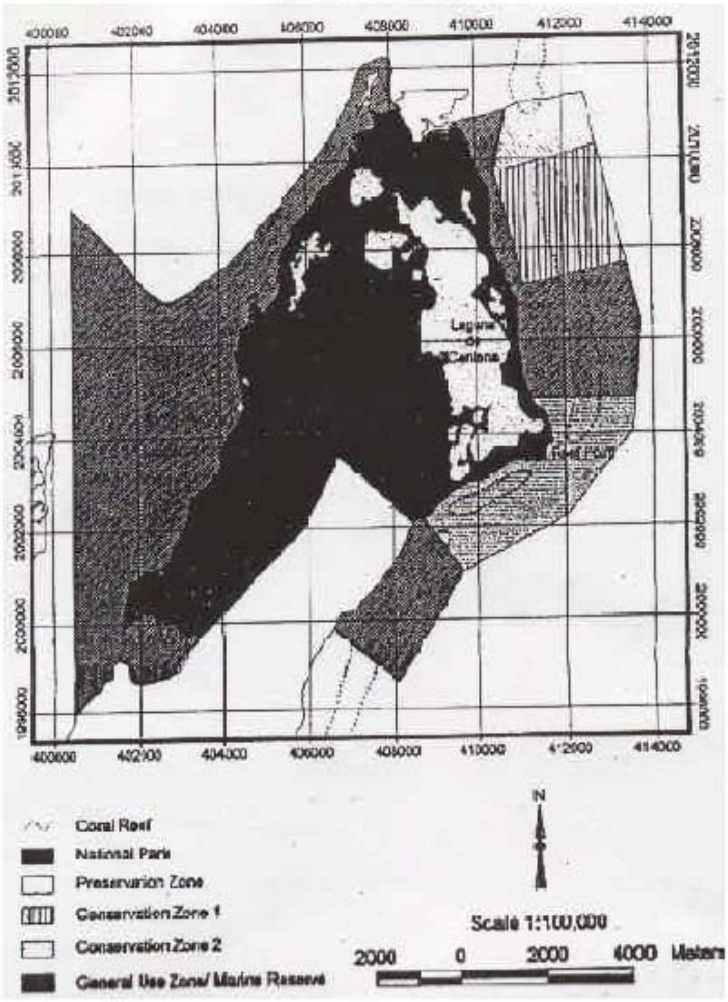
Bacalar Chico
Marine Reserve



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Addenda 5

HURRICANE PREPAREDNESS PLAN AND EVACUATION PROCEDURES

Section A.

1. A meeting should be held with the Fisheries Department to plan evacuation procedures such as:

- Relocation of boats
- Relocation of files and reading materials
- Equipment storage
- Assistance to staff for transportation to residences

2. All equipment and furniture should be properly tagged for identification purposes and the manager should ensure transportation to and storage at the designated site.

3. Servicing and maintenance of all equipment especially engines will be carried out more frequently (every two weeks) in order to ensure reliance. Engines should be serviced as soon as a hurricane threat is announced.

4. There should always be at least three staff members at the field station for any given week during the hurricane season.

5. The cellular phone should not be disconnected during this time.

6. Large quantities of garbage bags should be stored in the locker for the purpose of securing electrical equipment, books and files during transportation and for those items to be left on site.

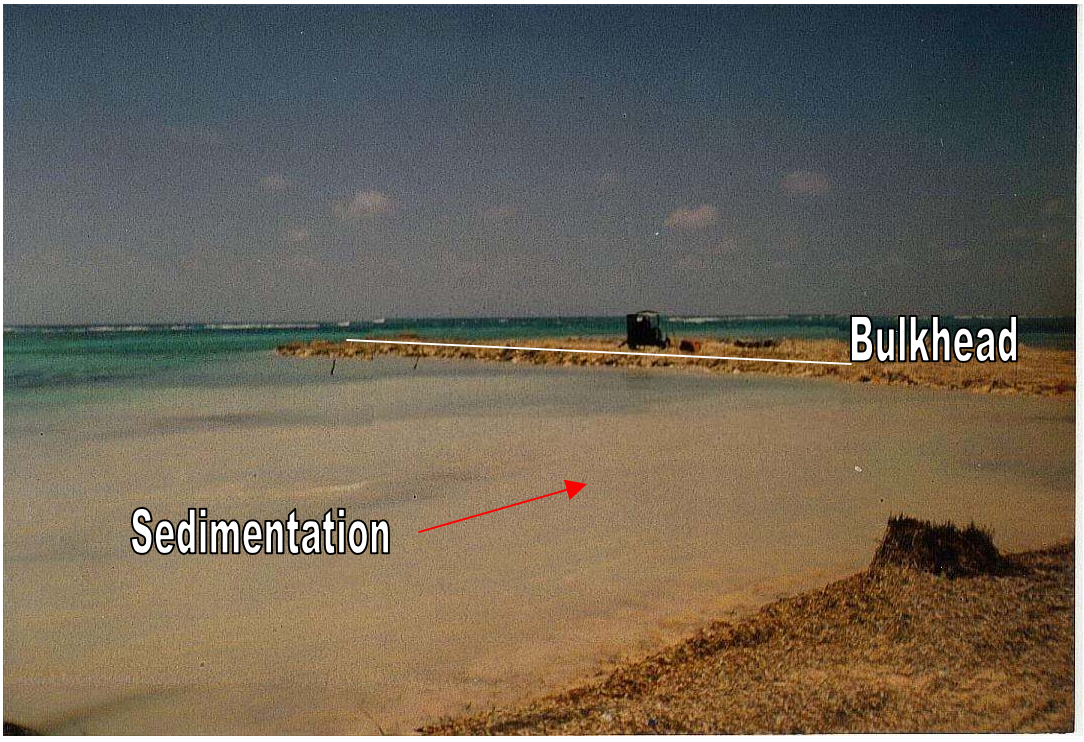
7. All files should be kept on the filing cabinet for easier transportation to a safe place. All files from the computer's hard drive should be copied to disks and stored in a waterproof container/bag to be carried to safety by the Manager. *No files should be left on site.*

8. Locks, lumber, nails and 14 plywood sheets should be stored for the purpose of securing the two buildings.

9. Boats that are not in use should be hauled to shore and secured by rope at the San Juan Field Station. Engines should be placed on their stands and stored in the storeroom.

10. Volunteers will be taken to Belize City and sent to their respective Embassies or other locations as specified by their respective organization(s).

PICTURES TAKEN ON THE SITE DURING CONSTRUCTION PERIOD

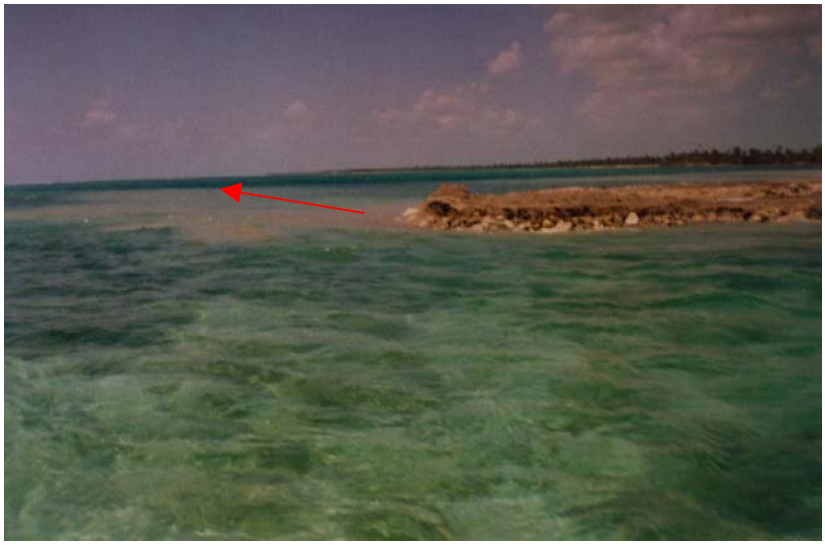


Picture A. Bulkhead placed at Basil Jones around a trench, which was constructed by dynamiting to place a water intake pipe. A water pump was used to remove the water from inside the bulkhead constantly while work continued.

