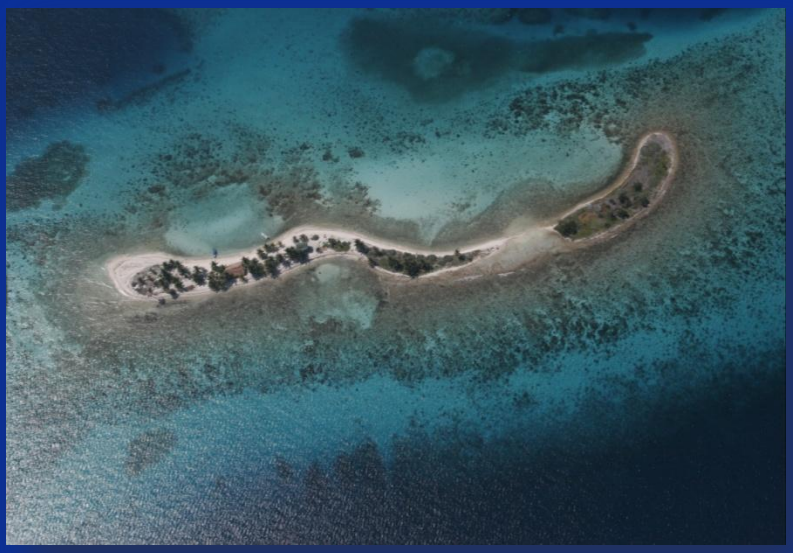
Laughing Bird Caye

National Park



Doug Perrine, 2007

Management Plan

2011 – 2016

A component of Belize's

World Heritage Site

BELIZE FOREST • DEPARTMENT •

SEA BELIZE

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Laughing Bird Caye National Park

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Introduction

Background and Context

Laughing Bird Caye National Park is one of four marine protected areas that, with the surrounding seascape, form the Southern Belize Reef Complex, a system-level planning and management unit. Three of these protected areas are managed by the Southern Environmental Association (SEA), in partnership with the Government of Belize. Laughing Bird Caye National Park was established in 1991 (SI 167), under the National Parks System Act (1981), and later extended to include the entire faro (SI 94 of 1996), in recognition of the unique nature and exceptional integrity of the Laughing Bird faro, its national, regional and international importance, and its value as a local recreational area. The National Park covers 10,119 acres (approximately 4,095 hectares), and is located on the shallow reef platform of the Atlantic coast of Mesoamerica, in lagoonal waters sheltered by the longest barrier reef in the Western Hemisphere, the Mesoamerican reef system.

SITE INFORMATION

Size: 10,119 acres (4,095 ha)
Statutory Instrument: SI 94 of 1996
Original SI: SI 167 of 1991
IUCN Category: II
Management Authority: Forest Department
Co-management Partner:
Southern Environmental Association (SEA)
Contact: E-mail: info@seabelize.org
Web site: www.seabelize.org

Location: Laughing Bird Caye National Park lies 18 km offshore, to the east-south-east of Placencia.
Uses: Non-extractive – tourism, education and research.
Management Plan: In prep. (2010)
Biodiversity information: SEA, Conservation International (MMAS), Lisa Carne (resilient corals / restoration) and various independent researchers.
Facilities (2009): Rangers station, visitor centre, picnic tables, barbecue pit, bathroom facilities.
Tourism Visitation (2009): 9,008
On-site Staff (2009): 1 head ranger, 2 rangers, supported by the SEA central office staff in Placencia

This reef system stretches approximately 1,000 km from the Yucatan to the Bay Islands in Honduras. The Belize Barrier Reef is the largest component of this Mesoamerican Reef System, and possibly the least impacted reef complex in the Atlantic–Caribbean area (UNESCO, 1996). The Mesoamerican Reef has been identified as one of 233 ecoregions with biodiversity and representational values considered outstanding on a global scale, and has been recommended several times as a priority area for conservation (Olson & Dinerstein, 1998; Roberts, 2001, Kramer and Kramer, 2002). Belize, a country with a low population and relatively low rate of coastal development, is recognized for having some of the least impacted reef areas in the region, and the highest diversity of fish species (ReefBase, 2006).

Laughing Bird Caye National Park (LBCNP) itself has been designated as one of seven components of the Belize Barrier Reef System - World Heritage Site, in recognition of the uniqueness of its contribution to Belize's reef system. It was designated "*to protect the unique biodiversity associated with the Laughing Bird Caye faro, and to manage, protect and promote the sustainable use of Laughing Bird Caye National Park for the benefit of present and future generations*" (Friends of Laughing Bird Caye / TIDE (2000)). This is achieved through a series of five objectives:

1. *Protect and maintain the natural and scenic values of Laughing Bird Caye National Park*

2. *Provide environmentally sustainable, well managed recreational opportunities for local, national and international visitors*

3. *Increase awareness of the marine ecosystems and conservation benefits of Laughing Bird Caye National Park, to promote a supportive environment for effective management*

4. *Act as a model of co-management, as part of the World Heritage Site, and within the framework of the system level management of the Southern Belize Reef Complex*

5. *Provide opportunities for economic benefit for local stakeholder communities*

In keeping with its designation as a National Park, LBCNP is a completely no-take area (NTA) and is recognized for supporting extraordinarily high biological diversity. The park provides nursery and feeding habitats for at least twenty three species of international concern, recognized under the IUCN Redlist as Critically Endangered, Endangered or Vulnerable (IUCN, 2010), including five species of coral, three species of turtle, fifteen species of fish and the vulnerable West Indian manatee. The faro (or shelf atoll) itself is home to a wide variety of unique habitats, and hosts a number of endemic species. Laughing Bird Caye has also historically provided nesting sites for hawksbill and green turtles, critical to the survival of these species within the region. Historically, the National Park also supported a nesting colony of laughing gulls, after which the caye and National Park were named.

The National Park designation is considered to be equivalent to ***Category II: A protected area managed primarily for ecosystem protection and recreation*** (NPAPSP, 2005; IUCN, 1994).

Purpose and Scope of Plan

Laughing Bird Caye National Park is one of three protected areas managed by SEA, and a component of the Southern Belize Reef Complex. This five year management plan has been developed to provide guidance to the Southern Environmental Association and Forest Department, the co-management partners, towards effective management of Laughing Bird Caye National Park.

Laughing Bird Caye National Park was designated as a National Park, under the National Park Systems Act of 1981, Chapter 215, Laws of Belize, Revised Edition 2000), for:

> *"....the protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public"*

These objectives, along with designation as part of both Belize's World Heritage Site (1996) and the Southern Belize Reef Complex system-level planning initiative, bring certain criteria to be taken into consideration during the development of the management plan.

Since the development of the first management plan in 2000 (Friends of Laughing Bird Caye/TIDE, 2000), the uses of the protected area and the status of the resources have changed, and the knowledge base has improved substantially from the interim years of research and data collection. The management regime has changed from a volunteer effort under Friends of Laughing Bird Caye to the more formal Non-Governmental Organization (NGO) Friends of Nature (FoN), and most recently, through a merger of FoN and Toledo Association for Sustainable Tourism and Empowerment (TASTE) to form a new NGO - the Southern Environmental Association (SEA).

The programmes in this Management Plan address the current status of the National Park, and reflect the more participatory approach to management being adopted in Belize today. It includes general information on the physical and biological attributes of the reserve, documents the current uses and management problems, defines the goals and objectives of the National Park, summarises conservation planning outputs, outlines specific management programmes (including zoning), sets in place the means for measuring management effectiveness, and recommends an implementation schedule.

In line with the National Protected Areas Policy and System Plan, this Management Plan has been prepared with the input of the various stakeholders of the protected area through meetings with SEA staff, a series of workshops with key stakeholder components, and interviews with a wide variety of individuals, including fishermen, the tourism sector, management staff and researchers, and seeks to conserve the resources of the reserve while allowing economic benefit through tourism. The management programmes are based on the best available data and scientific knowledge, with the integration of conservation planning strategies, and fit within

the scope of the current zoning scheme and regulations that govern the protected area, except where recommended management regimes are highlighted for review.

This management plan is designed to provide a framework for both broad management activities and more specific research and monitoring activities over the next five years. It is recommended that detailed operational plans be developed on an annual basis by the Southern Environmental Association, based on this framework provided by this management plan, with an annual review of implementation success, allowing for adaptive management over this time frame.

1. Current Status

1.1 Location

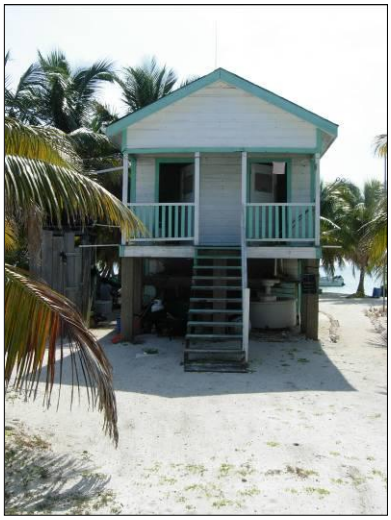
Laughing Bird Caye National Park, part of the larger Southern Belize Reef Complex system-level planning unit, lies in the general area of UTM 384 549 N, 1859 762 W (16˚26.59'N; 88˚11.85'W), 19.3 km (12 miles) east of Placencia, in the Stann Creek District (Map 1), and is one of seven marine protected areas which, combined, were inscribed as the Belize Barrier Reef Reserve System - World Heritage Site in 1996.

The protected area has developed around Laughing Bird Caye, a 1.4 acre long and narrow sand and shingle caye (1,400 feet long and between 20 and 120 feet in width (427m long and between 6.1m and 36.6m wide), that sits on an elongated ridge of the most southerly of Belize's coral faro formations. The Laughing Bird Faro rises out of deep water, with the Victoria Channel to the east and the inner lagoon to the west, and encloses a central lagoon area. Laughing Bird Caye National Park - the caye itself along with the immediate waters - was originally declared a protected area in 1991 under the National Parks System Act (SI 167 of 1991), to provide protection from increasing tourism impacts.

The National Park was later expanded to an area of 10,119 acres (approximate 41 square kilometres), to include the adjacent faro (SI 94 of 1994; Annex 1), in response to requests from conservationists and tour operators, who recognized the need for greater regulation if the qualities of the area were to be maintained. Laughing Bird Caye's beauty, proximity to Placencia Village and sheltered waters have made it a popular tourist destination for over 20 years.

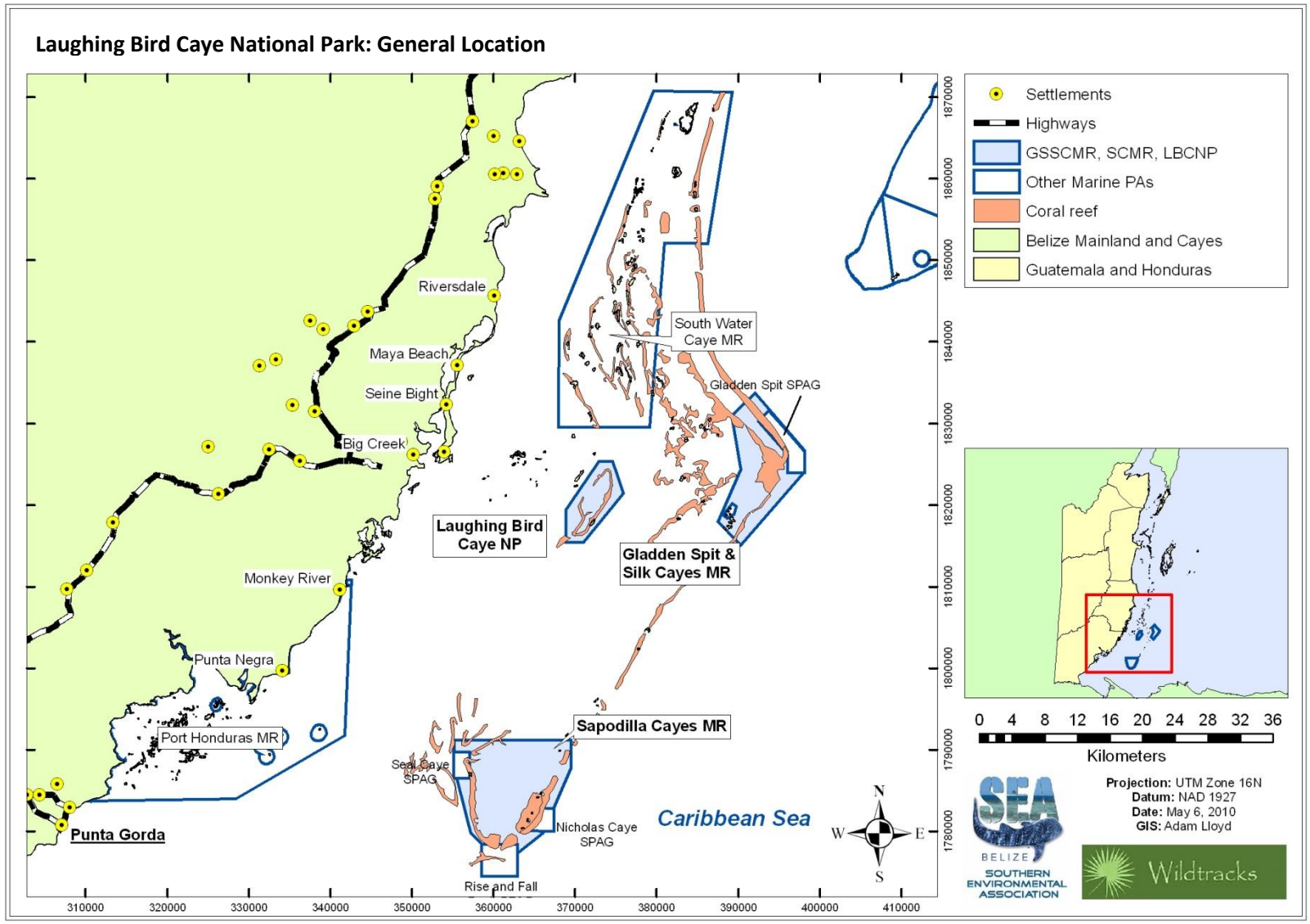
Access to the National Park is by sea, with increasing tourism visitation from coastal communities on mainland Belize. Boats originate primarily from Placencia – traditionally a fishing village that now also functions as a significant centre for tourism and coastal development. Smaller cruise ships also use the waters near Placencia during the tourist season, taking advantage of the deep Victoria Channel and have used Laughing Bird Caye in the past.

There are no permanent settlements within the National Park, but a number of communities exist on the mainland to the west of Laughing Bird Caye. The closest of these is Placencia. Other stakeholder communities include Independence, Seine Bight and Maya Beach / Riversdale, lying on the southern coastal plain.



The caye is divided into two zones. The first is the Recreational Zone, including the visitor infrastructure (barbeque pits, a palapa and picnic tables, and toilet block), and a rangers station, established in 2001 to provide more comprehensive enforcement of the rules and regulations.

Facilities of Laughing Bird Caye National Park Recreational Zone – Ranger's Station and Visitor Palapa



Map 1: Laughing Bird Caye National Park: General Location

The second zone is a 'no-entry' Preservation Zone that encompasses the naturally vegetated northern tip of the caye. Access is restricted to reduce disturbance to the bird and marine life.

Signs direct visitors to specific snorkelling areas to minimise impacts to shallow corals. Snorkelers and divers often use the areas around the caye, and Miss Pamela, a retired tugboat lying in 90 feet of water, was sunk to provide an artificial wreck site in March 2003, to create a new dive site.

Laughing Bird Caye: Preservation Zone (post Hurricane Richard)
(Photo: Dr. Annelise Hagan / SEA)

1.2 Regional Context

Laughing Bird Caye National Park is part of the Meso-American Reef (MAR), which stretches for more than 1,000 km along the coast of Belize, Guatemala, Honduras and Mexico. One of the most diverse ecosystems on earth, the MAR is considered outstanding on a global scale, and a priority for conservation action - stabilizing and protecting coastal landscapes, maintaining coastal water quality, sustaining species of commercial importance, and providing employment in the fishing and tourism industries for more than a million people living in coastal areas (Global Environment Facility, 2001).