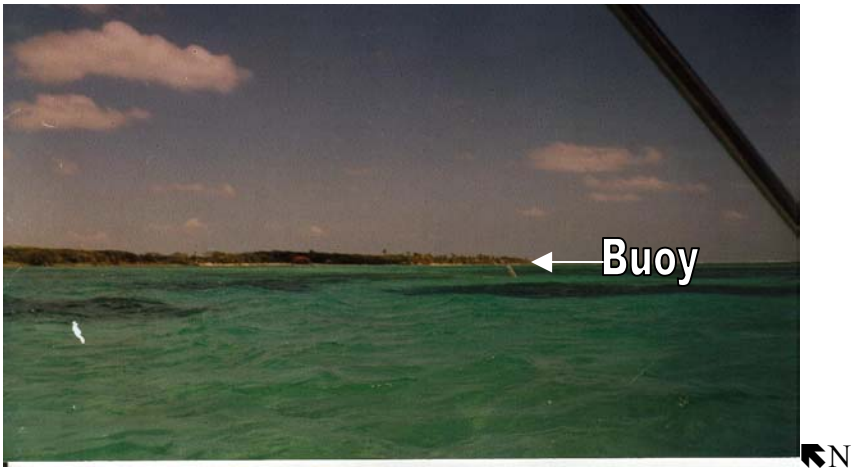
Picture B. Inshore trench where the water intake-pipe was deployed. The close proximity to the sea and the amount of sediments being accumulated are clearly visible.

Picture C. Black band disease present in this coral head is the main cause of coral mortality within the Basil Jones area.

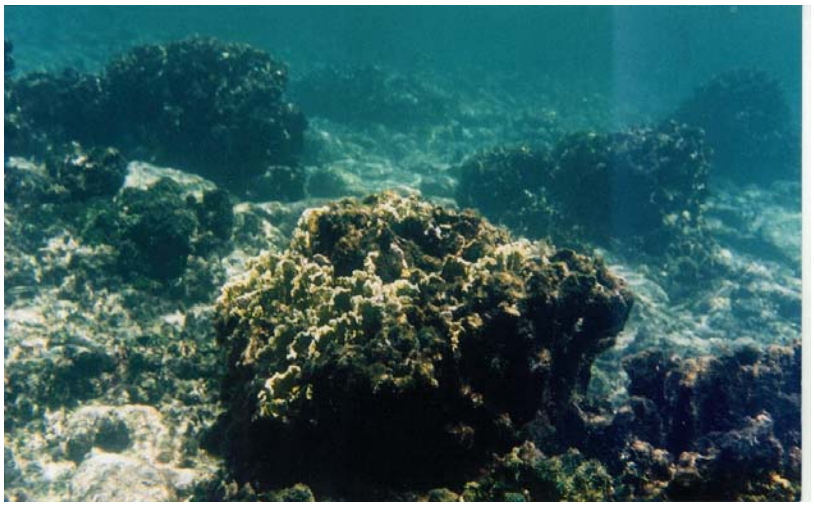
Picture D. Evidence of 1998 bleaching that caused significant mortality in the area.



Picture E. Large amounts of sediments were transported in the direction of the Basil Jones Channel during low tides since during this times the water currents move west to east.



Picture F. Marker Buoy at south boundary of the marine reserve shows that these activities were taking place within the Reserve. The bulkhead referred to in this report is north from this point.



Picture G. Presence of Coral Bleaching on *Millepora* species.

Table 1. AGRRA results

Description	Basil Jones	Grand Canyons
Coral Cover	23.8	27.7
Colony/m	.92727272727	.721428571
% Old Dead	29.2	12.8
% Recent dead	10.9	10.5
% Colonies WB condition	6.9	2.0
% Colonies YB condition	23.5	0.0
% Colonies BB condition	1.0	0.0
% Unknown condition	40.2	79.2
% Pale	8.8	5.9
% Partial Bleach	16.7	8.9
% Bleached	1.0	1.0
% Damsel fish	13.7	19.8
% Macro algae	9.1	11.1
% Turf algae	58.5	57.9
% Crustos algae	32.4	31.0
Macro Height	2.6	2.9

There was a high incidence of disease in the Basil Jones area as the table can show. The rate of *old dead coral* was also higher and this could be attributed to the presence of disease in comparison to the Grand Canyons where it was rarely seen. The percentage of *recent dead coral* was similar on both areas suggesting that disease is spreading to the forereef area but has not yet fully propagated. All other variables were similar in both areas and did not show any significant change. During this study sedimentation was not a factor observed on the forereef at Basil Jones.

Summary:

Primarily Blackband disease and White plague are causing coral mortality in the Basil Jones area. Contributing to the mortality was the stress compounded on the corals by the 1998 Bleaching event after which very few coral heads recovered. Also, Hurricane Mitch did substantial structural damage to the coral system.

NOVA did cause coral damage when ferrying its construction materials, dredging for barge landing and dredging and subsequent dynamiting the bedrock for deployment of the intake line. It destroyed a large area of priceless seagrass beds and small corals formations. The ecosystem suffered alteration in the Basil Jones Area since corals formations, seagrass beds and mangroves are inter-dependent. The damage area will take a long time to be recolonized and will be affected by strong long shore currents which will impede life forms to properly attach to the substrate. The recruits that were attempting to grow in the area were priceless life forms.

Nova's hatchery operation is an additional threat to the marine reserve due to its proximity to the reef especially in the event of any effluent spillages or chemical runoffs. Careful monitoring is also required for their wastewater management. An effluent monitoring program would be very useful to mitigate pollution on the environment and aquifers. It is recommended that the Department of Environment makes a site visit to evaluate their operations.

The Bacalar Chico Marine Reserve office should be consulted before any permits for any type of development is issued so that the staff can plan monitoring the implementation of any guidelines that the given permits stipulate.

References

Coral bleaching and Mortality in the Basil Jones area of Bacalar Chico National Park and Marine Reserve, Belize 1998. Submitted by: Gregory W. Smith, Basil Jones Area, and San Pedro Belize

Report on Observed Damages In the Bacalar Chico Marine Reserve and World Heritage Site Caused By Poor Practices At the Shrimp Hatchery Owned By NOVA Company.

RAPID ECOLOGICAL ASSESMENT OF NORTHERN AMBERGRIS CAYE prepared by Belize Center For Environmental Studies, 1 October 1993

A FIELD COURSE IN BELIZE, CENTRAL AMERICA by Drs' S.J Mazullo, C.D Burke, W.D Bischoff, 1998

Appendix 1

Copy of coral bleaching report by Greg Smith

11. Inform and educate fishermen of our plans and how they fit in it.

12. If possible, petty cash will be kept in the Managers desk drawer for use during evacuation procedures.

Section B.

1. Contact the Marine Protected Areas Coordinator or the Ecosystems Management Unit Coordinator at the Fisheries Department through their contact numbers.

2. Secure the windows and door of the outpost with plywood and padlock the storeroom.

3. Transport compressor, dive tanks, dive gears, reading materials, butane tank, stove, table set, solar panels and batteries to the San Juan Headquarters.

4. Computer and other related equipment should be properly stored in their respective boxes and secured in double garbage bags.

5. Filing cabinet should be locked and secured with bags for transportation.

6. Communication equipment (radios antennas etc.) should be dismantled and packed in double garbage bags.

7. All electrical equipment such as electric saw, drill, solar panels etc. should be packed, tied and bagged.

8. Secure all windows and doors with plywood and lock where necessary.

9. The generator, compressor, fire extinguishers, butane tanks, dive tanks and remaining dismantled furniture should all be placed inside the water vat after it has been emptied.

10. Stove, refrigerator and kitchen furniture should be placed in the storeroom.

11. Secure all boats that are unable to be transported to Belize City. These should be hauled as far inland as possible and secured on the ground or on mooring buoys with ropes.

12. Place all items and personnel on board and depart to Main Office where further instructions will be followed.

Coral Bleaching and Mortality in the Basil Jones Area of Bacalar Chico National Park and Marine Reserve, Belize, 1998

Submitted by: Gregory W. Smith, Basil Jones Area, San Pedro, and Belize

The bleaching event in the reef lagoon of the Basil Jones Area of Bacalar Chico Marine Reserve in 1998 was very severe. Almost every living coral within the area bleached. High mortality (greater than 99%) of some species occurred leaving only a few individual colonies alive of the Staghorn Coral, Fused Staghorn Coral, Elkhorn Coral, Thin Leaf Lettuce Coral, Lettuce Coral, and Blade Fire Coral. Also, the predominant coral within the area, Boulder Star Coral, suffered a massive outbreak of white plague disease and black-band disease immediately following the bleaching, which resulted in the mortality of over 90% of the Boulder Star Coral by November, 1999.

Introduction

Bacalar Chico Marine Reserve is located at the northern end of Ambergris Caye adjacent to the Belize/Mexico border in the Western Caribbean Sea. It includes approximately 8 miles of the second largest barrier reef in the world and in 1997 became a World Heritage Site. The southern most section of the Bacalar Chico Marine Reserve is known as the Basil Jones area and includes a deep channel through the barrier reef known as Basil Jones Cut. The coral bleaching and mortality observed by the author occurred from the northern side of Basil Jones Cut northward to the reef lagoon area directly in front of the author's home, approximately 400 meters. This reef lagoon area consists of the reef crest, patch reefs, seagrass beds, and sand patches. The barrier reef comes within 400 meters of the island's shore creating a shallow (3-6 feet) and very restricted area non-typical of the rest of Belize's barrier reef lagoon.

Since 1979 the author has lived in this area year round and regularly snorkeled in the reef lagoon. In January 1989, the author first observed bleaching of corals in the reef lagoon of the Basil Jones area. This bleaching occurred in the uppermost 10" of the patch reefs in the reef lagoon north of Basil Jones Cut. This bleaching and subsequent death of the upper 10 inches of corals was due to a severe cold wave and winds from the northwest, which exposed the upper 10" of coral to low temperatures for 3-4 days. This bleaching and die-off was not observed further south of the Basil Jones Cut where the reef lagoon is deeper and much further from the island's shore.

In September 1995, the author observed major bleaching of corals in the reef lagoon of the Basil Jones area. The Boulder Star Coral (*Montastrea annularis),* the Finger Coral (*Porites porites),* the Thin Leaf Lettuce Coral (*Agaricia tenuifolia)*, the Blade Fire Coral *(Millepora complanata)* and the Massive Starlet Coral (*Siderastrea siderea)* were primarily affected during this bleaching event and did sustain some mortality. A few

individuals of other species of corals within the area did also bleach, but most other corals were unaffected.

In late June 1998, the author observed a bleached area on a colony of Staghorn Coral (*Acropora cervicornis)*. The author then photographed this bleached area on 1 July 1998 and another bleached area on a second colony of Staghorn within 20 feet of the first colony. Many healthy, unbleached colonies of Staghorn coral were also within 20 feet. See Photos 1-3 Below.

PHOTO #1: Partial Bleaching of Staghorn Coral, 1 July 98

PHOTO #2: Partial bleaching of second Staghorn Coral colony, 1 July 98

PHOTO #3: Close-up of Photo #2 bleached area of Staghorn Coral colony, 1 July 98

The areas that bleached of the two Staghorn Coral colonies were observed to die and become covered with algae by 16 August 1998 when Photo #4 was taken (see photo below.)

PHOTO #4: Same Staghorn Coral as Photo #1, bleached area dead and algae covered, 16 Aug 98

The next change that was recorded was the bleaching of all the Staghorn Coral colonies within the area during the last few days of August 1998. The remaining area of the Staghorn Coral photographed in Photo #1 that had been healthy on 16 August, 98 was included in this bleaching (see Photo #5 below.) Subsequently, the bleached area died by October 1, 1998 (see Photo #6 below) and was reduced to coral rubble by high waves from Hurricane 'Mitch' (see Photo #7 below.)

PHOTO #5: Same Staghorn Coral as Photo #1, remainder of colony bleaching, 1 Sept 98

PHOTO #6: Same Staghorn Coral as Photo #1, total colony now dead, 1 Oct 98

Photo #7: Same Staghorn Coral as Photo #1, colony dead and broken into rubble
No longer provides shelter for dozens of fish

All of the Staghorn Coral colonies within this area bleached and died by 1 October 1998 (see Photos # 8 and 9 below.) When high waves generated by Hurricane 'Mitch' hit this area all of the Staghorn Coral colonies were reduced to dead coral rubble (see Photos 10 and 11 below.)

PHOTO #8: Other colonies of Staghorn Coral dead, 1 Oct 98

PHOTO # 9: All colonies of Staghorn Coral in this one area dead, 1 Oct 98

PHOTO #10: Colonies of Staghorn Coral dead coral rubble, 3 Nov 98

PHOTO #11: Colonies of Staghorn Coral dead coral rubble, 3 Nov 98

The bleaching and death of Staghorn Coral in the Basil Jones Area began occurring in June 1998 and was followed by bleaching and high mortality of Fused Staghorn Coral (*Acropora prolifera),* Elkhorn Coral (*Acropora palmata),* Thin Leaf Lettuce Coral (*Agaricia tenuifolia),* Lettuce Coral (*Agaricia agaricites)*, and Blade Fire Coral (*Millepora complanata.)* Photos 12- 24 document the bleaching and mortality of these species also (see photos below.) All of the above species of corals within the Basil Jones Area of Bacalar Chico Marine Reserve and World Heritage Site suffered very high mortality. Less than 1% of these species of corals remained alive in January 1999.

PHOTO #12: Fused Staghorn Coral colonies bleached, 28 Sept 98

PHOTO # 13: Fused Staghorn Coral colonies same as Photo #12 now dead coral rubble, November 3, 98

PHOTO #14: Elkhorn Coral bleaching 17 Sept 98

PHOTO #15: Same Elkhorn Coral as Photo #14 algae beginning on areas bleached in Photo #14 new areas now bleached, 28 Sept 98

PHOTO #: 16 Close-up of algae growth on Elkhorn Coral, 28 Sept 98

PHOTO # 16: Bleached Elkhorn Coral colonies, 28 Sept 98

PHOTO #17: Bleached Elkhorn 28 Sept 98

PHOTO #18: Thin Leaf Lettuce Coral bleached 17 Sept 98

PHOTO #19: Thin Leaf Lettuce Coral bleached 28 Sept 98

PHOTO #20: Blade Fire Coral bleached 17 Sept 98

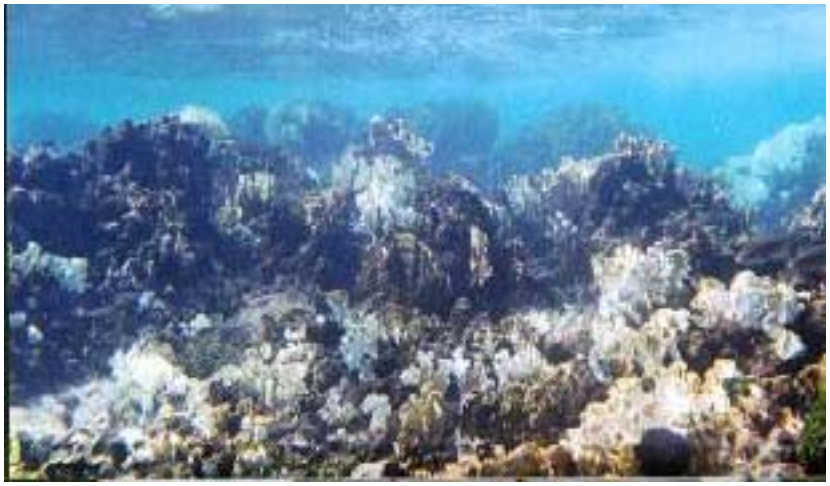


PHOTO #21: Fire Coral colonies bleached and dead, 1 Oct 98

The predominant species of coral within the Basil Jones Area is Boulder Star Coral (*Montastrea annularis)*. This species began bleaching in late August and mortality was observed on some individuals as early as 28 Sept 98 (see Photos 22-24 below.)