Belize has an estimated 1,420 km² of reef within its waters - 5.5% of the reefs of the Wider Caribbean (World Resources Institute, 2004). The Belize Barrier Reef is included on a list of 18 richest centres of endemism and has been highlighted as one of the most threatened by human impacts (Roberts et al., 2002). In the Wider Caribbean region, recent studies have shown that nearly two-thirds of coral reefs are threatened by human activities (World Resources Institute, 2004), and recently, Belize has been shown to have a percentage live coral cover that is slightly lower than the average for the Caribbean (AGGRA /McField et al., 2008 (ed. Wilkinson et al., 2008)). Belize is one of the areas highlighted as having the lowest impacts, with its small population and relatively low coastal development rate. However impacts are increasing - recent quantitative data on fish populations comparing 2002 and 2008 observations in the Southern Belize Reef Complex indicate a staggering decline in populations of larger reef fish such as grouper, snapper, and triggerfish (Mumby, 2009[1]), a trend seen throughout the coastal

[1] Report to the Belize Fisheries Department: Fishing Down the Foodweb (P. Mumby, 2009)

shelf of Belize, increasing the importance of no-take areas such as Laughing Bird Caye National Park within the National Protected Areas System.

Table 1: International Conventions and Agreements of Relevance to Laughing Bird Caye National Park	
Convention on Biological Diversity (Rio de Janeiro, 1992) Ratified in 1993	To conserve biological diversity to promote the sustainable use of its components, and encourage equitable sharing of benefits arising from the utilization of natural resources. ***Laughing Bird Caye National Park provides an important and integral part in the national protected areas system, protecting biodiversity and threatened species, as per Belize's commitment under the CBD.***
Alliance for the Sustainable Development of Central America (ALIDES) (1994)	Regional alliance supporting sustainable development initiatives. ***Initiatives within the stakeholder communities of Laughing Bird Caye National Park are targeted for facilitation of sustainable economic and environmental development, with the support of the Forest Department***
Central American Commission for Environment and Development (CCAD) (1989)	Regional organisation of Heads of State formed under ALIDES, responsible for the environment of Central America. Initiated Mesoamerican Biological Corridors and Mesoamerican Barrier Reef Systems Programmes. ***Data gathered through monitoring initiatives at Laughing Bird Caye National Park have been shared regionally in the past through MBRS.***
Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena de Indias, Colombia, 1983)	Regional convention with the objective of protecting the marine environment of the Wider Caribbean through promoting sustainable development and preventing pollution. ***Laughing Bird Caye National Park is an important and integral part in the national protected areas system, protecting biodiversity and threatened species, as per Belize's commitment under this Convention.***
Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)	The World Heritage Convention requires parties to take steps to identify, protect and conserve the cultural and natural heritage within their territories. ***Laughing Bird Caye National Park has been accepted as one of seven sites that together comprise Belize's World Heritage Site under the Convention. However, this WHS has recently been placed on the list of 'sites in danger' (WHS, 2009).***
International Convention for the Protection and Conservation of Sea Turtles for the Western Hemisphere (December 21st, 1997)	To protected and conserve sea turtle species of the Western Hemisphere. ***Laughing Bird Caye National Park protects important feeding and nesting areas for sea turtles, including the Critically Endangered hawksbill***

The National Park contains assemblages of regionally important ecosystems of remarkable biodiversity and beauty, as well as of great scientific value, and importance for many species of global conservation concern, among them the critically endangered elkhorn and staghorn corals (*Acropora palmata* and *Acropora cervicornis*), hawksbill turtle (*Eretmochelys imbricata*) and the goliath grouper (*Epinephelus itajara*), The area also protects endangered green and loggerhead turtles (*Chelonia mydas* and *Caretta caretta*). As a non-extractive protected area, it also contributes towards the regional viability of important commercial species, including the Queen Conch (*Strombus gigas*) and spiny lobster (*Panulirus argus*).

In 1983, Belize signed the **Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region** (the 'Cartagena Convention') with the primary objective being protection of the ecosystems of the marine environment, following recognition of the regional importance of the Mesoamerican Barrier Reef System (MBRS), the majority of which lies within Belizean waters (Table 1).

The global importance of Laughing Bird Caye National Park was recognized in 1996, through its inclusion as one of a serial nomination of seven sites that comprise the Belize Barrier Reef System - World Heritage Site (Table 2), under the **Convention Concerning the Protection of World Culture and Natural Heritage representative of the Belize Barrier Reef Reserve System**, under criteria (iii), based on the classic examples of fringing, barrier and atoll reef types, and on the pristine nature of the mangrove and caye vegetation communities.

Table 2: The Seven Protected Areas of the Belize Barrier Reef World Heritage Site

Site	IUCN Category
Bacalar Chico National Park and Marine Reserve	II (National Park) IV (Habitat/Species Management Area)
Laughing Bird Caye National Park	II (National Park)
Half Moon Caye Natural Monument	II (Natural Monument)
Blue Hole Natural Monument	III (Natural Monument)
Glover's Reef Marine Reserve	IV (Habitat/Species Management Area)
South Water Caye Marine Reserve	IV (Habitat/Species Management Area)
Sapodilla Cayes Marine Reserve	IV (Habitat/Species Management Area)

In 2009, however, Belize's World Heritage Site was placed on the danger list, following an assessment of the state of the seven marine protected areas and of the human impacts affecting them, triggered by reports of mangrove clearance in the adjacent South Water Caye Marine Reserve. The Government is currently drafting a series of strategies to address the concerns of the WHS committee, including the designation of a National Focal Point, with strengthened coordination between Government departments, through the establishment of a WHS Working Committee, as well as the strengthening of protection of terrestrial ecosystems of the cayes, the cessation of sale of lands within the World Heritage Sites and guidelines to

control development of lands already under private ownership, as well as addressing the issues of overlapping oil concession areas. The future of Belize's World Heritage Site rests on this response, which is to be assessed at the World Heritage Committee at its 34th session in 2010.

Other concerns raised during the assessment that are more specifically related to Laughing Bird Caye National Park included the alteration of terrestrial ecosystems to maintain the aesthetically appealing sandy beaches, as a result of revenue generation mechanisms focused on tourism. The assessment also flagged the presence of invasive species such as *Casuarina* and lionfish, and the limited management activities being implemented to address these.

Other regional initiatives have also been initiated, with the recognition of the increasing threats to the overall health of the reef system, the Governments of Mexico, Belize, Guatemala and Honduras (the four countries bordering the MBRS) committed themselves in June 1997 through the Tulum Declaration to the development of a 15-year Action Plan – the **Mesoamerican Barrier Reef System Project** - for the conservation and sustainable use of this ecosystem. This initiative, adopted by the Heads of State in June 1999, is supported by the **Central American Commission on Environment and Development** (CCAD), which works to harmonize environmental policies within the region. This has also brought a level of standardization to management and monitoring practices across the region, and provided investment into increasing management effectiveness.

Conservation of this National Park is also a step towards fulfilling Belize's international commitments under the **Convention on Biological Diversity**, signed in 1992, and the **International Convention for the Protection and Conservation of Sea Turtles for the Western Hemisphere**, signed in 1997.

As a signatory of the **Convention for the Regulation of International Trade of Endangered Species** (CITES), Belize is obligated to follow the CITES permitting procedures, with a permit required for every individual export of conch (*Strombus gigas*), validated by Customs Department, in order for Belize to export this product to the USA. The Belize Fisheries Department has developed a sustainable use strategy for this species, in order to maintain its export market.

1.3 National Context

1.3.1 Legal and Policy Framework

Laughing Bird Caye National Park is a national protected area, defined by Statutory Instrument 94 of 1996 under the **National Parks System Act** (1981). The protected area is currently managed by the Southern Environmental Association, through a co-management agreement with the Forest Department (Ministry of Natural Resources).

Belize has an impressive record of establishing protected areas, with a total of 83 marine and terrestrial reserves, spawning aggregation sites, crown reserve cayes supporting important bird colonies, archaeological reserves, and recognized private reserves (NPAPSP, 2005). Almost 2,000,000 acres are designated for conservation (including sustainable resource use) – either as national or private protected areas.

The national objectives for conservation revolve around the protection, conservation and rational use of Belize's natural resources within the context of sustainable human development.

These goals are supported by the National Protected Areas Policy and System Plan (NPAPSP, 2005), which was developed following a full review of the national protected areas system in 2005.

LAUGHING BIRD CAYE NATIONAL PARK

SI 94 of 1996

ALL THAT portion of the Caribbean Sea comprising approximately 10,119 acres in the Stann Creek District, situate within and surrounding the Laughing Bird Caye Faro and being part thereof and being described as follows:

Commencing at a Point 'A' Northeast of Laughing Bird Caye having the scaled U.T.M. coordinates of 375 904 East and 1821 478 North;

thence in a Northwesterly direction to a Point 'B' North-Northwest of Laughing Bird Caye having the scaled U.T.M. coordinates of 374 630 East and 1825 363 North;

thence in a general Westerly direction to a Point 'C' North of Laughing Bird Caye having the scaled U.T.M. coordinates of 372 904 East and 1825 363 North;

thence in a Southwesterly direction to a point 'D' West-Northwest of Laughing Bird Caye and having the scaled U.T.M. coordinates of 368 860 East and 1819 430 North;

thence in a general Southerly direction to a Point 'E' Southwest of Laughing Bird Caye and having the scaled U.T.M. coordinates of 368 860 East and 1815 416 North;

thence in an Easterly direction to a Point 'F' having the scaled U.T.M. coordinates of 371 073 East and 1815 416 North; thence in a Northeasterly direction to the point of commencement.

The National Protected Areas Policy and System Plan was accepted by Cabinet in January 2006, and centres around the following policy statement:

> *The Government of Belize shall promote the sustainable use of Belize's protected areas by educating and encouraging resource users and the general public to properly conserve the biological diversity contained in these areas in order to maintain and enhance the quality of life for all. This shall be achieved by facilitating the participation of local communities and other stakeholders in decision-making and the equitable distribution of benefits derived from them, through adequate institutional and human capacity building and collaborative research and development.*

Laughing Bird Caye National Park is also an important component of Belize's strategies for conservation of the marine environment. Whilst the entire Barrier Reef and associated coral reef structures do not have full protected status within Belize, there are 13 marine protected areas within the national system (totalling 608,742 acres). Eight of these are designated under Fisheries Department as Marine Reserves, the remaining five (including Laughing Bird Caye National Park) being under Forest Department (Table 3).

Table 3: Marine Protected Areas in Belize

Protected Area	Mgmt. / Co-mgmt	IUCN Category	SI	Area (Acres)
Bacalar Chico National Park & Marine Reserve	Fisheries Dept.	IV	88 of 1996	15,765.8
Blue Hole Natural Monument	Forest Dept. / BAS	III	96 of 1996	1,023
Caye Caulker Marine Reserve	Fisheries Dept. / FAMRACC	VI	35 of 1998	9,670.2
Corozal Bay Wildlife Sanctuary	Forest Dept.	IV	48 of 1998	180,508.5
Gladden Spit and Silk Cayes Marine Reserve	Fisheries Dept. / Friends of Nature	IV	95 of 2003	25,978.3
Glover's Reef Marine Reserve	Fisheries Dept.	IV	70 of 1996	86,653
Half Moon Caye Natural Monument	Forest Dept. / BAS	II	30 of 1982	9,771
Hol Chan Marine Reserve	Fisheries Dept.	II	57 of 1987	3,813
Laughing Bird Caye National Park	Forest Dept. / Friends of Nature	II	94 of 1996	10,119
Port Honduras Marine Reserve	Fisheries Dept. / TIDE	IV	9 of 2000	100,000
Sapodilla Caye Marine Reserve	Fisheries Dept / TASTE	IV	117 of 1996	38,594
South Water Caye Marine Reserve	Fisheries Dept.	IV	118 of 1996	117,875
Swallow Caye Wildlife Sanctuary	Forest Dept. / FOSC	IV	102 of 2002	8,972

The Fisheries Department has also established 11 protected Spawning Aggregation Sites – the majority of the sites known within Belize waters, and a further 2 have seasonal protection for Nassau Grouper.

History of establishment

Traditionally, the Laughing Bird Caye itself was used as a fishing camp for fishers from Placencia, Independence and Monkey River, the 1.4 acres of caye, with its clear, sheltered waters, idyllic sandy beaches, and easy access to Placencia, has also historically been an important recreational site for local families. In the late 1970s, the caye started to be the focus of day trips from local hotels, with increasing use as more people in Placencia became involved in tourism. The importance of Laughing Bird Caye to the growing local tourism community catalysed concerns when rumours circulated in 1990 about the sale of the caye, and discussions on its use as an oil storage area, resulting in significant community lobbying for protection of the area (FoN Annual report, 2006).

As a result, Laughing Bird Caye itself was declared as a protected area in 1991 under the National Parks System Act (SI 167 of 1991). However, local stakeholders recognized the need for greater protection and regulation of the entire faro if the qualities of the area were to be maintained. The park was subsequently extended in 1996 (SI 94 of 1996) to 10,119 acres (4,095 ha), as part of Belize's World Heritage Site designation, to include the entire faro and the associated unique and representative biodiversity, and to manage, protect and promote the sustainable use of Laughing Bird Caye National Park.

Site Status

Laughing Bird Caye is designated as a National Park - one of five distinct categories of protected area under the mandate of the Forest Department (Ministry of Natural Resources) (Table 4). The purpose of a National Park is "protection of nationally important recreation areas," with the "protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public."

In keeping with its designation, LBCNP is a non-extractive protected area, with use being restricted to tourism, research and education.

Table 4: Categories of Protected Areas in Belize

Category	Legal Foundation	Purpose	Activities Permitted
Nature Reserve	National Parks System Act, 1981	To protect biological communities or species, and maintain natural processes in an undisturbed state.	Research, education
National Park *Laughing Bird Caye*	**National Parks System Act, 1981**	**To protect and preserve natural and scenic values of national significance for the benefit and enjoyment of the general public.**	**Research, education, tourism**
Natural Monument	National Parks System Act, 1981	To protect and preserve natural features of national significance.	Research, education, tourism
Wildlife Sanctuary	National Parks System Act, 1981	To protect nationally significant species, biotic communities or physical features.	Research, education, tourism
Forest Reserve	Forests Act, 1927	To protect forests for management of timber extraction and/or the conservation of soils, watersheds and wildlife resources.	Research, education, tourism, sustainable extraction
Marine Reserve	Fisheries Act, 1948	To assist in the management, maintenance and sustainable yield of fisheries resources	Sustainable extraction, research, education, tourism

The management regime of Laughing Bird Caye National Park is considered to be the equivalent of IUCN designation ***Category II: A protected area managed primarily for ecosystem protection and recreation.*** This is defined as:

> ***"Natural areas of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation detrimental to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible."***

With the following management objectives

1. To protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes;

2. To perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity;

3. To manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state;

4. To eliminate, and thereafter prevent, exploitation or occupation detrimental to the purposes of designation;

5. To maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation; and

6. To take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.

National Planning Strategies

The national objectives for conservation revolve around the protection, conservation and rational use of Belize's natural resources within the context of sustainable human development. These objectives are supported by the **National Strategy on Biodiversity**, through the National Biodiversity Strategy and Action Plan (Jacobs and Castaneda, 1998) (though this was never ratified at Government level), and more recently, the **National Protected Areas Policy and System Plan (NPAPSP**) (Meerman and Wilson, 2005), adopted by the Government of Belize in 2006. Management is theoretically guided by the National Protected Areas Policy and System Plan, although limited resources currently restrict effective management at Government level.

The overall goals of both the National Biodiversity Strategy and the NPAPSP reflect the national objectives - ecological and economic sustainability over the long term, with the development of human and institutional capacity to effectively manage the biodiversity resources within Belize. There are also moves towards decentralisation of the management of these resources, with a strong focus on co-management partnerships (such as that between SEA and the Forest Department), community-based participation and equitable benefit from conservation efforts.

Under the NPAPSP, government seeks to increase management effectiveness through grouping protected areas into system level management units. Laughing Bird Caye National Park is one of four protected areas (with South Water Caye Marine Reserve, Gladden Spit and Silk Cayes Marine Reserve and Sapodilla Cayes Marine Reserve) that, together, form the Southern Belize Reef Complex, transcending site-level administrative categories (Map 2).

Two other such system-level units are currently being established to increase management effectiveness by reducing overlap and maximizing on synergies – the Maya Mountains Massif and the Maya Mountains Marine Corridor (Table 5; Map 3).

System Level Management Unit	Protected Areas
Southern Belize Reef Complex *Total number of pas: 4 (including Spawning Aggregation Sites* *Total pa area: 182,447 acres* *Total seascape area:779,682 acres*	Laughing Bird Caye National Park; South Water Caye Marine Reserve, Gladden Spit and Silk Cayes Marine Reserve, Sapodilla Cayes Marine Reserve Spawning Aggregations: Rise and Fall Bank, Nicholas Caye, Seal Caye, Gladden Spit Bird Sanctuary: Man O' War Caye
Maya Mountains Massif *Total number of pas: 14* *Total pa area: 1,260,800* *Total landscape area:1,260,800 acres*	Bladen Nature Reserve; Chiquibul Forest Reserve; Chiquibul National Park; Cockscomb Basin Wildlife Sanctuary; Columbia River Forest Reserve; Deep River Forest Reserve; Maya Mountain Forest Reserve; Mountain Pine Ridge Forest Reserve; Noj Kaax Me'en Elijio Panti National Park; Sibun Forest Reserve; Sittee River Forest Reserve; Victoria Peak Natural Monument; Vaca Forest Reserve; (also includes Caracol Archaeological Site / IoA)
Maya Mountain Marine Corridor *Total number of pas: 10* *Total pa area: 619,933 acres* *Total landscape area:729,630 acres* *Total seascape area:100,000 acres*	Bladen Nature Reserve, Cockscomb Basin Wildlife Sanctuary, Columbia River Forest Reserve, Payne's Creek National Park, Deep River Forest Reserve, Golden Stream Corridor, Block 127, Maya Mountain Forest Reserve, Port Honduras Marine Reserve, Swasey Bladen Forest Reserve (also includes Num Li Punit Archaeological Site / IoA)

Table 5: System Level Management Units

Conservation Planning initiatives for these system level management units recognize that resources exist in a larger landscape beyond the boundaries of the protected areas themselves, and set out discrete goals and objectives at system rather than site-level, increasing management effectiveness through the development of mechanisms for collaboration for surveillance and enforcement, biodiversity monitoring, education, outreach, and management.

The Southern Belize Reef Complex

The **Southern Belize Reef Complex** (SBRC) stretches southwards from the northern boundary of South Water Caye Marine Reserve to the northern boundary of Port Honduras Marine Reserve, and south-eastwards from the coastline of Belize to the Sapodilla Cayes and the outer reef (Map 3). This area is characterized by the variety of reef structures, important cross-shelf habitat linkages and an assemblage of ecosystems considered possibly the most biodiverse in the region. The SBRC is of great scientific value and importance for many species of conservation concern, including the critically endangered hawksbill turtle *(Eretmochelys imbricata)* and goliath grouper (*Epinephelus itajara*), and the endangered green and loggerhead turtles (*Chelonia mydas* and *Caretta caretta*) (IUCN, 2008).

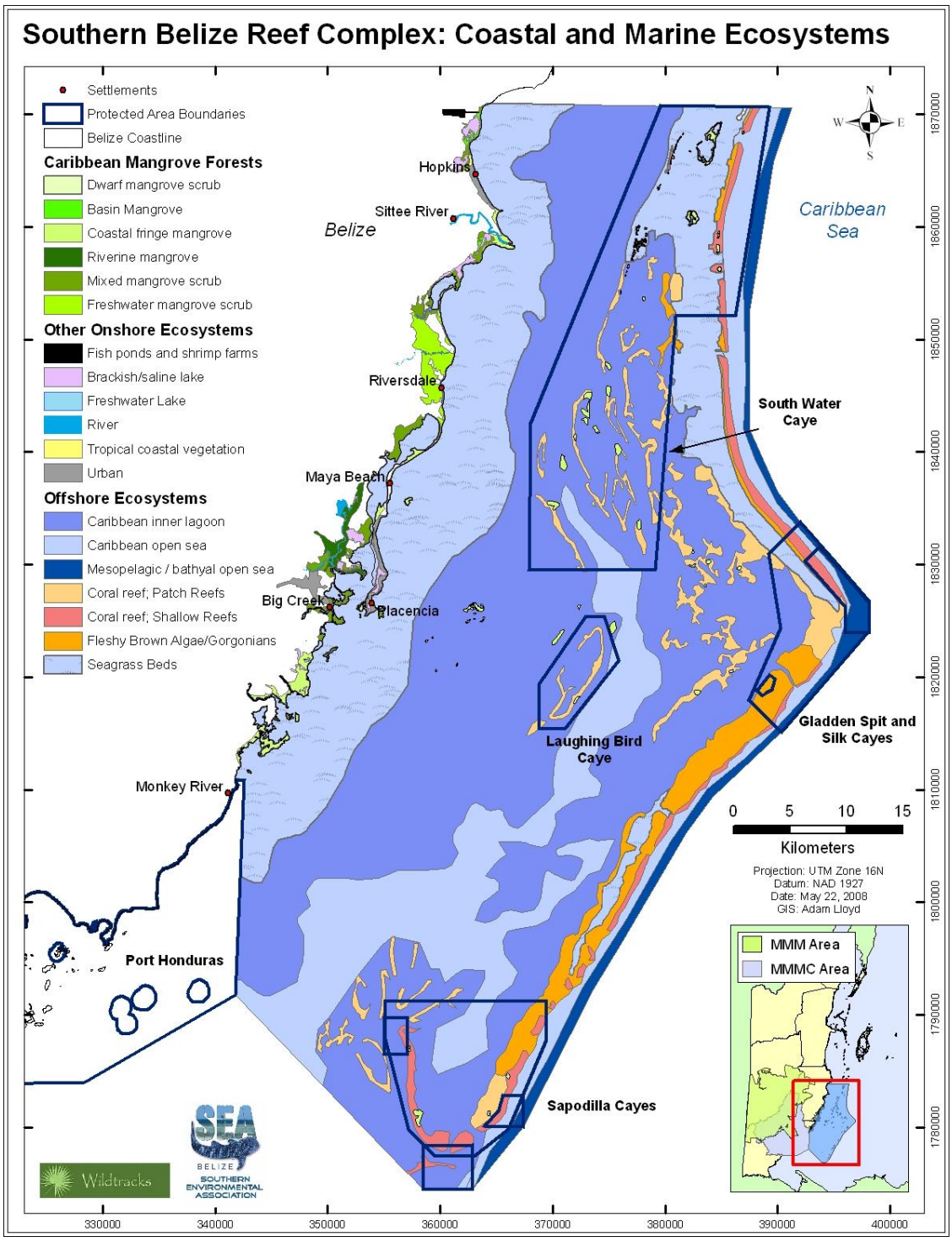
The SBRC encompasses Laughing Bird Caye National Park and three other marine protected areas - Sapodilla Cayes Marine Reserve, Gladden Spit and Silk Cayes Marine Reserve, and South Water Caye Marine Reserve. Laughing Bird Caye National Park, Sapodilla Cayes Marine Reserve and South Water Caye Marine Reserve are part of a serial nomination of seven sites that are recognized as components of the Belize Barrier Reef System - World Heritage Site, representing classic examples of fringing, faro and barrier reefs. Also covered within the scope of the SBRC are four legally protected critical spawning aggregation sites – the three sites within the Sapodilla Cayes Marine Reserve, and Gladden Spit, the largest aggregation known in the Mesoamerican Reef ecoregion.

Within the SBRC, the estuarine and coastal areas are considered important for the West Indian manatee, whilst the sandy beaches have a history of use as nesting sites for all three marine turtle species. The near shore mangrove nursery areas and seagrass are regionally important for recruitment for a significant number of the commercial marine species. These resources are an integral part in the support of the cultural traditions of the coastal fishing communities.

As part of the Southern Belize Reef Complex, management of Laughing Bird Caye National Park needs to be aligned to the SBRC vision, with the SBRC goals and objectives for system level management being incorporated into the management planning process.

A collaborative stewardship of the internationally recognized Southern Belize Reef Complex, through strategic partnerships to conserve and improve the integrity of these socio-economically and biologically important ecosystems for the benefit of future generations

A collective Vision for the Southern Belize Reef Complex
Belize CAP Workshop, May, 2008



Map 3: SBRC Project Scope

The project scope, running from the northern boundary of South Water Caye Marine Reserve south to the southern boundary of Sapodilla Caye Marine Reserve; and from the mangroves and littoral forests of the coastline to the barrier reef, was defined by the SBRC Core Planning Team, and then later amended following stakeholder input at the first Conservation Action Planning workshop.

Legal Framework

The conservation framework of Belize is supported by a number of laws designed to protect wildlife and national heritage within the country. The **National Parks System Act** (1982) is responsible for the establishment and management of protected areas (including Laughing Bird Caye National Park), and the **Wildlife Protection Act** (1982) addresses the need to protect wildlife resources - primarily terrestrial wildlife, but also the West Indian manatee, birds, fish[2], dolphins and crocodiles that may live within or pass through the protected area.

Also developed under the Ministry of Natural Resources are the **Forest (Protection of Mangrove) Regulations** (SI 52 of 1989, recently revised, 2010), which provide for the protection of mangroves, with restrictions on mangrove alteration and / or clearance. Before granting a permit for mangrove alteration, Belize law requires the Forest Department consider whether the project will adversely affect the conservation of the area's wildlife, water flow, erosion and values of marine productivity, and to find either 'that the proposed alteration will not significantly lower or change water quality' or that the degradation of water quality is in the "larger and long-term interest of the people of Belize" (Chapter 213, Section 5.5, Belize's Forest Act). Red mangrove is limited to the centre of the northern portion of the caye (Walker, site visit, 2010), and does not fulfil it nursery function for marine species, increasing the importance of adjacent mangrove areas for maintenance of commercial species such as lobster and snapper. All three of these Acts are administered by the Forest Department, under the Ministry of Natural Resources.

The **Fisheries Act** (1948), administered by the Fisheries Department (Ministry of Agriculture and Fisheries), is the principal governing legislation to regulate the fishing industry, and is directly concerned with maintaining sustainable fish stocks and protecting the marine and freshwater environments. It also provides protection for nesting turtles and nest sites. Marine turtles themselves have been given protection since the original Fisheries Ordinance in 1940.

The **Mines and Minerals Act** (1989) and the **Petroleum Act** (1991) regulate the exploration and extraction of all non-renewable resources, including petroleum. As Laughing Bird Caye National Park is included within an oil exploration area, granted to S.O.L. Oil Belize Ltd. this is of significant concern to the management of the protected area, and to the World Heritage Site Convention. Under the UNESCO review of the World Heritage Site (the Belize Barrier Reef Reserve System), a recommendation is made that protected areas within the BBRRS, including Laughing Bird Caye National Park, be excluded from mining and oil prospecting and extraction license areas.

[2] Forest Department has rights over fish within the National Park and Fisheries Department has rights for them outside. This was confirmed for LBC when there were issues of shark feeding at LBCNP and BHNP

Whilst the above are the legislative Acts directly relevant to Laughing Bird Caye National Park, there are others that are also of relevance. The **Environmental Protection Act** (1992) was drawn up under the Department of the Environment (Ministry of Natural Resources), with the aim of ensuring that development initiatives within Belize are planned for minimum environmental impact – in the context of Laughing Bird Caye National Park, this is particularly important when ensuring that the impacts on the protected area from development in adjacent areas are minimized – particularly dredging or any potential oil exploration activities.

Any caye development in the adjacent area is regulated through the requirement for an Environmental Impact Assessment (EIA), under the associated **Environmental Impact Assessment Regulations** (SI 105 of 1995) which controls and regulates the EIA process. Under this legislation, an accepted EIA results in the production of an Environmental Compliance Plan (ECP), which is then to be approved and monitored by the DoE. The DoE is also responsible for responding to human impacts on the reef, such as pollution, boat groundings and fuel spills. DoE has a mechanism in place for assessment of damage from boat groundings, based on the area impacted.

The Port Authority is mandated to ensure the safety of navigational channels, through the installation of navigational aids (**Belize Port Authority Act**, 1976; revised, 2003), and installation and maintenance of demarcation buoys. It also has a role in the registration of boats and monitoring of vessels using navigational channels and the removal of boats from the reef, when groundings occur.

Financial sustainability is partially addressed at Government level through the development of a funding mechanism to assist in management and development activities within protected areas – the Protected Areas Conservation Trust (**PACT Act**, 1996), through a 'conservation tax' of Bz$7.50 levied on non-residents as they leave the country. The Southern Environmental Association, as the co-management partner, is eligible for funding from the Trust, and has received funding in the past.

There is currently significant fragmentation in decision making, with these different Acts falling under different Ministries. This is being addressed through the implementation of the **National Protected Areas Policy and System Plan** (NPAPSP, 2005; Figure 1), currently guided by two bodies - the National Proteted Areas Secretariat, which is itself guided by the National Protected Areas Technical Committee (NPATC). More recently, the Policy Coordination & Planning Unit of the Ministry of Natural Resources and the Environment has been tasked to strengthen the NPATC and ensure a greater level of inter-departmental communication and coordination than has been the case to date.

National Protected Area Policy Declaration

Recognizing that:

Protected areas in Belize provide irreplaceable public benefits from ecosystem services such as clean water, clean air, carbon sinks, gene pools, baseline data for research and development, all of which contribute to the local, national and regional economies,

And that:

Protected areas are an important resource base for the development and strengthening of economic activities and contribute to poverty elimination by supporting industries such as agriculture, tourism, fisheries, timber and non-timber products, research, bio-prospecting, mining, water and energy services among others:

The Government of Belize shall promote the sustainable use of Belize's protected areas by educating and encouraging resource users and the general public to properly conserve the biological diversity contained in these areas in order to maintain and enhance the quality of life for all. This shall be achieved by facilitating the participation of local communities and other stakeholders in decision making and the equitable distribution of benefits derived from them, through adequate institutional and human capacity building and collaborative research and development.

General Principles:

The Government of Belize shall:

1. ***Assure, for all Belizeans, safe, healthy, productive, aesthetically and culturally pleasing surroundings by preserving important historic, cultural, aesthetic and natural aspects of Belize's natural heritage;***

2. ***Promote the widest range of beneficial uses of biodiversity without degradation, risk to health or safety, or other undesirable and unintended consequences in order to provide for sustainable economic development;***

3. ***Achieve a balance between population and biodiversity resource use which will permit a higher standard of living and the conservation of natural resources for future generations;***

4. ***Enhance the quality of renewable resources and strive for the optimum use of non-renewable resources.***

NPAPSP, 2005

Figure 1

1.3.2 Land and Sea Tenure

Laughing Bird Caye National Park is included in Belize's territorial waters (Maritime Areas Act of 1992). The seabed are national land, and thus any activities need to be licensed by the Lands Department. Any mining, including beach sand mining or dredging activities, and oil exploration / drilling activities, require a license from the Geology & Petroleum Department. A single caye – Laughing Bird Caye – lies within the National Park.

1.3.3 Evaluation of Protected Area

Global Importance

Laughing Bird Caye National Park (LBCNP) has been designated as one of seven components of the Belize Barrier Reef System - World Heritage Site, in recognition of the uniqueness of its contribution to Belize's reef system, the largest, and possibly the least impacted reef complex in the Atlantic–Caribbean area (UNESCO, 1996). Declared in 1991, at first the park only protected Laughing Bird Caye itself, but was then expanded in 1996 to include all of the Laughing Bird Faro.

In keeping with its designation as a National Park, LBCNP is a completely no-take protected area and is recognized for supporting extraordinarily high biological diversity. The park provides nursery and feeding habitats for at least twenty three species of international concern, recognized under the IUCN Redlist as Critically Endangered, Endangered or Vulnerable (Table 6; IUCN, 2010), including five species of coral, three species of turtle, fifteen species of fish and the vulnerable West Indian manatee. The faro itself is home to a

Laughing Bird Caye National Park Species of International Concern	
Critically Endangered	
Staghorn Coral	*Acropora cervicornis*
Elkhorn Coral	*Acropora palmata*
Goliath Grouper	*Epinephelus itajara*
Hawksbill Turtle	*Eretmochelys imbricata*
Endangered	
Loggerhead Turtle	*Caretta caretta*
Green Turtle	*Chelonia mydas*
Nassau Grouper	*Epinephelus striatus*
Boulder Star Coral	*Montastraea annularis*
Star Coral	*Montastraea faveolata*
Great Hammerhead	*Sphyrna mokarran*
Vulnerable	
Lamarck's Sheet Coral	*Agaricia lamarcki*
Queen Triggerfish	*Balistes vetula*
Pillar Coral	*Dendrogyra cylindrus*
Marbled Grouper	*Dermatolepis inermis*
Elliptical Star Coral	*Dichocoenia stokesii*
White Grouper	*Epinephelus flavolimbatus*
Snowy Grouper	*Hyporthodus niveatus*[1]
Hogfish	*Lachnolaimus maximus*
Mutton Snapper	*Lutjanus analis*
Cubera Snapper	*Lutjanus cyanopterus*
Montastraea coral	*Montastraea franksi*
Yellowmouth Grouper	*Myctoperca interstitialis*
Rough Cactus Coral	*Mycetophyllia ferox*
Whale Shark	*Rhincodon typus*
Whitelined Toadfish	*Sanopus greenfieldorum*
Rainbow Parrotfish	*Scarus guacamaia*
West Indian Manatee	*Trichechus manatus*

[1]Formerly *Epinephelus niveatus*

Table 6: Species of International Concern of Laughing Bird Caye National Park

wide variety of unique habitats. Laughing Bird Caye has also historically provided nesting sites for hawksbill and green turtles, important to the survival of these species within the region.