PHOTO #22: Boulder Star Coral bleached 1 Oct 98

PHOTO #23: Boulder Star Coral bleached and dead with new algae growth, 1 Oct 98

PHOTO #24: Close-up of dead area of Boulder Star Coral showing algae, 1 Oct 98

The Boulder Star Corals continued to suffer significant new mortality throughout all of 1999. Newly dead white areas could be seen on hundreds of Boulder Star Coral colonies throughout the area. These dead areas appeared to be caused by white plague and black band disease (see photos 25-30 below.)

PHOTO # 25: Diseased and dying Boulder Star Coral, June 1999

PHOTO # 26: Diseased and dying Boulder Star Coral, June 1999

PHOTO # 27: Diseased and dying Boulder Star Coral, June 1999

PHOTO # 28: Diseased and dying Boulder Star Coral, June 1999

PHOTO # 29: Diseased and dying Boulder Star Coral, June 1999

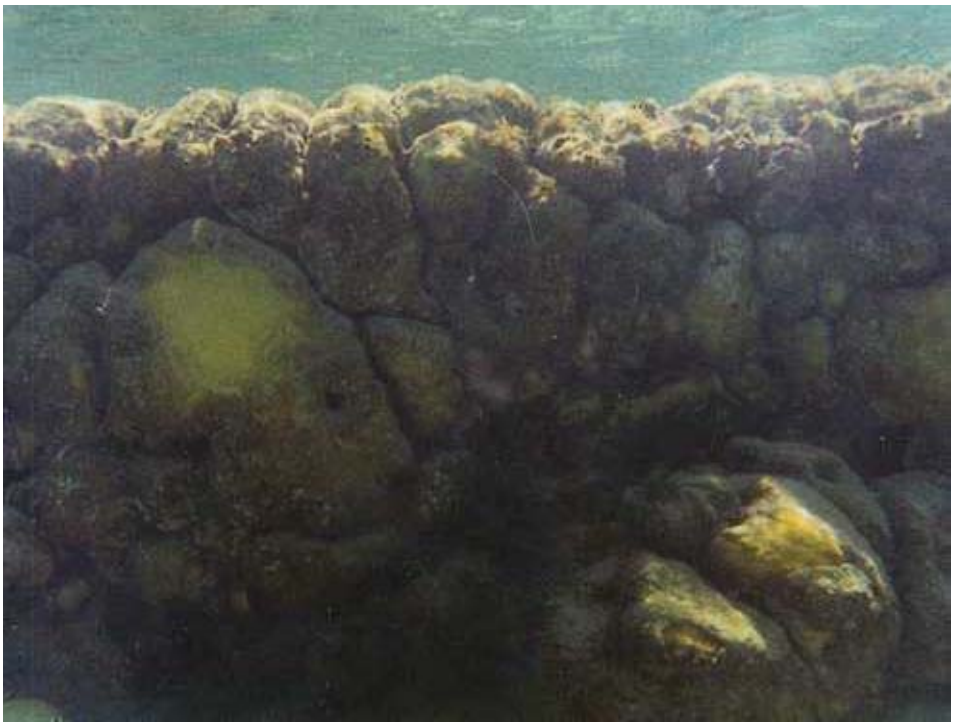


PHOTO # 30: Diseased and dying Boulder Star Coral, June 1999

Mortality of the Boulder Star corals continued throughout all of 1999 resulting in over 90% of the Boulder Star coral in this shallow water area dying by November 1999. New patches of diseased Boulder Star coral can still be seen as of January 2000 and therefore the mortality continues.

Land Systems Map Legend

AB: Dominant Rock Type, alluvium; Main Soil Types: Ambergris; Drainage Density, none; Local Relief, < 5 meters; Altitude, < 5 meters; Dominate Subunits, bar; Characteristic Vegetation, beach forest; Water Availability, low.

AI: Dominant Rock Type, hard limestone; Main Soil Types: Shipstern; Drainage Density, None; Local Relief, <5 meters; Altitude, < 5 meters; Dominate Subunits, flat plain; Characteristic Vegetation, low broadleaf semi-deciduous forest with patches of marsh forest; Water Availability, low.

AN: Dominant Rock Type, hard limestone alluvium; Main Soil Types: Shipstern/Ycacos; Drainage Density, none; Local Relief, <5 meters; Altitude, < 5 meters; Dominate Subunits, flat plain; Characteristic Vegetation, mosaic of beach forest and mangrove; Water Availability, low.

ZY: Dominant Rock Type, alluvium, limestone; Main Soil Types: Shipstern/Ycacos; Drainage Density, very low; Local Relief, 0 meters; Altitude, < 5 meters; Dominate Subunits, savanna (ss), swamp (m); Characteristic Vegetation, mangrove; Water Availability, very high.

Addenda 7

LEGEND

Geomorphological Category	Benthic Category
Unclassified	Unclassified
Deep Water	Unclassified
Shallow Lagoon Floor	Sparse Seagrass (standing crop 1-10 g.m-2; cover < 30%)
Various	Sand and Sparse Algae
Turbid Water	Seagrass
Backreef Pavement	Sand with sparse coral & algae
Shallow Lagoon Floor	Medium Dense Seagrass (standing crop 11-80 g.m-2; cover 30-70%)
Backreef Pavement	Fleshy Brown Algae with dead coral
Diffuse Patch Reef	Massive & Encrusting Corals
Dense Patch Reef	Massive & Encrusting corals
Shallow Lagoon Floor	Fleshy Brown Algae with sparse gorgonians (< 3 gorgonians m-2)
Deep Lagoon Floor	Mud
Forereef	Dense Massive & Encrusting Corals (> 5 % coral cover)
Reef Crest	Branching Corals
Forereef	Bare substratum / Medium dense soft corals
Shallow Lagoon Floor	Dense seagrass (standing crop > 80 g.m-2; cover > 70%)
Forereef	Sparse Massive & Encrusting Corals (1-5% coral cover)
Low Relief Spur & Groove	Leaf Corals with Green Calcified Algae
Low Relief Spur & Groove	Massive & Encrusting Corals
High Relief Spur & Groove	Massive & Encrusting Corals
Backreef Pavement	Rubble and sparse algae
Shallow Laggon Floor	Mud
Shallow Lagoon	Bedrock
Shallow Lagoon Floor	Sand & sparse seagrass
Shallow Lagoon Floor	Bedrock / Rubble & dense gorgonians (> 3 gorgonians m-2)
Shallow Lagoon Floor	Sand, sparse algae & sparse corals
Shallow Lagoon Floor	Seagrass with distinct coral patches
Shallow Lagoon Floor	Sparse Massive & Encrusting Corals
Shallow Lagoon Floor	Bedrock / Rubble and dense gorgonians (> 5 gorgonians m-2)
Backreef	Sparse Massive & Encrusting Corals (1-5% coral cover)
Shallow Lagoon Floor	Sparse Massive & Encrusting Corals (1-5% coral cover)
Shallow Lagoon Floor	Bedrock / Rubble, sparse gorgonians and algae (< 3 gorgonians m-2)

Addenda 8

MEMORANDUM OF UNDERSTANDING

FOR THE CO-MANAGEMENT OF THE BACALAR CHICO MARINE RESERVE

BETWEEN THE FISHERIES DEPARTMENT, GOVERNMENT OF BELIZE

AND

GREEN REEF ENVIRONMENTAL INSTITUTE

THIS AGREEMENT is made the _____ day of _____ 2003, between the Fisheries Department, Government of Belize of the first part (herein after referred to as The Fisheries Department), and Green Reef Environmental Institute a private, non-profit Belizean organization duly formed and existing Company Limited by Guarantee and not having a shared Capital, Chapter 206 of the Laws of Belize with registered address in San Pedro Town, Ambergris Caye, Belize of the second part (herein after referred to as Green Reef).

WHEREAS the Minister of Fisheries has the power to declare Marine Reserves under section 7 of the Fisheries (Amendment) Act of 1983, Chap. 174 of the Laws of Belize, and to do everything necessary for the sound management and administration of these Reserves;

AND WHEREAS the Fisheries Administrator of the Fisheries Department is responsible for the administration of the Marine Reserves, and is therefore joined as a party hereto;

AND WHEREAS the Fisheries Department and Green Reef (collectively, The Parties) are desirous of entering into an Agreement to cooperate in the management of the Bacalar Chico Marine Reserve (herein after referred to as The Reserve) declared under the Fisheries (Bacalar Chico Marine Reserve) Order, 1996;

IT IS HEREBY AGREED:

1. The Fisheries Department and Green Reef shall jointly manage and further develop the Bacalar Chico Marine Reserve.

2. The Fisheries Department, and Green Reef, in keeping with the provisions of the Fisheries Act, shall exercise such joint management.