National Importance

Laughing Bird Caye National Park encompasses the entire Laughing Bird Faro, with fringing reefs and a central lagoon dominated by hardy species that can tolerate varying levels of salinity and turbidity, conditions that may provide greater resilience to climate change, increasing this MPA's importance within the marine protected areas system, contributing towards the long term viability of coral reefs in Belize.

The National Park is one of four protected areas that form the Southern Belize Reef Complex (SBRC), which stretches southwards from the northern boundary of South Water Caye Marine Reserve to the northern boundary of Port Honduras Marine Reserve, and south-eastwards from the coastline of Belize to the Sapodilla Cayes and the outer reef. This area is characterized by its variety of reef structures, important cross-shelf habitat linkages and an assemblage of ecosystems considered possibly the most biodiverse in the region. The SBRC is of great importance for many species of conservation concern, including the critically endangered hawksbill turtle and goliath grouper, and the endangered green and loggerhead turtles (IUCN, 2008). The caye itself provides critical nesting beaches for hawksbill turtles.

As a non-extractive protected area Laughing Bird Caye National Park serves as an important source for a wide variety of commercial species. The high density of conch within the park has been highlighted by a number of researchers as proof that the no-take zones are working (Finch et al., 2008). Other species such as spiny lobster and finfish also flourish within the park's boundaries, leading fishermen to work the edges of the park in order to capitalize on the impacts of the no-take zones.

Laughing Bird Caye National Park has now become a major attraction for snorkelers and divers, and is important in sustaining the tourism industry of the central Belize coastal communities – especially Placencia. Placencia is a major contributor to the national tourism income for Belize.

1.3.4 Socio-Economic Context

Belize has a low population currently estimated at approximately 307,900 (Figure 2; CIA, 2010), of which 51.2% are urban dwellers (UN data, 2007[3]). Population densities are low, with just over 13.1 persons per sq. km., concentrated mostly within the northern plain, southern coastal plain, Belize Valley and Stann Creek Valley, with much of the remaining country being less suited to habitation, with swampy lowlands and steep terrain in the Maya Mountains. It is a country of many ethnic cultures, with Mestizo, Creole, Maya and Garifuna being the major population groups (Figure 3). The Maya occupants of Belize, descendants of the original Central American civilization, at its height approximately 2,000 years ago, are subdivided into three ethnic groups – the Yucatec Maya of the north, the Mopan Maya of the west and south, and the Ketchi of the southern regions. The northern coastal fishing communities are based on the Mestizo culture, being settled in the 1850's by refugees from the Mexican Caste War. Communities in central Belize, particularly those of the Belize River Valley, are predominantly Creole, founded on the descendents of slaves brought to Belize direct from Africa, or via the West Indies, to work in the logging industry in the late 1700 / early 1800s. The southern coastal communities are more Garifuna based (descendents of Black African / Carib Indian), being settled by refugees who sailed to Belize from St. Vincent's in the West Indies.

Figure 2: Belize Demographic Statistics (Average)

Population (2010 est.)	307,899
Population density (2008 est)	13.1/sq. km.
Annual growth rate (2010)	2.2%
Birth rate (2010 est.)	27.3 per 1000
Mortality rate (2010 est.)	5.8 per 1000
Fertility rate (2010)	3.3 children per woman
Life expectancy (2010)	78 (female); 74 (male)
Below Poverty level	33.5% (2002)
	43% (2010)
Literacy rate (2010)	76.9%
Unemployment rate (2008)	8.2%
GDP (2008)	Bz$2.75 million
GDP (per capita, 2008)	Bz$9,138 per capita

Ref: UN data, 2010
CIA Factbook, 2010
Ministry of Health
CSO, Mid-term 2004
CSO, Poverty Assessment Report, 2002

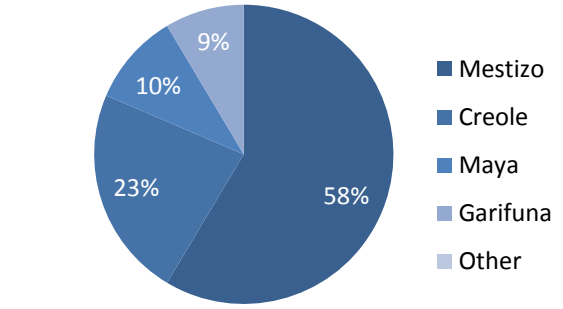


Figure 3: Belize Demographic Statistics

There is an ongoing emigration of Belizeans to the United States – generally those from urban areas who have completed secondary school or have professional training. There is also a significant influx of Central American refugees – primarily from Guatemala and Honduras – with an estimated 20% of heads of households being born outside of Belize (2010 Poverty assessment data).

[3] World Statistics Pocketbook | United Nations Statistics Division

The economy of Belize has, in the past, been based largely on agriculture, with fisheries, banana, sugar and citrus forming some of the traditional exports that contribute significantly towards the GDP. This has recently been exceeded by revenue from oil extraction, and there is an increasing reliance on the developing tourism industry, which is rapidly becoming the major foreign exchange earner.

While fishing is prohibited within Laughing Bird Caye National Park, the fishing industry does have a significant impact on the viability of the commercial fish stocks of the marine protected area, and provides the historical context for the protected area. This traditional industry provides employment for over 2,240 fishers and over 120 processing plant personnel (Ministry of Agriculture and Fisheries, 2008). The majority of the fishermen that use the area adjacent to Laughing Bird Caye National Park originate from the mainland communities of Hopkins, Sittee River, Riversdale, Seine Bight (including Maya Beach), Placencia, Independence and Monkey River, the northern coastal community of Sarteneja, and to a lesser extent, Copper Bank and Chunox.

Fishing techniques vary, with the more southerly communities using hand lines for finfish, particularly the traditional fishers permitted to use the spawning aggregation sites during the spawning season. There is a switch to free-diving for spiny lobster and queen conch at the opening of lobster and conch seasons. Fishermen from the northern communities focus more on lobster and conch, and fish these more intensively throughout the shallow protected lagoon of the Belize Barrier Reef, during the open season. Fishermen tend to be between 15 and 35 years of age, often with limited education. Alternative job opportunities in many of these coastal communities, particularly those of the north, are limited, with many fishermen leaving primary school to go directly into fishing (FAO, 2005; SACD, 2009[4]). Hopkins, Monkey River and Placencia, in the south have been able to shift with varying degrees of success to a greater dependence on tourism (Hopkins public consultation, 2010).

[4] Sarteneja Tourism Development Plan (SACD, 2009)

The Fisheries Sector (including aquaculture) ranked 4th in its contribution to the national GDP, though the actual percentage contribution has declined from 23% in 2006 to 1.5% in 2008, as petroleum exports and tourism sectors continue to grow. Fisheries products are composed of two major components – capture fisheries (predominantly lobster, conch and finfish – representing approximately 45%) and aquaculture (shrimp and tilapia – 55%), primarily for the export market. The primary exploited capture fisheries species, lobster and conch, have both declined since the early 1980s, when the industry was at its peak. It is estimated that 80% of the lobster and conch is exported through the four fishing cooperatives, and the remaining 20% is sold for local consumption (Cooper et al., 2008), with the majority of the finfish being marketed locally. Capture fisheries export earnings totalled approximately Bz$20.5 million dollars in 2008, primarily from the traditional lobster and conch capture fisheries (Ministry of Agriculture and Fisheries, 2008).

The developing tourism industry, one of the fastest growing sectors in Belize, is also rapidly becoming one of the major foreign exchange earners, with over 840,000 tourists arriving in Belize in 2008 (Belize Tourism Board (BTB), 2009). Of

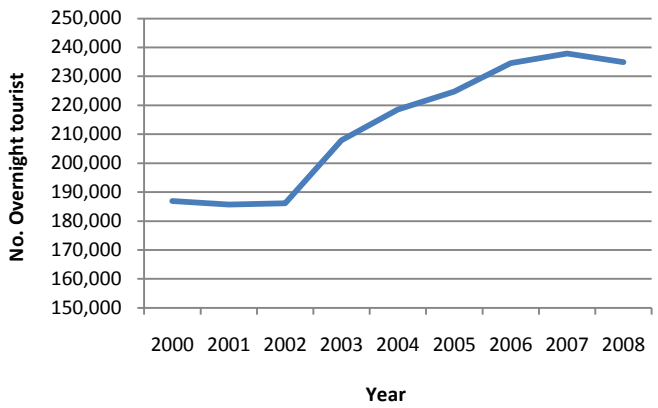


Figure 4: Belize International tourism arrivals (2000 – 2008) (BTB, 2009)

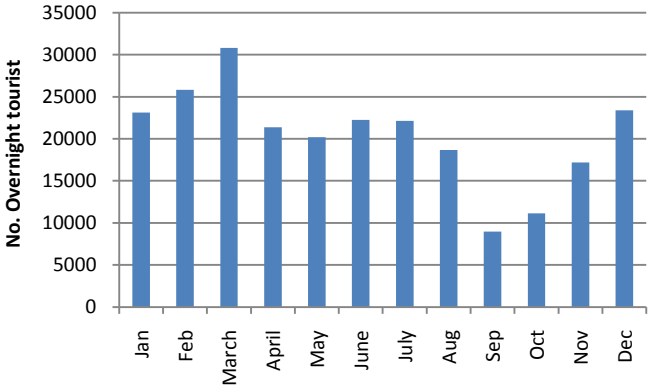


Figure 5: Belize International tourism arrivals per month (2008) (BTB, 2009)

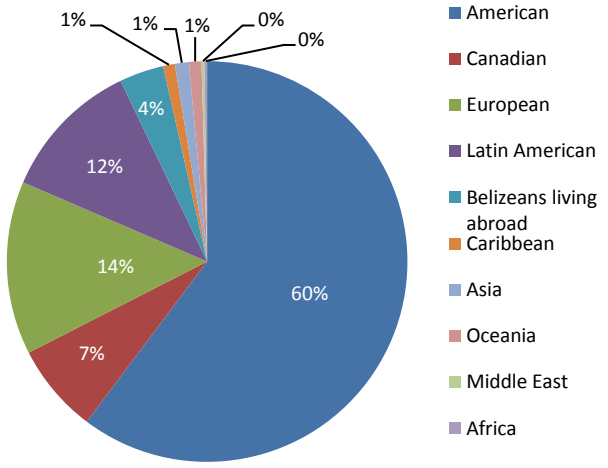


Figure 6: Belize International tourism arrivals by origin (2008) (BTB, 2009)

these, 234,929 (approximately 28%) are overnight visitors (Figure 4), the balance being cruise ship visitation.

Overnight tourism in Belize shows a distinct seasonality, with the majority of visitors arriving in the first quarter of the year. The lowest months are September and October, the main tropical storm season (Figure 5).

Laughing Bird Caye, the closest caye to the central Belize coastline with beach rather than mangrove, is ideally situated for tourism. Placencia, the main departure point for tours to Laughing Bird Caye, started as a small fishing community with ten hotels (with 58 beds) in 1988, and has since developed into a major tourism destination, with 99 hotels (with 706 beds), with tourism operations generating 12.4% of the national hotel room revenue for 2008 (BTB, 2009). Reef based tourism now also provides substantial employment opportunities for local guides and tourism developments on the mainland. In 1994, tourism in Placencia provided an estimated 19 people with direct employment steadily increasing to 429 in 2008, approximately 28% of the population of Placencia – a significant shift from fishing to a tourism-based economy.

Placencia is just one of a number of communities that have been identified as major stakeholders in the protected area, directly through tourism, or more indirectly through its impacts on commercial fishing (Table 7; Map 4).

State of Tourism in Belize

Tourism is the third ranking productive sector in Belize, contributing Bz$952.9mn to GDP in 2010, with projections suggesting that this will increase to 34.2% (Bz$1,020mn) in 2021. The tourism sector provided an estimated 39,000 jobs in 2011, 31% of total national employment. This is predicted to increase to 61,000 jobs, 36% of total employment by 2021 (WTTC, 2011).

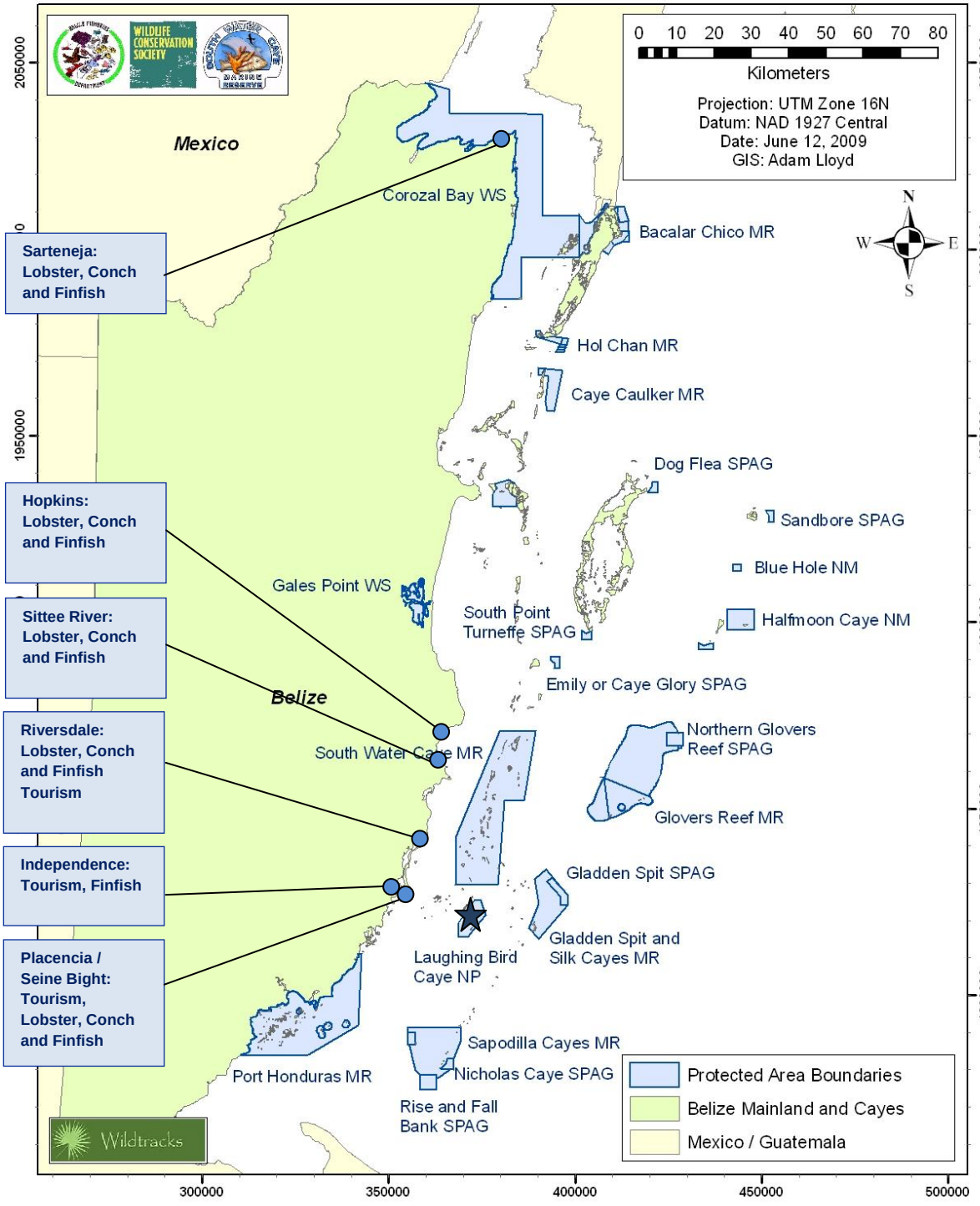
2008 statistics show that the cruise ship visitors far outnumber overnight visitors, but provide less income for the country – it is estimated that the average cruise passenger inputs $44 per day into the local economy, while the average overnight visitor spends $96 per day - more than twice as much. Per visit, stay-over visitors spend on average 6.8 days in Belize, which translates into an average of $653, or over 14 times more than the average cruise passenger (BTB, 2009).

Currently (2010), Placencia is being targeted as a potential cruise ship tourism destination, and is faced with the decision as to whether to follow this path, or maintain its current reliance on overnight tourism.

Table 7: Stakeholder Communities of Laughing Bird Caye National Park				
Community	**Location (UTM) Distance (km)**	**Population (approx.)**	**Population components**	**Comments**
Placencia (including Riversdale)	E16 03653894 N18 26544 (16 km west)	1,200[1]	Predominantly Creole	Historically a fishing community – now a primarily tourism based economy. Main promoter and user of Laughing Bird Caye National Park. (Includes Riversdale).
Sarteneja	E16 0378750 N18 29500 (210 km north)	2,300[2]	Mestizo	Largest fishing community, concentrating on lobster and conch throughout Belize waters using traditional sail boats. Largest number of fishermen utilizing the SBRC.
Independence	E16 0348723 N18 27872 (20 km west)	2,880[4]	Mixed primarily Creole	Primarily a residential area for employees in Placencia and Big Creek, and in the citrus industry. Some tourism, mostly associated with Placencia, and a small number of fishermen, who target the areas around LBCNP.
Seine Bight	E16 0363200 N 18 64680 (20 km west)	831[4]	Garifuna	Historically a fishing community – now moving towards a tourism-based economy. Traditionally used LBCNP as a camp for fishing trips and for cultural activities associated with the Dugu ceremony. Now use Buttonwood Caye. Current (2010) issues with manatee slaughter for meat.
Hopkins	E16 0363200 N18 64680 (25 km north)	1,027[3]	Garifuna	No traditional or recent use of LBCNP, but benefits from participation in SEA educational activities, focused on the National Park

[1]SEA; [2]Sarteneja Health Committee, 2005; [3]CSO Census data, 2000; [4]Abstract of Statistics, 2007

Primary Stakeholder Communities of Gladden Spit and Silk Cayes Marine Reserve



Map 4: Laughing Bird Caye National Park: Principal Stakeholder Communities

Until it was declared a no-take area (NTA), Laughing Bird Caye was an important fishing location for both conch and lobster extraction. The caye itself was used as a fishing camp, with fishermen occasionally also bringing their families out for day trips, for recreation purposes (N. Gray). Sarteneja, the largest fishing stakeholder of the area before its designation, had 8 vessels (an estimated 56 fishermen) frequently and predictably fishing in the areas around the caye and the associated faro (Moretti / CI, 2009), the fishermen learning the specific reef patches and currents of the faro when joining the boats at a young age. Following the establishment of the National Park, a number of these fishermen shifted their area of focus to the reef adjacent to the boundaries, whilst others moved to different areas. As most of the Sarteneja boats work areas of reef much larger than the protected area, the impact was considered to be relatively small on the fishermen in general, and at most had a slight impact on a small number of fishermen who adjusted relatively easily (Moretti).

Whilst Placencia fishermen considered themselves to be integrated into the establishment process for the National Park, there was a general consensus among Sarteneja fishermen that despite being the largest fishing stakeholder of the area, they were not consulted prior to the establishment of the protected area.

With the erosion of the traditional preferential markets for Belize's sugar in the European Union and in the United States of America coupled with the market low prices, there has been a shift in two other northern communities - Chunox and Copper Bank - away from farming and into fishing, increasing the total number of active fishermen active on the reef, (FAO, 2010), but without the traditional fishing background, traditional fishing areas, training and respect for the reef found in the older, more established fishing communities, some comment that these fishermen are less inclined to fish within the legal framework. This is also considered a problem with some of the younger fishermen of Sarteneja (Sarteneja community consultation, Sarteneja, 2010).

A basic stakeholder analysis identifies stakeholder interests and impacts (Table 8).

Table 8: Stakeholder Analysis for Laughing Bird Caye National Park				
Stakeholder	**Influence or Impact of Laughing Bird Caye National Park on Stakeholder**		**Influence or Impact of Stakeholder on Laughing Bird Caye National Park**	
Community Stakeholder Hopkins, Sittee River, Seine Bight, Riversdale, Placencia, Monkey River, Independence	▪ Management of reef for tourism and as a fisheries source area ▪ Providing stakeholders with an option to shift income base from fisheries dependency to tourism, with increased economic benefits ▪ SEA, as co-management agency, focused on education, awareness and alternative livelihoods for fishermen, associated with the protected area ▪ Protection of reef resources in perpetuity for future generations ▪ Exclusion from traditional fishing areas	+ + + + -	▪ Active cooperation and collaboration from tourism stakeholders towards effective protected areas management ▪ Lower impact of reef tourism implementation through adoption of Best Practices by tourism stakeholders through awareness and alternative livelihood training ▪ Illegal fishing within the National Park ▪ Anchor damage to coral and seagrass ▪ Seine Bight - community members engaged in killing manatees for meat ▪ Sittee River – not an active participant in management at Board level	+ + - - -
Community Stakeholder Sarteneja	▪ Management of reef and spawning aggregation site for fisheries ▪ Protection of fish, lobster and conch resources within the National Park ensuring continued viability of fishery ▪ Exclusion from traditional fishing areas	+ + -	▪ Low level of cooperation or openly antagonistic towards protected area ▪ Illegal fishing within the National Park ▪ Fishing impacts within protected areas (including damage to coral) ▪ Anchor damage to reef	- - - -
Commercial Fishermen	▪ Protection of fish, lobster and conch resources within the National Park ensuring continued viability of fishery ▪ Exclusion from traditional fishing areas	+ -	▪ Some support for effective management of protected area (southern communities) ▪ Some fishermen have low level of cooperation or are openly antagonistic towards protected area ▪ Illegal fishing within the National Park ▪ Anchor damage to reef	+ - - -

Table 8: Stakeholder Analysis for Laughing Bird Caye National Park (cont.)				
Stakeholder	**Influence or Impact of Laughing Bird Caye National Park on Stakeholder**		**Influence or Impact of Stakeholder on Laughing Bird Caye National Park**	
Tour Guides (including tour boat captains)	▪ Benefit from having Laughing Bird Caye National Park as a major venue for snorkelling and dive-associated tourism	+	▪ Support the conservation goals of Laughing Bird Caye National Park	+
	▪ Benefit from the management of tourism access to the whale shark congregation at Gladden Spit as a major venue for snorkelling and dive-associated tourism	+	▪ Provide interpretation for visitors, facilitating overall visitor appreciation	+
	▪ Benefit from training opportunities associated with Laughing Bird Caye National Park	+	▪ If well trained, assist with visitor management within the protected area through in-depth briefings	+
	▪ Employment in reef-based tourism initiatives	+	▪ If poorly trained, can result in poor visitor management and increased impact on corals and associated fauna, anchor damage etc.	-
	▪ Income from using Laughing Bird Caye National Park for tourism	+	▪ Impact behaviour of fish through feeding	-
			▪ Potential impact on spawning aggregation and whale sharks from dive boat noise impacts	-
			▪ Anchor damage to coral and seagrass	-
			▪ Illegal fishing impacts within National Park from overnight sail charters	-
			▪ Camping impacts on Silk Cayes from kayak groups	-
Local / National Tour Operators	▪ Benefit from having Laughing Bird Caye National Park as a major venue for dive- and snorkelling-associated tourism	+	▪ Provide marketing at a national level, and send visitors to Laughing Bird Caye National Park	+
	▪ Income from using Laughing Bird Caye National Park as a tourism destination	+	▪ Support the conservation goals of Laughing Bird Caye National Park	+
			▪ Provide a financial sustainability mechanism for management of the protected area	+
			▪ Increase the potential for exceeding the carrying capacity of the protected area	-

Table 8: Stakeholder Analysis for Laughing Bird Caye National Park (cont.)				
Stakeholder	**Influence or Impact of Laughing Bird Caye National Park on Stakeholder**		**Influence or Impact of Stakeholder on Laughing Bird Caye National Park**	
International Tour Operators	▪ Benefit from having Laughing Bird Caye National Park as a venue for dive- and snorkelling-associated tourism ▪ Income from using Laughing Bird Caye National Park as a tourism destination	+ +	▪ Provide marketing at an international level, and send visitors to Belize, who may visit Laughing Bird Caye National Park ▪ Support the conservation goals of Laughing Bird Caye National Park ▪ Provide a financial sustainability mechanism for management of the protected area ▪ Increase the potential for exceeding the carrying capacity of the protected area	+ + + -
BTIA	▪ Benefit from having Laughing Bird Caye National Park as a tourism destination ▪ Benefit from global recognition of Belize as having a World Heritage Site, based on the pristine and unique value of the Belize Barrier Reef – including LBCNP	+ +	▪ Providing national and international marketing of Laughing Bird Caye National Park ▪ Support the conservation goals of Laughing Bird Caye National Park	+ +
General Belize Public	▪ Maintenance of fish, lobster and conch stocks ▪ Benefit from global recognition of Belize as having a World Heritage Site, based on the pristine and unique value of the Belize Barrier Reef – including LBCNP ▪ Environmental services ▪ Cultural and aesthetic appreciation ▪ Increased awareness through education	+ + + + +	▪ Support of the general public will strengthen the position of protected area ▪ Lack of support may increase chances of dereservation	+ -
Visitors: Tourists	▪ Enjoy Laughing Bird Caye National Park as a tourism destination ▪ Benefit from education and awareness opportunities	+ +	▪ Entrance fee contributes towards the goal of sustainability ▪ Provide marketing nationally and internationally by word of mouth, if happy with level of product ▪ Presence deters illegal fishing within the National Park ▪ Negatively impact marine and terrestrial environments	+ + + -

Table 8: Stakeholder Analysis for Laughing Bird Caye National Park (cont.)				
Stakeholder	**Influence or Impact of Laughing Bird Caye National Park on Stakeholder**		**Influence or Impact of Stakeholder on Laughing Bird Caye National Park**	
Visitors: Researchers	▪ Benefit from being linked to the Southern Environmental Association and Laughing Bird Caye National Park ▪ Benefit from access to a virtually pristine reef environment and relatively unique faro structure ▪ Benefit from historic baseline information on past research activities within protected areas ▪ Benefit from access to a World Heritage Site	+ + +	▪ Conservation management benefits from data gathered, greater knowledge of marine and terrestrial environments and species within area ▪ Benefit from increased research activity within area ▪ Benefit from increased presence, deterring fishing incursions ▪ Possible impact of research activities on marine environments	+ + + -
Sailboat Charter Companies	▪ Benefit from protection of Laughing Bird Caye National Park as a major bareboat destination	+	▪ Support the conservation goals of Laughing Bird Caye National Park ▪ Impacts of sewage and detergent, bilge water. grey water and oil ▪ Anchor damage on mooring sites ▪ Potential for grounding on the reef ▪ Lack of compliance to rules and regulations due to limited awareness ▪ Subsistence fishing within National Park	+ - - - - -
Government of Belize	▪ Provides fisheries management for fishing Industry ▪ Provides environmental services towards the health of the nation of Belize ▪ Laughing Bird Caye National Park included within the National Protected Areas System Plan - assists in fulfilling Belize Government's commitment to the conservation of natural resources, CCAD, CBD, and MBRS ▪ Income generation of significant foreign revenue as a contributing factor towards Belize's attraction as a tourism destination ▪ Provides employment opportunities in stakeholder communities	+ + + + +	▪ Political support (currently being strengthened through the NPAPSP) ▪ Lack of political support for and understanding of conservation ▪ Uncertainty of long term future commitment	+ - -

1.4 Physical Environment of Management Area

1.4.1 Climate

Temperature and Rainfall

Whilst Laughing Bird Caye National Park lies only 17 km south east of Placencia, it has a distinct climate that differs from the mainland. Meteorological, oceanographic, and biological conditions have been recorded within the adjacent South Water Caye Marine Reserve, at Carrie Bow Caye (34 km to the north), since 1993, following its selection as a long term monitoring site, under the Caribbean Coastal Marine Program (CARICOMP) - one of the longest continuous programs of its type. Principal parameters recorded are land-sea-water temperatures, water salinity (conductivity), dissolved oxygen, solar radiation, tides, wind direction and speed, and rainfall (CCRE 2002), providing data that is also applicable to Laughing Bird Caye National Park.

Rainfall varies throughout the year - there is a pronounced dry season stretching from January through to the end of April, with minimum monthly rainfall as low as 47mm in April, the driest month. This is followed by a wetter season (May to December) with maximum monthly rainfalls in the region of 300 and 600mm, punctuated by a mini dry season in July/August. The majority of the rain falls within the hurricane season, associated with passing tropical storms, particularly between September and November (Figure 7).

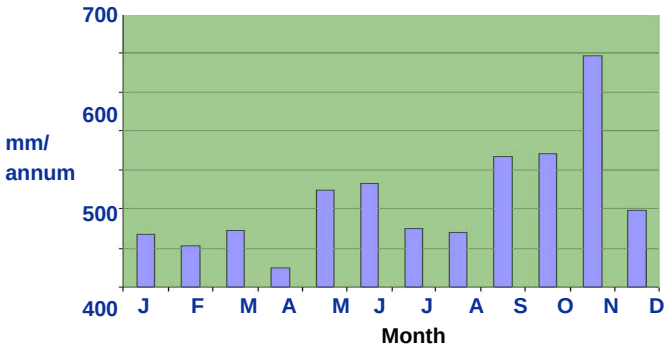


Figure 7: Rainfall - Carrie Bow Caye (2002 – 2004)

Month	Mean Temperature 2002 - 2004	Mean Total Rainfall (mm) 2002 - 2004
January	24.61	136
February	25.08	106
March	26.47	146
April	26.88	47
May	27.96	248
June	28.60	264
July	28.39	149
August	28.83	140
September	29.06	334
October	28.30	342
November	26.45	594
December	24.95	196

Table 9: Mean Temperature and Rainfall (2002 – 2004) Carrie Bow Caye, 2002 - 2004

Annual air temperatures on Carrie Bow Cay average 27.1°C, fluctuating throughout the year from a minimum of 23.5°C in January, during the cold fronts, and a maximum in September of 29.2°C (Table 9; CCRE, 2005)

Weather Systems: Belize is affected by three very distinct seasonal weather systems: trade winds, northers and tropical storms. All three have an influence on the rainfall and temperature patterns, on the sea level, and on the currents around the Laughing Bird Caye National Park itself.

- ***Trade Winds*** – the predominant winds, blowing from the east and north-east
- ***Northers*** - high-pressure fronts moving down from the north, occurring between October and April
- ***Tropical Storms*** - occurring between June and November, originating in the mid-Atlantic

Tropical Storms: Tropical storms affect Belize every year, with the effects being felt particularly strongly on the outlying cayes and atolls. Originating in the Atlantic Ocean over warm, tropical waters, these storms are non-frontal, developing highly organized circulations, and ranging in scale from tropical depressions and tropical storms (with sustained wind speed < 74 mph) to hurricanes (with sustained wind speed > 74 mph). These storms move westward towards the Caribbean, gathering strength until they hit land.

The hurricane season stretches from the month of June through November, with historical records identifying nine hurricanes and seven tropical storms that have passed within a 50-km radius of Laughing Bird Caye National Park (Table 10; NHC, 2010). Whilst many hurricanes often have very focused paths of destruction, their effects are wide ranging, particularly at sea. As well as the physical and mechanical damage to the coral, hurricanes also stir up the water, increasing turbidity and can reduce water clarity for a significant time after the storm event itself. Water clarity can be further reduced following tropical storms by the associated heavy rainfall, which can exacerbate erosion and increase sediment transport from the mainland via the rivers.

Hurricanes often result in major changes to the shapes and sizes of cayes - during Hurricane Hattie, rubble and shingle were deposited at the northeast and southwest ends of Laughing Bird Caye, and along the southeast shore (Stoddart, 1963). The most recent extreme hurricane impacts at Laughing Bird Caye National Park have been from Hurricane Mitch (1998) and Hurricane Iris (2001).