3. The Fisheries Department, after seeking advisement from Green Reef and the Bacalar Chico Advisory Committee, may put in place such other regulations by Statutory Instrument or otherwise as may be necessary in order to develop full implementation of this Agreement.

4. (i) The Fisheries Department and Green Reef, after consultation with the Bacalar Chico Advisory Committee, the Coastal Zone Management Institute, and other agencies and NGOs as agreed upon by The Parties, shall together formulate and implement detailed Management Plans (hereinafter referred to as "The Plans") for the further development of The Reserve to explicitly include goals, objectives, permitted activities, standards, methods of implementation and control, priorities, budget, personnel requirements, target dates and such other matters as shall be agreed.

   (ii) The Plans shall also specify the assessment methods to monitor accomplishments and shall provide the necessary periodic evaluations and refinements. The Plans shall include provisions for methods of protection, enforcement, visitor usage, staffing, structures, monitoring, research and any other provisions as are appropriate The Reserve.

   (iii) The Fisheries Department and Green Reef shall jointly approve The Plans for implementation by the Parties or their assigns, and/or The Reserve staff.

5. (i) The Fisheries Department and Green Reef, after consultation with the Bacalar Chico Advisory Committee, the Coastal Zone Management Institute, and other agencies and NGOs as agreed upon by The Parties, shall jointly direct the staff of the Marine Reserve in regard to the day-to-day management of The Reserve. The Fisheries Department shall provide additional security and enforcement of the Marine Reserve and assist in providing infrastructure, and Green Reef shall provide technical direction in regard to conservation & management of flora and fauna of The Reserve. Notwithstanding the foregoing, the Fisheries Department shall retain all statutory rights and duties over The Reserve as specified by law, which are not amended by this agreement.

   (ii) All material assets, such as equipment, tools, instruments and hardware obtained for the Reserve shall be the property of the Reserve".

6. (i) The reserve staff, after consultation with The Fisheries Department and Green Reef, shall be responsible for the proper implementation of all aspects of visitor use within The Reserve and the day-to-day maintenance of equipment provided for The Reserve, as well as for public awareness campaigns and education with respect to The Reserve.

   (ii) Green Reef shall be permitted to conduct research within The Reserve through permits issued by the Fisheries Administrator. Any agency, entity or person doing any research, scientific or otherwise, must first obtain a prescribed permit from The Fisheries Department, but Green Reef shall be exempt from paying the Fisheries Department its proscribed fees for research conducted within The Reserve.

7. Green Reef and The Reserve staff shall jointly develop and provide the Fisheries Administrator with quarterly financial statements, annual reports and reports on any major revision in operations regarding management of The Reserve. For its part, The Fisheries Department, upon written request from Green Reef, shall provide Green Reef with relevant financial information pertaining to The Reserve.

8. The Fisheries Department shall, in accordance with the Fisheries Regulations, process all applications for scientific research by any other organizations, after consultation with Green Reef, and the Bacalar Chico Advisory Committee.

   (i) Recreational & extractive activities pertaining to The Reserve shall be decided jointly by the Parties hereto pursuant to the Plans, however, The Fisheries Department reserves the right to refuse any activity, including extractive activities, within The Reserve which in its judgement, is not consistent with the goals and legal framework governing The Reserve.

9. (i) The Reserve staff will collect fees, such as entrance fees, program fees and other fees associated with the management, development and use of The Reserve.

   (ii) All fees collected by The Reserve staff shall be apportioned according to a mutually agreed schedule between:

      (a) Green Reef, for use in institutional strengthening; and

      (b) The Marine Reserves Trust Fund, for use in the management and development of The Reserve.

10. The Fisheries Department shall provide assistance to Green Reef in the form of tax exemptions and other like benefits as are enjoyed by non-profit, non-governmental organizations for the carrying out of activities related to the management of The Reserve.

11. Any endowment, trust fund, grant, loan subsidy or any monies whatever obtained by Green Reef in support of its role in the management and development of The Reserve under this Agreement shall be for the exclusive use of Green Reef, providing these monies fall within the priorities as defined in the approved Management Plan The Reserve.

12. In the event of an infringement of any of the terms of this Agreement, the party making a complaint shall give notice thereof in writing to the other party and The Parties shall then use their best efforts to resolve the matter within three (3) months of the date of the written notice.

13. If no satisfactory resolution is reached, the complaint may be taken to an agreed – upon arbitrator.

14. If no satisfactory resolution is reached, the complaining party may, by further notice of at least thirty (30) days after the expiration of the period referred to above, terminate this Agreement. In the event of the dissolution of this Agreement, neither The Fisheries Department, nor Green Reef, shall incur any liabilities.

15. Either party may, wherever it deems necessary, and after consultation with the other party, terminate this Agreement, provided that notice of a minimum of six (6) months is given to the other party.

16. This agreement shall be amended where such proposed amendment is reduced to writing and signed by The Parties.

SIGNED:

_____	_____
Hon. Servulo Baeza Minister of Agriculture, Fisheries & Cooperatives	Beverly Wade (Miss) Fisheries Administrator
_____	_____
Guillermo Paz Green Reef President	Green Reef First Vice President

AS WITNESS to the hands of The Parties:

_____

TERMS OF REFERENCE FOR THE RESERVE MANAGER

QUALIFICATIONS:

- First Degree in Science or Natural Resource Management.
- Knowledge of data collection and analysis.
- Certification in SCUBA diving is an asset.

DUTIES:

- Implementing surveillance and enforcement of marine reserve regulations.
- Management of the reserve.
- Assist in the design and implementation of research and monitoring programs.
- Liaising with visitors to the marine reserve.
- Develop interpretive and educational programs.
- Where applicable, lead the collection of baseline data to enact reserve regulations.
- Develop a sustainability plan.
- Any other task that may be assigned from time to time.

TERMS OF REFERENCE FOR BIOLOGIST

QUALIFICATIONS:

- Associate Degree in Science with a sound biology component.
- Knowledge of data collection and analysis.
- Certification in SCUBA diving.

DUTIES:

- Where applicable, collection of baseline data to enact reserve regulations.
- Assisting with surveillance and enforcement of marine reserve regulations.
- Assisting the manager with management of the reserve.
- Design and implementation of research and monitoring programs.
- Liaising with visitors to the marine reserve.
- Assisting with the development of interpretive and educational materials.
- Any other task that may be assigned from time to time.

TERMS OF REFERENCE FOR RANGERS

QUALIFICATIONS:

- High School diploma with a sound science component.
- Must have good boat handling and navigational skills.
- Certification as a SCUBA diver.

DUTIES:

- Whenever applicable, collection of baseline data to enact reserve regulations.
- Surveillance and enforcement of marine reserve regulations.
- Assist with research and monitoring projects.
- Liaise with visitors to the marine reserve.
- Assist with the development of interpretative and educational material.
- Upkeep of infrastructure and equipment.
- Any other task that may be assigned from time to time.