Name	Cat.	Year	Date Passed LBCNP
Not named	H1	1906	13th October
Not named	H1	1918	25th August
Not named	TS	1934	4th June
Not named	TS	1934	8th June
Not named	TS	1938	11th October
Not named	H2	1941	28th September
Not named	TS	1943	22nd October
Not named	H1	1945	4th October
Abby	H1	1960	15th July
Anna	H2	1961	24th July
Francelia	H3	1969	3rd September
Laura	TS	1971	20th November
Fifi	H2	1974	19th September
Gert	TS	1993	17th September
Kyle	TS	1996	11th October
Mitch*	H5	1998	28th October
Iris	H4	2001	9th October

TS: Tropical Storm
H: Hurricane
H1: Category 1: winds > 74 – 95mph
H2: Category 2: winds 96 - 110mph
H3: Category 3: winds 111 - 130mph,
H4: Category 4: winds 131 – 155mph
*Whilst Mitch did not pass within 50km, it had a huge impact on the reef in the area

Table 10: Hurricanes Affecting Laughing Bird Caye National Park (<50km) (www.nhc.noaa.gov)

In late October, 1998, shortly after peak bleaching temperatures, Hurricane Mitch swept across the Gulf of Honduras. The storm then stopped for 2 days adjacent to the Bay Islands of Honduras 244 km (150 miles) south west of Laughing Bird Caye. 25km (16) miles to the east of Laughing Bird Caye, at Gladden Spit, the storm tide reached 2.8m, with up to 29% of coral colonies showing signs of mechanical damage (FoN, 1999). In 2001, Hurricane Iris passed almost directly over Laughing Bird Caye, with waves of between 4 and 5.5 meters above normal, however the mechanical damage from Iris was estimated at less than 1% (Figure 8; Bood, 2001). As with Hurricane Mitch, the event occurred shortly after a period of unusually high water temperatures, the increased hurricane activity being correlated with the same high water temperatures that caused the bleaching event. Survey sites at the adjacent Gladden Spit area reported a 58% incidence of coral bleaching, with no significant increase in bleaching following the hurricane. The most recent hurricane, Hurricane Richard, passed to the north of the caye with minimal impact.

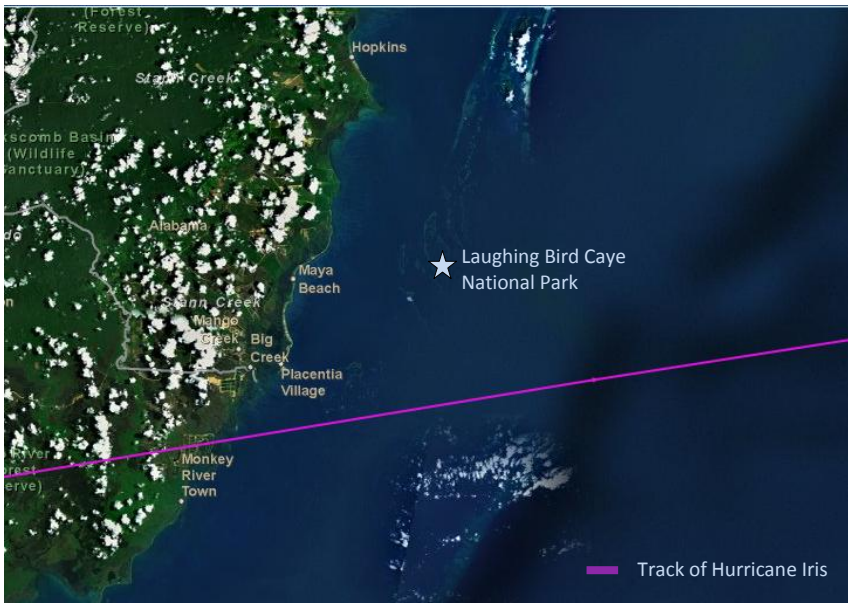


Figure 8: Laughing Bird Caye National Park: Hurricane Iris

1.4.2 Geology

The Belize continental shelf underlies the entire coastline of Belize and extends seaward 15-40 km from the coast. It is a complex underwater platform of Pleistocene limestone rock that ends abruptly on top of the first of three northeast-southwest escarpments that lie off the coastline. The first escarpment runs parallel to the coast, dropping off to the east to a depth of about 1 km (Figure 9). An extensive reef system has developed upon the rim of this escarpment, forming the Belize Barrier Reef (Rath, 1996), sheltering the lagoon to the west. Cayes dot this platform, some formed on mangrove peat, others from coral outcrops and sand deposition.

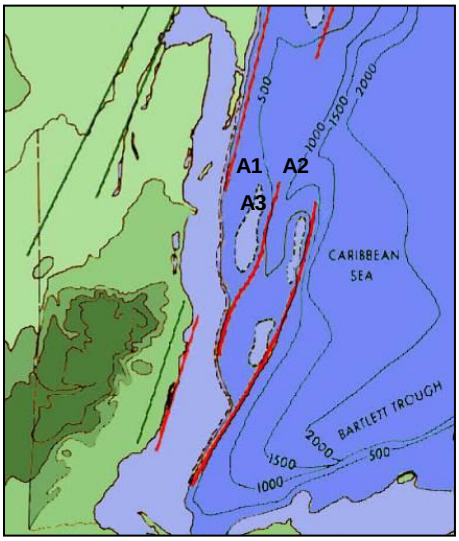


Figure 9: Fault lines that run parallel to the Belize coastline, forming the base of the reef

In the Laughing Bird Caye area, and north to the Pelican Cayes of South Water Caye Marine Reserve, the shelf structure reaches its maximum complexity with a narrow outer platform and a maze of patch reefs, faros, and pinnacles. There are varying thoughts on the formation of the faros. Some have theorised that the faros are the result of karstic processes. The more recent theory, however, is that when the area was exposed in the early Pleistocene era, (2.5 – 1.8 million years ago), rivers flowed across the delta on the exposed coastal shelf, depositing silica sediment, producing a series of rhomboid-shaped topographically high areas that later became major sites for late Pleistocene coral colonization, and limestone deposition. The current faros, including the Laughing Bird faro, are thought to have grown on these carbonate mounds, reaching a thickness of 13 metres, above the thick underlying Pleistocene limestone base rock. This has resulted in the unusually steep-sided faro or rhomboid reef, with angles of 50-80°, established over the last 9,000 years, with a growth rate estimated at 1.4 meters/millennium. The dense networks of branching corals act as a physical barrier, trapping sediments and forming the faro walls.

1.4.3 Bathymetry

Belize has an extensive maritime area of 10,000km^2 (Hartshorn et al., 1984). Unique to this area is a 250 km long barrier reef that extends from the tip of the Yucatan Peninsula southward into the Gulf of Honduras (Burke, 1982). Seaward of the reef crest are three coral atolls: Glover's Reef, Lighthouse and Turneffe Islands Atolls.

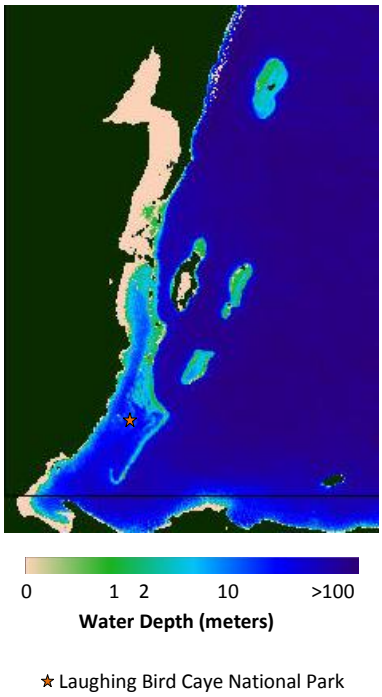


Figure 10: Water Depth (SeaWiFS, 1999)

The barrier reef complex has been divided into three provinces based on their community distribution and geomorphic characteristics: Northern, Central, and Southern Provinces (Burke, 1982). The protected area lies within the Southern Province, which extends for about 59 km from Gladden Spit to the Sapodilla Cayes and is distinguished by shallow-water reefs, which occur as fringe around the cayes. The depths of the water over these reefs are less than 5 meters forming exposed reefs during low tides. Depth contours for the inner lagoon increase from 10 to 40 m toward the center of the lagoon. Outside the main barrier, the reef slopes gradually from 10 to 50 m (Figure 10).

Laughing Bird faro, lying in the relatively deeper waters of the southern province lagoon, rises out of depths of 44 m - the Victoria Channel to the east, 30m to the west - the Inner Channel (the main commercial shipping route) to the west, reaching depths of 30 m (Map 5; WRISCS Project, 2000/British Royal Admiralty Charts), both lying outside the protected area boundary.

The faro encloses a densely pinnacled lagoon with a floor that is 24 m (80 feet) in depth in places, with spires sticking up 50-60 feet (15 – 18 m). The windward side of the faro rim is within 10 feet of the surface in most places, with Laughing Bird Caye itself occupying 1.4 acres of the south east surface of the rim (Figure 11; Wantland and Pusey, 1971).

The faro can be divided into three distinct areas: the rim, inner flank, and outer flank. The rim of the faro is a nearly continuous ring of relatively narrow reef enclosing a central lagoon area, with several ridges that project inwards (Map 6). The inner lagoon is completely enclosed and reaches a maximum depth of 5 m. Patch reefs and mounds, diverse in size and structure, criss-cross the inner

Depth	Core Material	Age (C14 data)
0 – 36 feet	unconsolidated, coarse coral-algal sand & coral rubble	4775 ± 130 years B.P
37-58 feet	fine carbonate sand and greenish-gray mud	6725 ± 155 years B.P
58.5-65.5 feet	dense vuggy limestone	Pre-Wisconsin age

Table 11: Data from sediment borehole on the southern tip of Laughing Bird Caye (Wantland and Pusey, 1971)

lagoon across a floor that is nearly flat, with a fine mud substrate, atop carbonate sand, above dense limestone (Table 11).

Laughing Bird Caye sits on an elongate sand ridge, and is the southernmost of the islands in the central lagoon - and the only one associated with the Laughing Bird Faro. The caye is not static in either size or shape, the sand beach changing with the currents and seasons. In 1962, it was estimated to be approximately 460 m long and varying from 9 to 40 m wide, with an area of 1.36ha (Stoddart, 1963).

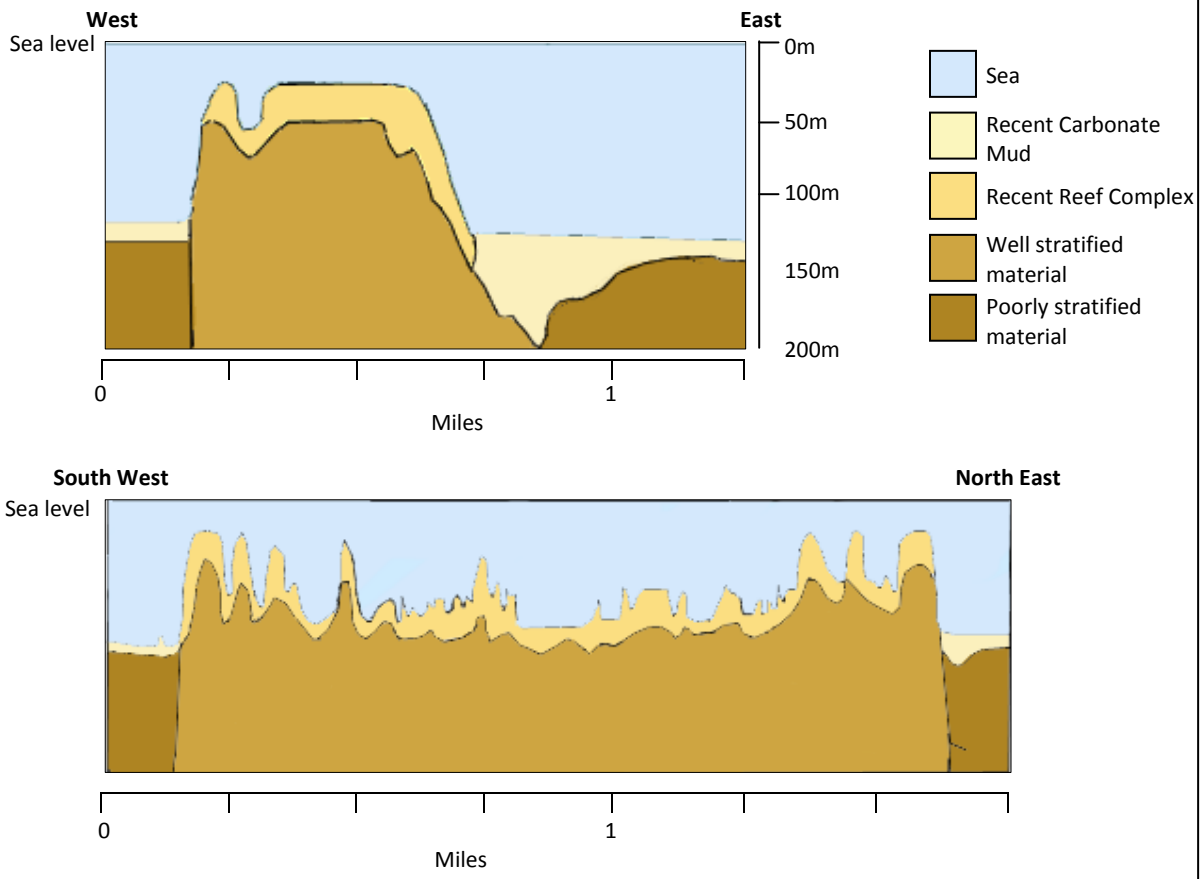
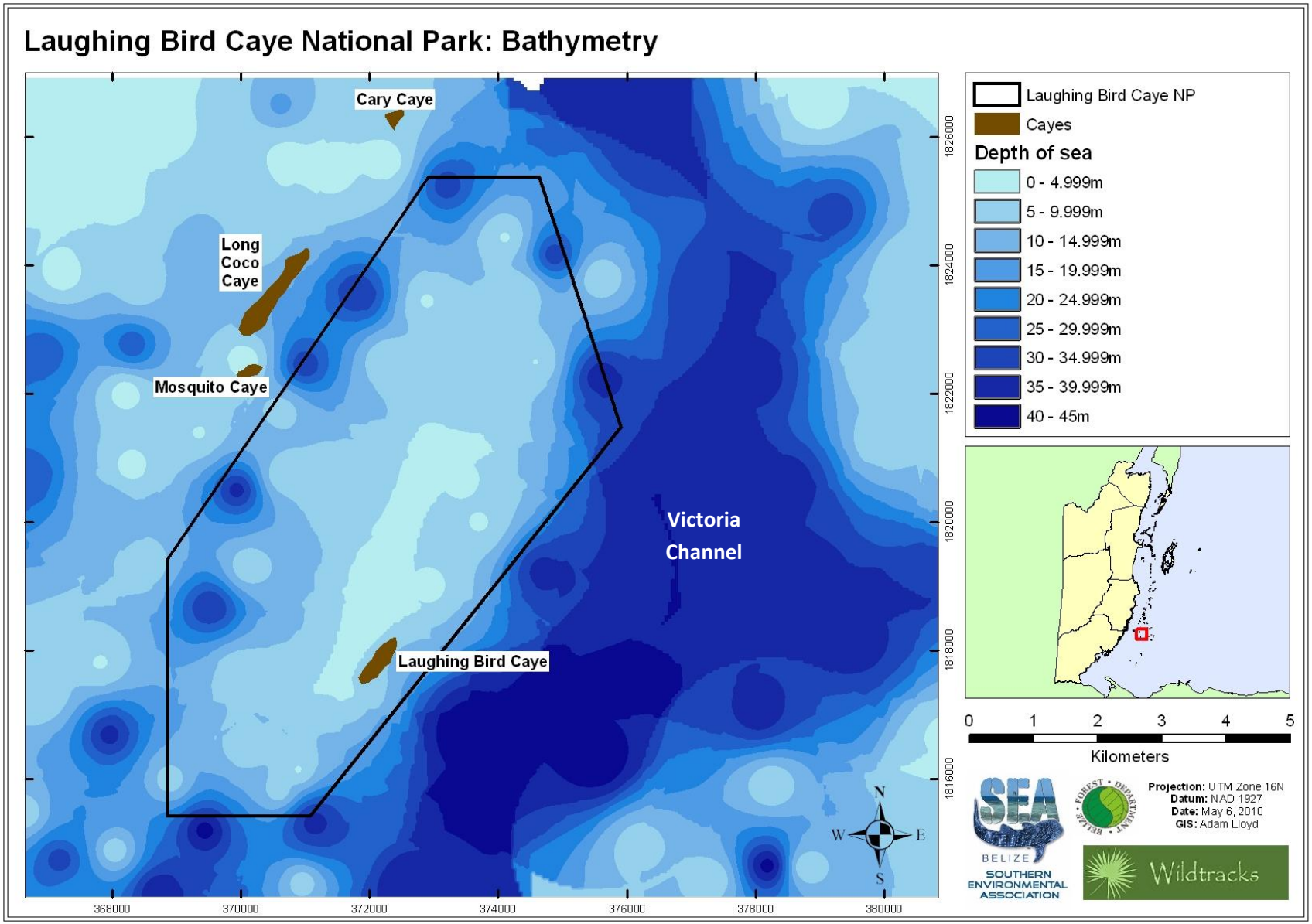
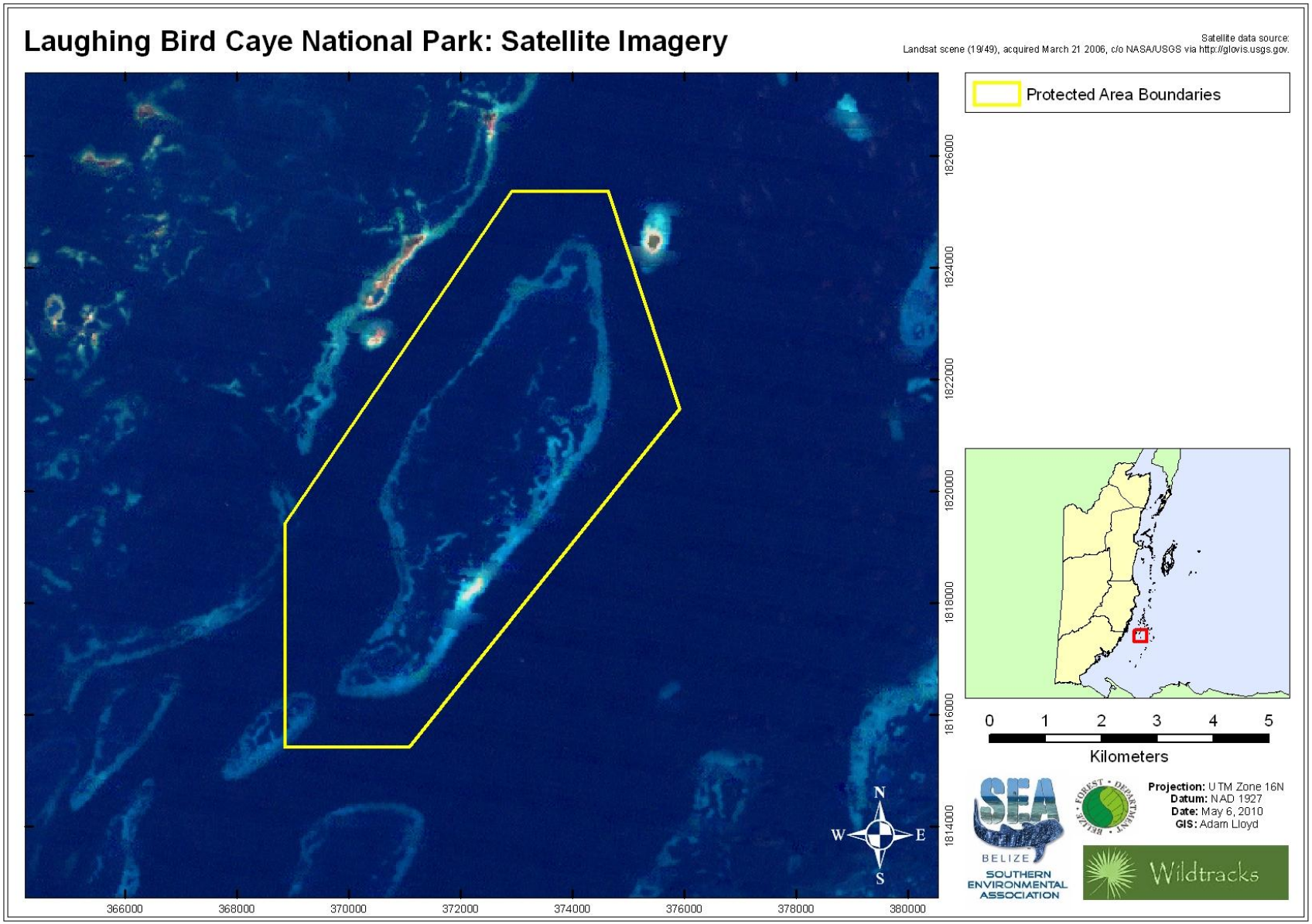


Figure 11: Profiles across Laughing Bird Caye Faro (after Wantland and Pusey, 1971)



Map 5: Laughing Bird Caye National Park: Bathymetry



Map 6: Laughing Bird Caye National Park: Relief (Satellite)

Figure 12: Earthquake damage to the Laughing Bird faro (*Photo: Dr. Annelise Hagan / SEA*)

Laughing Bird Caye National Park lies within a fault area affected by occasional earth tremors and earthquakes. The most recent was reported in 2009, a 7.3 magnitude earthquake occurred off the coast of Roatan, resulting in damage to the coral rim of the Laughing Bird area, primarily on the west and south-facing slopes of the faro Figure 12). A reported 30% of the reef surveyed during a post-earthquake assessment of the area (both within the National Park and to the immediate south) was completely lost, with a further 25% showing moderate damage - cracking and overturned corals (Shank et al., 2010).

1.4.4 Tides and Water Movement

Knowledge of currents is essential in determining the transport of larvae, nutrients and pollutants, as well as abetting the spread of disease and invasions (demonstrated by the rapid spread of disease in *Diadema antillarum* throughout the Caribbean region in the 1980s). Connectivity through currents has also resulted in the rapid invasion of Belize by the lionfish (*Pterois volitans*), which has been increasing exponentially at Laughing bird Caye National Park, as part of a larger, regional invasion. An initial, isolated report of its presence was recorded in 2001, in the Laughing Bird caye area (B. Sutton / Ecomar), though no more were seen until 2009, when populations have grown exponentially.

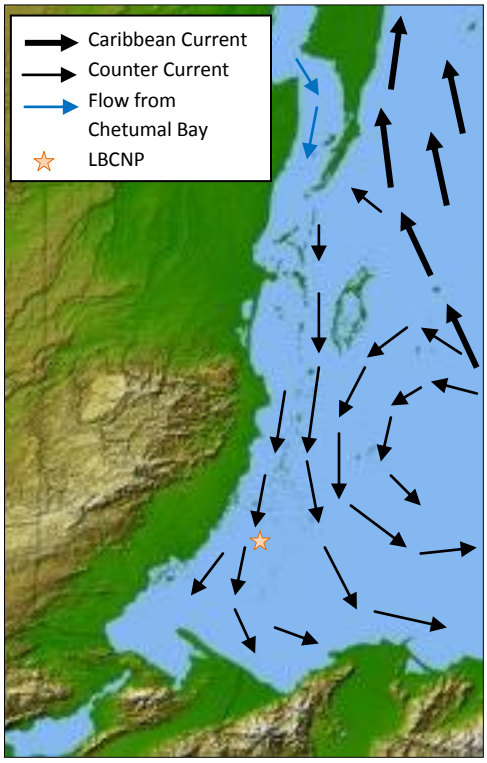


Figure 13: Currents of the Belize Reef (after Ezer et al., 2005)

On a regional scale, the main oceanic current, the warm-water Caribbean Current, forms the main surface circulation in the Caribbean Sea, flowing westwards from the Lesser Antilles towards southern Belize, then northwards offshore, beyond the atolls, eventually through the Yucatan Channel, with an average flow rate of between 38 to 43 cm (15 to 17 inches) per second. This creates a counter current in the Gulf of Honduras area, including much of the coastal waters of Belize, which flows south / southwest-wards past the Belize coastline and Barrier Reef (Heyman et al., 2000; Stoddart, 1962), in the shelf lagoon and offshore basins (Figure 13; Purdy et al., 1975).

Tides in the central region of the Belize reef system are considered to be microtidal, and average an estimated 30cm throughout the coastal shelf (Stoddart, 1962; Caribbean Coral Ecosystems Program, 2005). The currents generated by these tides as they pass through reef cuts and at river mouths are thought to play a significant role in the spatial dispersion of sediment, nutrients, and larvae along the shallow reef flats and back reef (Heyman & Kjerfve, 2001).

Winds may have a more influential impact on sea level than tides, with strong north winds resulting in currents shifting to a more southerly direction, and lower sea levels - throughout Belize, the northerly winds are known to depress the water level on the mainland by as much as a foot for several days at a time during the early part of the year. This is true on the reef as well, and probably has a greater influence on shallow water and reef crest biodiversity than the regular tides (Stoddart, 1962; Caribbean Coral Ecosystems Program, 2005).

1.4.5 Water Parameters

The Smithsonian Institute Field Station has been monitoring basic water parameters within South Water Caye Marine Reserve since 1994 / 1995 in the central reef region. No data is presently available from LBCNP, but this has been written into the management plan for future monitoring.

Data Set	Visibility (m) (Range)	Salinity (ppt) (Mean Monthly Range)	Temperature (°C) Mean Monthly Range
Seagrass	7.0m – 15.8m	33.3‰ – 37.3‰	23.6°C – 31.3°C
Reef	-	-	25.4°C – 30.3°C

Table 12: Mean and range values of visibility, salinity, conductivity, and temperature at 0.5m depth (From: CARICOMP data, Carrie Bow Caye)

Water Temperature

The Smithsonian Institute Field Station has been monitoring basic water parameters within the Southern Belize Reef Complex since 1994 / 1995, at Carrie Bow Caye. Measurements in 1994 - 1996 show that mean monthly water temperatures ranged between 25.4°C – 30.3°C at 0.5m depth (Caricomp, 2001), and 26.2°C to 30.3°C at a depth of 13m (Figure 14). Increasing water temperature has been linked with coral bleaching - during September, 1995, for example, sea surface temperatures reached a 12-year high of 29.9°C to the east, at Glovers Reef. Surface water temperatures over the drop-off at Carrie Bow Caye were the highest recorded since CARICOMP monitoring began in January 1993, reaching a peak of 30.4°C during the first two weeks of June 1995 (Jones, 2003). Bottom water temperatures at CARICOMP Coral Reef Site I (13m water depth) averaged 29.8°C (±0.16) during the last week of August. This coincided with the first widespread coral bleaching event within Belize reef waters.

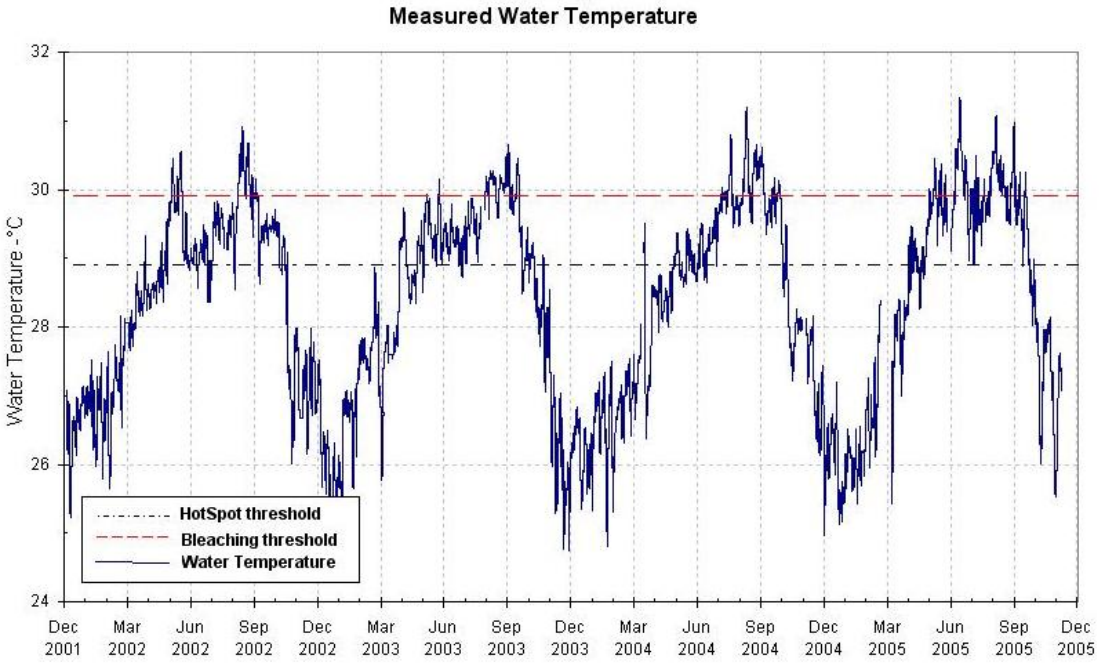


Figure 14: Four year Water Temperature at Carrie Bow Caye (http://cbc.riocean.com, accessed 2011)

By December 1995, temperatures had fallen to a monthly average of 27.7°C, due partly to the passages of Hurricanes Opal and Roxanne across the Yucatan Peninsula in late September and early October, respectively. This pattern has been replicated across the entire reef of Belize, including Laughing Bird Caye National Park.

Sedimentation / Turbidity

Sedimentation and agrochemical contamination from mainland watersheds have been highlighted as perhaps one of the greatest impacts on the Belize reef, after climate change. Laughing Bird Caye National Park lies east of five watersheds - South Stann Creek, Santa Maria Creek, Mango Creek, Sennis Creek and Monkey River (Map 7), which drain some of the principal citrus and banana growing areas of central Belize (Map 8). Following storm events, the increased sediment load of these rivers is also accompanied by an increased pesticide load, as rain washes agrochemicals from the watersheds into the rivers, and from there into the sea. Generally occurring in September/October, these events impact water turbidityand quality within the National Park, as seen following the passage of Hurricane Mitch in October 1998.

Sediment core analysis of two sites within the Belize reef system (Turneffe Atoll and Sapodilla Cayes), indicate that sediment and agrochemical runoff onto the reef has increased relatively steadily over time, consistent with historical and current land use trends. Sediment supply to the reef is greater in the south, in the Sapodilla reef area with greater urgency for action to reduce runoff impacts (Figure 15, WRI, 2006; Carilli et. al. 2009), though the Laughing Bird faro is also affected.

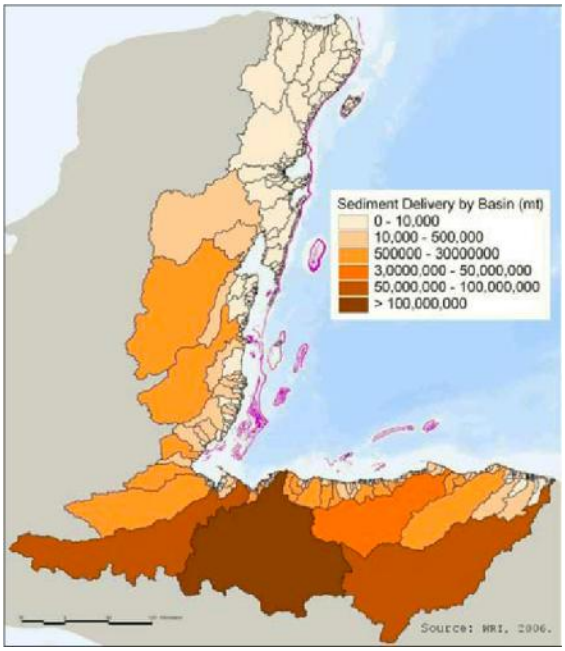


Figure 15: Sediment Delivery by watersheds. After Burks and Sugg / WRI, 2006.

- More than 80 percent of sediment, and more than half of all nutrients (both nitrogen and phosphorous) entering the Mesoamerican Reef originate in Honduras
- Guatemala was identified as a source of about one-sixth of all sediments and about one-quarter of all nitrogen and phosphorous entering coastal waters.
- Compared to the other countries, relatively minor percentages of the regional sediment load come from Belize 10 to 15%) and the Yucatan Peninsula in Mexico (5 %) of the nutrients from all modelled watersheds.
- Of the 400 watersheds in the region, the Ulu'a watershed in Honduras was found to be the largest contributor of sediment, nitrogen, and phosphorous. Other significant contributors are the Patuca (in Honduras), Motagua (in Guatemala and Honduras), Aguan (in Honduras), Dulce (in Guatemala), Belize (in Belize), and Tinto o Negro (in Honduras).

Adapted from ***"Human-caused Pollution Damaging Prized Central American Reefs; WRI analysis maps sources in Belize, Guatemala, Honduras, Mexico"*** *WRI, 2006*

Seawifs ocean colour images also shows that a large pulse of river water extends from the Guatemalan and Honduran rivers, stretching all the way to Laughing Bird Caye National Park, and even out as far as Glover's Reef Atoll, during these storm events (Figure 16; Soto et. al. 2009; WRI/ICRAN, 2006; Andrefouet et al., 2002). Connectivity was tracked using the proxy of weekly mean chlorophyll-a concentrations, derived from satellite imagery over a nine-year period. These studies indicated that Honduran river plumes, particularly that of the Ulu´a River, reached the southern part of the Belize Reef 61% of the time. This provides further support for WRI studies on the origins of impacting watershed run-off on the Mesoamerican Reef (WRI, 2006).