Below is a list of equipment at the headquarters:

Addenda 10

ITEM	Quantity	Quanlity	LOCATION
Laptop computer	1	Malfunctioning	San Juan Field Station
External CD Rom	1	Functioning	San Juan Field Station
External Modem	1	Functioning	San Juan Field Station
Desktop Computer	1	Functioning	San Juan Field Station
Scanner	1	Functioning	San Juan Field Station
HP Printer	2	Functioning	1 -San Juan Field Station, 1 – Angelus Press
UPS	1	Functioning	San Juan Field Station
Line Stabilizer	1	Functioning	San Juan Field Station
Monitor	1	Functioning	San Juan Field Station
Computer Speaker	1 Pair	Functioning	San Juan Field Station
Mic	1	Functioning	San Juan Field Station
GPS	1	Malfunctioning	San Juan Field Station
Slide Projector	1	Functioning	San Juan Field Station
Video Camera	1	Functioning	San Juan Field Station/Majil
Video Camera Housing	1	Functioning	San Juan Field Station/Majil
Still Camera	1	Destroyed by water	Disposed of by Mr. Edwards
25 Pelican	2	Functioning	San Juan Field Station
85 HP Engine	1	Spare parts	San Juan Field Station
115 HP Yamaha	1	New	San Juan Field Station
60 HP Engine	4	Functioning	San Juan Field Station
16 Ft Mexican Skiff	1	Functioning	San Juan Field Station
25 HP Engine	1	Functioning	San Juan Field Station
40 HP Engine	3	3 Spare Parts	San Juan Field Station
Generator	3	1 Functioning 2 Malfunctioning	2 - San Juan Field Station 1 – Paul & Williams
Butane Refrigerator	2	Not functional	2 - San Juan Field Station
Stoves	3	2 Functioning	2 - San Juan Field Station 1 - Outpost
Fire Extinguishers	10	Functioning	San Juan Field Station
Filing Cabinet	2	Usable	San Juan Field Station
Chainsaw	1	Operational	San Juan Field Station
Pick Axe	1	Operational	San Juan Field Station
Axe	1	Operational	San Juan Field Station
Handsaw	3	Operational	San Juan Field Station
Mall	1	Broken Handle	San Juan Field Station
Screen	0	Used	San Juan Field Station
Rubber boots	2	Used	1 – Samos 1 – Edwards
Compost Toilet	1	Functioning	San Juan Field Station
Fish Finder	1	Operational	San Juan Field Station
Cell Phone	1	Functioning	San Juan Field Station
Directional antenna & Cable	2	Functioning	San Juan Field Station
Antenna For Car	1	Functioning	San Juan Field Station
Inverter	1	Functioning	Outpost
Hand held Radio	6	1 Operational 3 Malfunctioning 2 Missing	San Juan Field Station 2 @ Tenchtronics
Ice Box	2	Usable	San Juan Field Station
Winch	1	Operational	San Juan Field Station
Storing Cabinet	1	Usable	San Juan Field Station
B-B-Q Pitts	2	1 usable	San Juan Field Station

Butane Tanks	7	Operational	San Juan Field Station
Beds and Mattresses	6	5 usable	San Juan Field Station
Bunks and Mattresses	2	Working	San Juan
Stretchers	6	Working	3 – Outpost 3 – San Juan Field Station
Bedside tables	6	Working	1 – Outpost 5 – San Juan Field Station
Dining Tables	3	Working	1 – San Juan Field Station 2 – Outpost
Cupboard	2	Working	1 – Outpost 1 – San Juan Field Station
Bookshelves	2	Working	1 – Outpost 1 – San Juan Field Station
Desks	4	Working	2 – Outpost 2 – San Juan Field Station
Computer Desk	1	Working	San Juan Field Station
Lawnmower	2	Working	San Juan Field Station
Weed whacker	1	Malfunctioning	San Juan Field Station
Water Cistern	8	2 – punctured 6 – Working	3 – Outpost 3 – San Juan Filed Station
Manual Water Pump	1	Working	San Juan Field Station
Electric Insect Repellent Pump	1	Malfunctioning	San Juan Field Station
Power Drill	1	Working	San Juan Field Station
Hydraulic Jack Hammer	1	Not Working	San Juan Field Station
BCD's	8	4 need repair	San Juan Field Station
Regulators	8	4 need repair	San Juan Field Station
Dive Tanks	8	All require testing for safety	Outpost

Below is a list of equipment at the headquarters:

ITEM	Quantity	Quanlity	LOCATION
Laptop computer	1	Malfunctioning	San Juan Field Station
External CD Rom	1	Functioning	San Juan Field Station
External Modem	1	Functioning	San Juan Field Station
Desktop Computer	1	Functioning	San Juan Field Station
Scanner	1	Functioning	San Juan Field Station
HP Printer	2	Functioning	1 -San Juan Field Station, 1 – Angelus Press
UPS	1	Functioning	San Juan Field Station
Line Stabilizer	1	Functioning	San Juan Field Station
Monitor	1	Functioning	San Juan Field Station
Computer Speaker	1 Pair	Functioning	San Juan Field Station
Mic	1	Functioning	San Juan Field Station
GPS	1	Malfunctioning	San Juan Field Station
Slide Projector	1	Functioning	San Juan Field Station
Video Camera	1	Functioning	San Juan Field Station/Majil
Video Camera Housing	1	Functioning	San Juan Field Station/Majil
Still Camera	1	Destroyed by water	Disposed of by Mr. Edwards
25 Pelican	2	Functioning	San Juan Field Station
85 HP Engine	1	Spare parts	San Juan Field Station
115 HP Yamaha	1	New	San Juan Field Station
60 HP Engine	4	Functioning	San Juan Field Station
16 Ft Mexican Skiff	1	Functioning	San Juan Field Station
25 HP Engine	1	Functioning	San Juan Field Station
40 HP Engine	3	3 Spare Parts	San Juan Field Station
Generator	3	1 Functioning 2 Malfunctioning	2 - San Juan Field Station 1 – Paul & Williams
Butane Refrigerator	2	Not functional	2 - San Juan Field Station
Stoves	3	2 Functioning	2 - San Juan Field Station 1 - Outpost
Fire Extinguishers	10	Functioning	San Juan Field Station
Filing Cabinet	2	Usable	San Juan Field Station
Chainsaw	1	Operational	San Juan Field Station
Pick Axe	1	Operational	San Juan Field Station
Axe	1	Operational	San Juan Field Station
Handsaw	3	Operational	San Juan Field Station
Mall	1	Broken Handle	San Juan Field Station
Screen	0	Used	San Juan Field Station
Rubber boots	2	Used	1 – Samos 1 – Edwards
Compost Toilet	1	Functioning	San Juan Field Station
Fish Finder	1	Operational	San Juan Field Station
Cell Phone	1	Functioning	San Juan Field Station
Directional antenna & Cable	2	Functioning	San Juan Field Station
Antenna For Car	1	Functioning	San Juan Field Station
Inverter	1	Functioning	Outpost
Hand held Radio	6	1 Operational 3 Malfunctioning 2 Missing	San Juan Field Station 2 @ Tenchtronics
Ice Box	2	Usable	San Juan Field Station
Winch	1	Operational	San Juan Field Station
Storing Cabinet	1	Usable	San Juan Field Station
B-B-Q Pitts	2	1 usable	San Juan Field Station

Butane Tanks	7	Operational	San Juan Field Station
Beds and Mattresses	6	5 usable	San Juan Field Station
Bunks and Mattresses	2	Working	San Juan
Stretchers	6	Working	3 – Outpost 3 – San Juan Field Station
Bedside tables	6	Working	1 – Outpost 5 – San Juan Field Station
Dining Tables	3	Working	1 – San Juan Field Station 2 – Outpost
Cupboard	2	Working	1 – Outpost 1 – San Juan Field Station
Bookshelves	2	Working	1 – Outpost 1 – San Juan Field Station
Desks	4	Working	2 – Outpost 2 – San Juan Field Station
Computer Desk	1	Working	San Juan Field Station
Lawnmower	2	Working	San Juan Field Station
Weed whacker	1	Malfunctioning	San Juan Field Station
Water Cistern	8	2 – punctured 6 – Working	3 – Outpost 3 – San Juan Filed Station
Manual Water Pump	1	Working	San Juan Field Station
Electric Insect Repellent Pump	1	Malfunctioning	San Juan Field Station
Power Drill	1	Working	San Juan Field Station
Hydraulic Jack Hammer	1	Not Working	San Juan Field Station
BCD's	8	4 need repair	San Juan Field Station
Regulators	8	4 need repair	San Juan Field Station
Dive Tanks	8	All require testing for safety	Outpost

SUMMARY OF CZMA/I MONTHLY EXPENDITURE SUPPORT FOR BACALAR CHICO MARINE RESERVE[1,2]

Bacalar Chico Marine Reserve	Salary	Insurance	Social Security	Fuel & Lubricants Montly Allowance	Subsistence & Accomodation Allowance	Total Montly Expenditure	All Risk Insurance Premium on Contents	Fire, Hurricane & Perils Premium on Contents	Total Yearly Insurance Premium Payable on Contents
Eck, Alicia	1,925.33	105.46	80.25	800.00	240.00		455.22	905.04	
Chan, Isani	1,544.00	105.46	80.25		240.00				
Samos, Auriel	1,322.00	105.46	80.25		240.00				
Edwards, Jason	1,255.33	105.46	72.25		240.00				
Subtotal	**6,046.66**	**421.84**	**313.00**	**800.00**	**960.00**	**8,541.50**	**455.22**	**905.04**	**1,360.26**

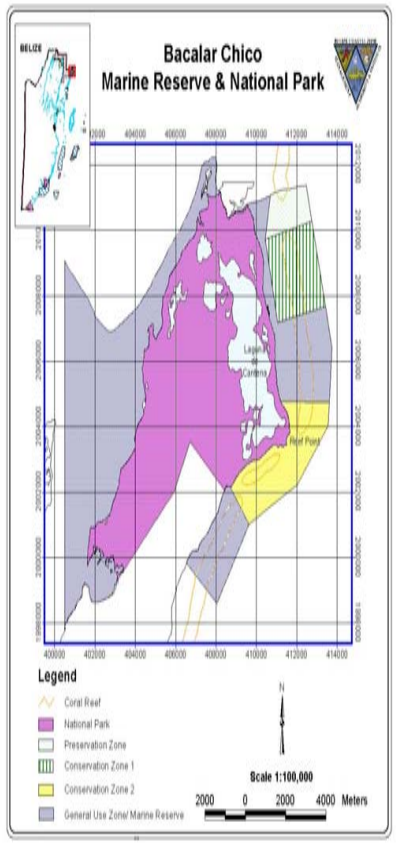
[1]Fuel - Cost represents 200 gals of duty free fuel and lubricants allocated on a monthly basis (this may vary base on activities)

[2]Subsistence and Accommodation is calculated at 4 days per month per staff @ $60.00 per day. Daily Subsistence Allowances will vary depending on Fisheries Admin Policies or Staff Contract.

Conservation Tips

- Do not touch coral while. snorkeling, diving etc.
- Do not feed Manatees.
- Do not disturb sea turtles or their nests.
- Proceed with caution and obey the signs along the Bacalar Chico canal.
- Abide by zoning regulations of Bacalar Chico Marine Reserve.
- Abide all fisheries regulations especially those concerning the fishing of lobsters and conch.

NATIONAL PARK
BACALAR CHICO
MARINE RESERVE



Rules for General Use Zone:-

- There is restricted fishing, fishermen must have a licence.
- Only Bacalar Chico residents are allowed to fish for subsistence purposes.
- There is to be no use of long lines, spearguns or gill nets.
- No traps made with seine. cast nets, gill nets, trammel nets or tangle nets, are permitted.
- Nets can only be used to round up fish within a beach trap.
- Each trap must be monitored daily. Birds, Manatees, rays, turtles, crocodiles, nurse sharks and dolphin caught in the traps must be released.
- No beach trap can trap fish beyond its capacity. fish must be removed every three days and juveniles released.
- No casting or dragging of any anchor which may damage coral is allowed.

Rules for Preservation Zone:-

- No fishing, sport fishing, diving or any other water activity is permitted.
- No motorized boats permitted except with written permission from the Fisheries Administration, or in case of an emergency.

Rules for Conservation Zone 1 and 2:-

- No boat is to be secured to the sea bed except in designated mooring areas, unless they have written permission of the Reserve, or in the case of an emergency.
- Rules regarding diving:-

1) Divers must register with the Reserve before entering.
2) Charter dives must possess a licence, and all dive boats must fly the 'divers below flag'.
3) Only certified SCUBA divers or divers under going a training course are allowed to dive.
4) Dive guides must explain the rules of the Reserve to their divers.
5) All boats must be registrated with the Fisheries Administrator.

Rules for Conservation Zone 1:-

- Only non - extractive recreational activities can take place.

Rules for Conservation Zone 2:-

- Sport fishing requires a licence
- Spear fishing is not permitted
- Trolling is allowed only between December and February.
- During Catch and release fishing tours fish can only be caught for subsistence purposes.

License types and costs

Fishing

- Any person wishing to fish within the reserve is to apply to the Fisheries Administrator for a license.
- A fee of $50 is to be paid upon the receipt of a fishing license.
- Upon expiry the license holder may apply to the Fisheries Administrator for renewal.

Research

- Any person wishing to conduct research within the reserve is to apply to the Fisheries Administrator for a license.
- A fee of $500 is to be paid upon the receipt of the license.
- The Fisheries Administrator may waive or alter the license fee at his discretion.

Sport Fishing

- Any person wishing to conduct Sport Fishing within the reserve shall apply to the Fisheries Administrator or the Reserve Manager for a licence.
- A fee of $30 is to be paid upon receipt of the licence.
- The license holder shall not kill any fish caught under a sport

Diving and Snorkeling

- Any dive boat operator who desires to conduct SCUBA diving and Snorkeling within the reserve is to apply to the Fisheries Administrator for registration.
- A fee of $30 is to be paid upon the registration of the boat.
- Boat registration expires on the 31st December following the date of issue.

Turtle Regulations

- Under the Fisheries Act, all species of sea turtles are now protected. Including the species of green, hawksbill and loggerhead that nest and forage in Belizean Waters.
- Species that migrate in our waters also have protection.

General Information

Licence Terms

- Licences are non transferable.
- Unless otherwise stated licences are valid for one year.
- The Fisheries Administrator may cancel the licence if the holder breaches the conditions of the licence.

Accidents

- Accidents should be reported to the Reserve of the Fisheries Administrator within 12 hours of the occurrence of the accident.
- The Government is not responsible for any personal injury or damage to property occurring within the reserve.

General Points

- The reserve office is open from 8:00am to 5:00pm.
- There is no fee for recreational water activities.
- No person shall:-

⇒ Remove or have in his possession any flora or fauna except under licence.

⇒ Deposit any material in or on the waters of the reserve except under licence.

⇒ Deface or tamper with signs

⇒ No person shall engage in activities outside the designated areas.

⇒ All fishermen are to declare the weight of fish caught to reserve Rangers upon request.

Offences and Penalties

- Any person who breaks any of the regulations commit an offence and are liable to a maximum fine of $1,000 and / or imprisonment for a maximum term of 6 months.
- Any person who damages the corals commits an offence and is liable to a maximum fine of $25,000 and to pay an additional penalty based on the assessed value of the damage caused.

GREEN REEF ENVIRONMENTAL INSTITUTE AND COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Independent User/-Stakeholder Questionnaire

Position: _____ Date: _____

1.	How many years have you used the Reserve for a source of income?	≤ 5 Yr < 10 Yrs ≥ 10 Yrs
2.	How many days do you spend in the Reserve/Year?	≤ 10 Days < 50 Days > 50 Days
3.	What part(s) of the reserve do you visit/use? [Select Any]	__San Juan __Cantena __Rocky Point __Robles __Basil Jones __Other/All:_____
4.	What Activities Do You Do In The Reserve? [Rank 1 – most often; 6-least often]	__Tour-Guiding __Commercial Fishing __Recreational Fishing __Sport Fishing __Research __Other:_____
5.	How many days do you tour-guide in the Reserve/Year?	≤10 < 100 > 100
6.	How many tourists do you guide in the Reserve/Year?	≤100 < 500 > 500
7.	What kind of activities do you offer to tourists? [Select Any]	__Sport Fishing __Swim / Snorkel / Dive __Birding __Manatee Watching __Picnicking __Archaeology __Kayaking __Star Watching __Other/None:_____

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

8. How much money do you earn from tour-guiding in the Reserve/Year?	≤ Bz $ 5,000 ≤ Bz $ 25,000 > Bz $ 25,000
9. How would you rank visitor satisfaction after visiting the reserve?	Fair Good Very Good Excellent
10. How many days do you Fish in the Reserve/Year?	≤10 < 50 > 100
11. What methods / species do you use / catch when fishing in the reserve? [Select Any]	__Diving: Lobster Conch __ Traps: Lobster Fin-Fish __Fly-Fishing: Bonefish Tarpon Snook Permit Barracuda __Trolling: Groupers Barracuda Jacks Snappers __Deep Sea: Marlin Wahoo Dolphin Tuna __Other: _____
12. How much money do you earn from fishing in the Reserve/Year?	≤ Bz $ 5,000 ≤ Bz $ 25,000 > Bz $ 25,000
13. Would you prefer to continue your present activities in the reserve, or try new activities for alternative livelihood? [Select one]	__Continue Present Activities __Try New Activities For Alternative Livelihood
14. Would kind of new activities would you like to participate in? [Select any]	__Aquaculture __Alternative Fishing Activities __Alternative Tour-Guiding Activities __Research __Anything I Can Do Within The Reserve __Anything Not Associated With The Reserve __Other:_____

GREEN REEF ENVIRONMENTAL INSTITUTE AND COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

15. What is your education level?	≤Primary ≤1st Form ≤ 2nd Form ≥3rd Form
16. Do you feel you have the skills to participate in new activities?	Yes No
17. Have You Ever Taken A Training Course To Learn A New Skill?	Yes No
If Yes, Which Course(s) Did You Take?	_____
18. Did you realize your expected benefits from the training experience?	Yes No
If Not, Explain Why	_____
19. What skills do you have now? [Select any]	__Boat Captain __Swimming / Snorkeling __Scuba __ID Marine Organisms: [Plants / Corals / Fish / Invertebrates/ Other] __Sport/ Fly-Fishing: __Other:_____
20. How much money could you invest in a new activity within the reserve if trained to do so?	≤ Bz $ 5,000 ≤ Bz $ 25,000 > Bz $ 25,000
21. How well do you think the Reserve is being managed?	Poor Fair Good Very Good Excellent
22. What do you think management is weak at? [Select any]	__Enforcement Of Laws & Regulations __Marketing The Reserve To Increase Tour-Guiding Opportunities __Monitoring Fisheries Stocks __Monitoring Tourism Activities __Working With / Helping Stakeholders To Develop New, Conservation Friendly Skills __Other:_____

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

23. By what means should the Reserve's management be improved?

    [Select any]

__Personnel Change
__Improving Management/Staff Skills
__Increasing the Number of Managers/Staff
__Reducing Regulations
__Increasing Regulations
__Other:_____

24. In your opinion, what is a reasonable fee to charge tourists, fishers and researchers to use the Reserve per person-day?

    [Circle one value per category]

Tourists	Fishers	Researchers
Bz $ 0	Bz $ 0	Bz $ 0
Bz $ 5	Bz $ 5	Bz $ 5
Bz $ 10	Bz $ 10	Bz $ 10
Bz $ 15	Bz $ 15	Bz $ 15
Bz $ 20	Bz $ 20	Bz $ 20
Bz $ 30	Bz $ 30	Bz $ 30
Bz $ 40	Bz $ 40	Bz $ 40
Bz $ 50	Bz $ 50	Bz $ 50

25. How should earnings from visitor fees be used after basic operating costs are met?

    [Select any]

__More Staff
__More Patrols / Enforcement Of Laws
__More Tour-Guide Training
__More Fisher Training
__Other Stakeholder Training
__Changing Regulations
__Building Tourist Accommodations
__Building Activity Infrastructure
[e.g. trails, observation towers, access to Mayan ruins, etc.]
__Marketing The Reserve To Increase Visitation
__Other:_____

26. What suggestions / comments do you have for improving the reserve beyond those already discussed?

_____
_____
_____
_____

Thank you!

GREEN REEF ENVIRONMENTAL INSTITUTE AND COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Hotel User-Stakeholder Questionnaire

Hotel Name: _____ Date: _____

1.	How many guests does your hotel accommodate per year?	≤1,000 < 2,500 < 5,000 >5,000
2.	How many guests inquire about the reserve/year?	0% ≤10% < 50% >50%
3.	How many guests are told about the reserve/year?	0% ≤10% < 50% >50%
4.	Does your hotel use its own guides, or hire independent guides or guides from other hotels?	Use Own Hire Out
5.	Does your hotel offer tours to the BCMR reserve?	Yes No
6.	How many guests does your hotel arrange trips for per year?	≤ 100 ≤ 500 < 1,000
7.	What does your hotel charge guests or tell guests it will cost to go the reserve?	≤ Bz $50 Ea ≤ Bz $100 Ea > Bz $150 Ea
8.	Why do you think the BCMR has lower visitor attendance than HCMR? [Select Any]	__Distance: High Visitation Cost In Money/Time __Lack of Activities Offered __Low Marine Wildlife Abundance __Lack of Guides / Guide Skills __Lack of Overnight Accommodations __Lack of Food/Beverage Services __Lack of Local Advertising & Marketing __Lack of Advertising/Marketing To Hotels __Lack of Advertising/Marketing On The Internet __Other: _____

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BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

9. Have you or any of your staff that interact directly with tourists making choices on what to do while visiting Belize ever visited the reserve? Yes No

10. Do you think park entrance fees influence guest's choices of whether or not to visit the Reserve? Yes No

11. In your opinion, what is a reasonable fee to charge tourists, fishers and researchers to use the Reserve per person-day?

[Circle one value per category]

Tourists	Fishers	Researchers
Bz $ 0	Bz $ 0	Bz $ 0
Bz $ 5	Bz $ 5	Bz $ 5
Bz $ 10	Bz $ 10	Bz $ 10
Bz $ 15	Bz $ 15	Bz $ 15
Bz $ 20	Bz $ 20	Bz $ 20
Bz $ 30	Bz $ 30	Bz $ 30
Bz $ 40	Bz $ 40	Bz $ 40
Bz $ 50	Bz $ 50	Bz $ 50

12. What suggestions / comments do you have for improving reserve visitation?

_____

_____

_____

_____

_____

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_____

_____

Thank you!

GREEN REEF ENVIRONMENTAL INSTITUTE AND COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

Position: _____ Date: _____

1. How long have you worked in/for the Reserve?	≤1 Yr	< 5 Yrs >5 Yrs
2. How many days do you spend in the Reserve/Year?	≤10 Days	< 50 Days >50 Days

3. What aspects of the Reserves operations & management need the greatest improvement / attention?

[Rank the most important as *1*, and the least important as *10*].

__Tourist Accommodation

__Management/Staff Training

__Tour-Guide Skills

__Communication Between Management and Staff

__Communication With Users/Stakeholders

__Enforcement Of Park Rules & Regulations

__Enforcement Of Belize Laws & Regulations

__Salaries

__Marketing/Pubic Awareness

__Equipment Availability, Condition & Maintenance

__Other (Write In the space below)

_____

4. Do you consider yourself to be adequately trained for your job? Yes No

5. What type of training do you feel you need to improve your job performance?

[Rank 1 – 3]

__Communication Training (e.g. people skills)

__Technical Training (e.g. diving; mechanic; computer skills, etc.)

__ Academic/Scientific Training (e.g. research, business administration skills, etc.)

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BACALAR CHICO MARINE RESERVE & NATIONAL PARK

Management & Staff Questionnaire

5. Do any members of your family or close friends rely on the Reserve as a source of income?

Yes No

6. Why did you choose to work with the BCMR?

[Pick one]

__Needed a Job

__Interesting Type of Work

__Family Interest/Encouragement

__Wanted a Government Career

__Wanted a Conservation Career

__ Other:_____

7. In your opinion, what is a reasonable fee to charge tourists, fishers and researchers to use the Reserve per person-day?

[Circle one value per category]

Tourists	Fishers	Researchers
Bz $ 0	Bz $ 0	Bz $ 0
Bz $ 5	Bz $ 5	Bz $ 5
Bz $ 10	Bz $ 10	Bz $ 10
Bz $ 15	Bz $ 15	Bz $ 15
Bz $ 20	Bz $ 20	Bz $ 20
Bz $ 30	Bz $ 30	Bz $ 30
Bz $ 40	Bz $ 40	Bz $ 40
Bz $ 50	Bz $ 50	Bz $ 50

8. What suggestions / comments do you have for improving Reserve management effectiveness?

_____

_____

_____

9. What suggestions / comments do you have for improving Reserve visitation?

_____

_____

_____

Thank you!

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[1]Note: Underlined numbers indicate literature references available in PDF format on report CD.