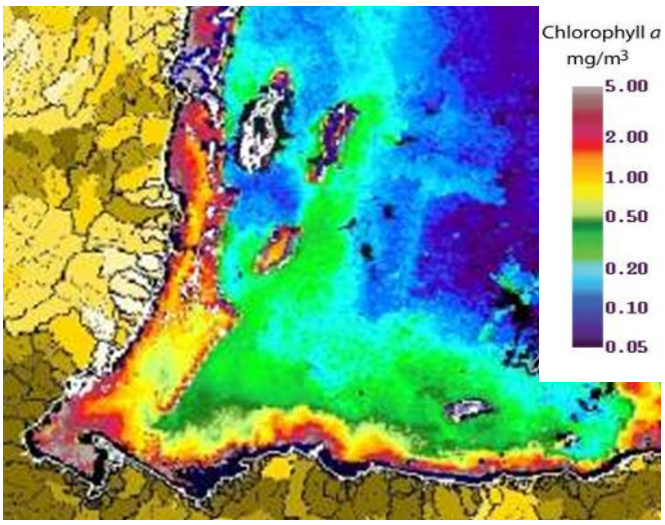
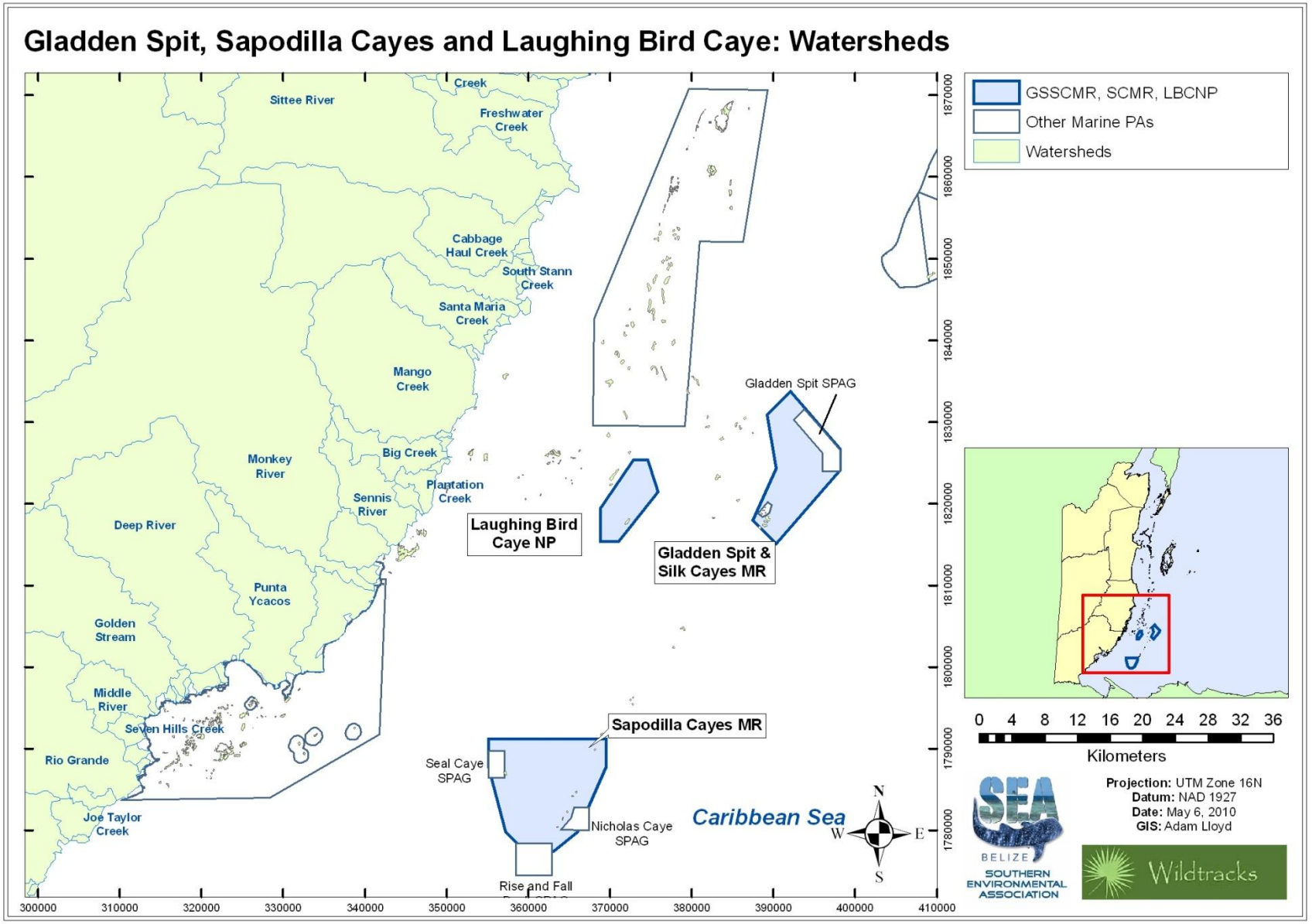
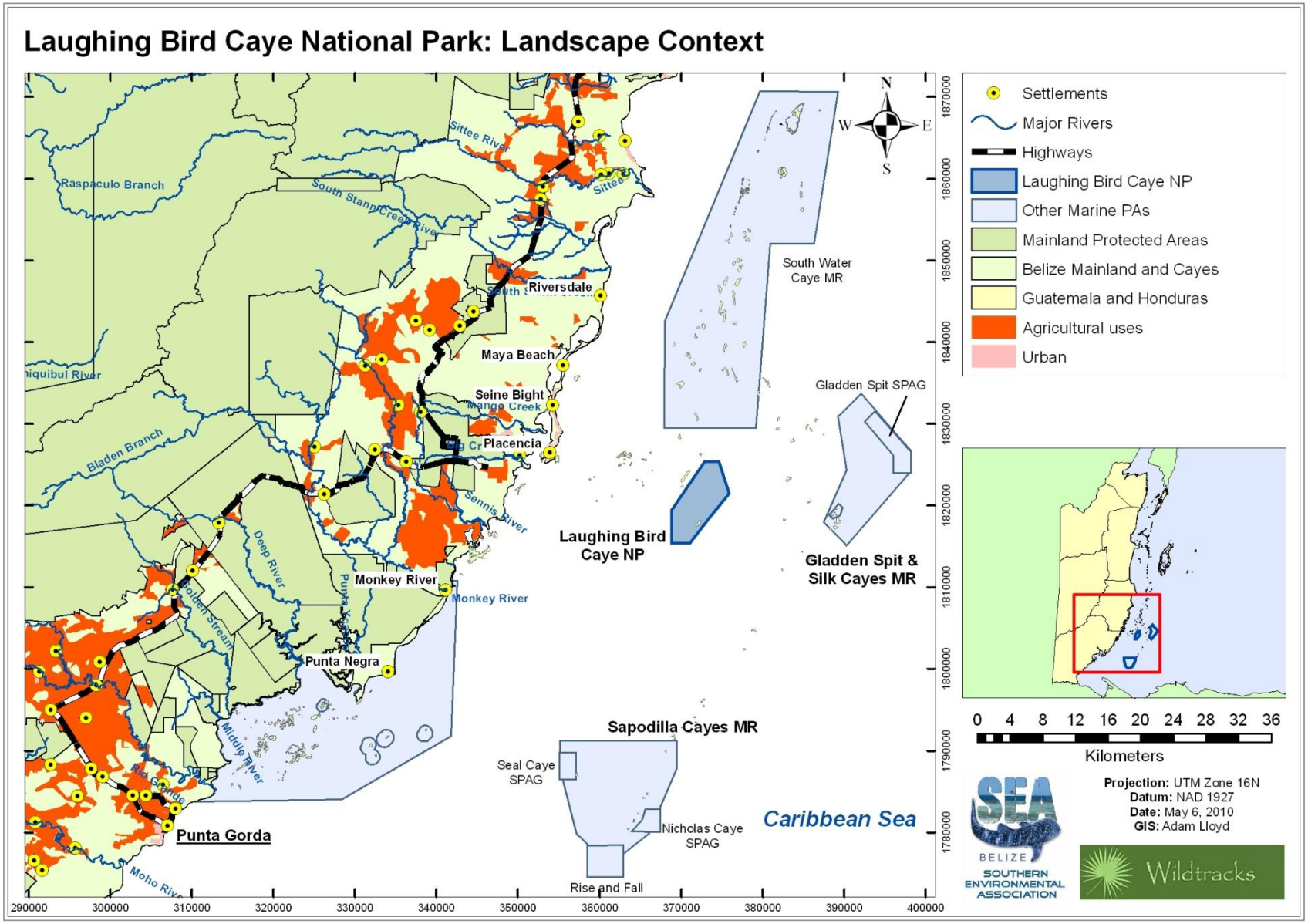


Figure 16: SeaWifs Chlorophyll α. After Shank et al., 2010/ Soto et al., 2009



Map 7: Laughing Bird Caye National Park: Watersheds



Map 8: Laughing Bird Caye National Park: Landscape Context

Salinity

Salinity varies dependent on the time of year, with lower salinity during the wet season (Figure 17). The salinity of normal seawater is 36 parts per thousand (ppt), with variation from 33.0‰ to 37.4‰ at the Carrie Bow Caye site. This range of salinities persists throughout the Belize continental shelf, including the Laughing Bird Caye area (Rath, 1996).

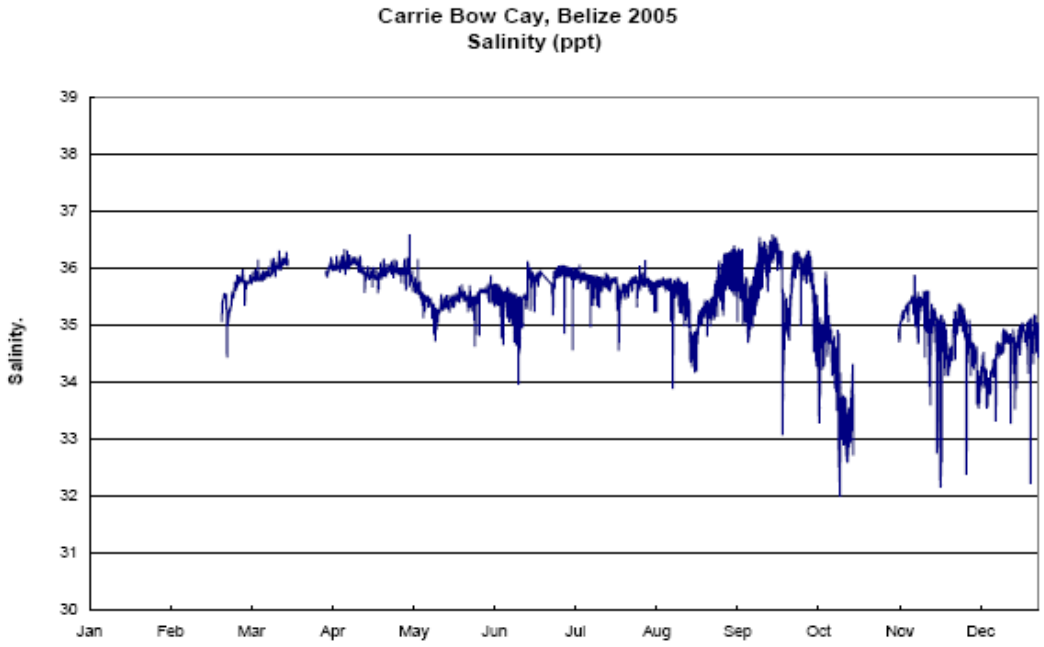


Figure 17: Salinity at Carrie Bow Caye (http://cbc.riocean.com, accessed 2009)

pH

The general pH is 7.2 in the vicinity of the reef and surrounding areas. The alkaline pH is attributed to the high calcium carbonate saturation along the reef. There is a growing global concern about ocean acidification, with the increasing absorption of carbon dioxide from the atmosphere, which is predicted to result in the inhibition of growth of reef builders. Whilst predictions are not yet considered as accurate, the process was identified and flagged as a concern as long as 40 years ago (Kleypas et al., 2006). Studies in Australia have demonstrated that there has been a 13.3 percent drop in calcification over a twenty year period, (1990 – 2009), an unprecedented decline in at least the past 400 years (De'ath et al., 2009), and extrapolations suggests that calcification rates may decrease by up to 60% within the 21st century, with ocean pH levels expected to drop by another 0.3 units by 2100.

1.5. Biodiversity of Management Area

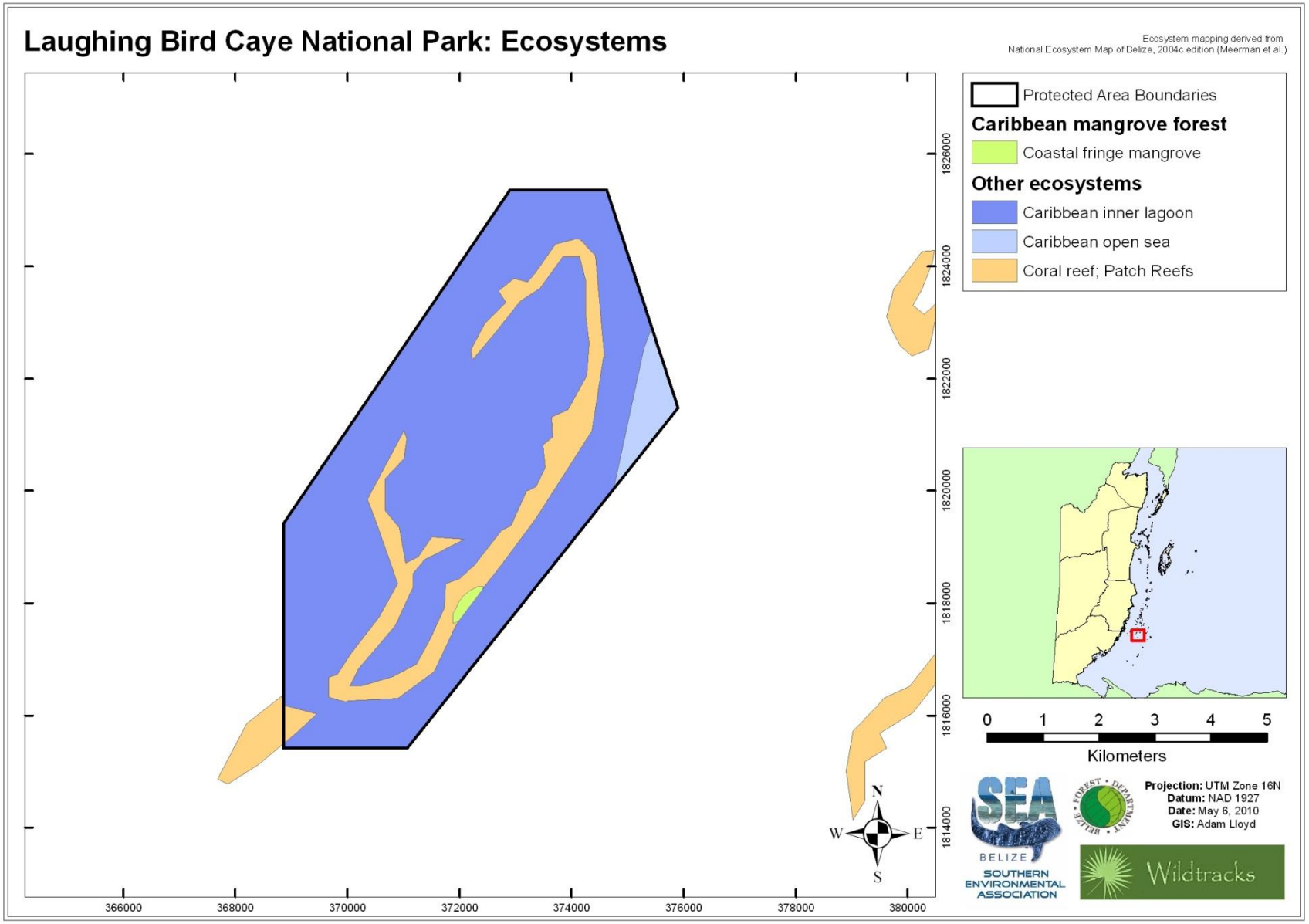
The Laughing Bird faro is considered one of the best examples of faro formation in the Caribbean, and is recognized for supporting extraordinarily high biological diversity, displaying a wide range of habitats, and providing protection for at least twenty-two species of international concern.

The protected waters of Laughing Bird Caye National Park serve as an important source for conch, as shown by the high densities of reproductive adults recorded within the park. Other species such as lobster and finfish also flourish within the park boundaries, providing a source area for the fisheries industry. The sandy beaches of the caye itself provide crucial nesting grounds for hawksbill turtles, and the remaining herbaceous beach vegetation, with its littoral forest component, supports a number of nesting birds and provides a stopping point for migratory birds.

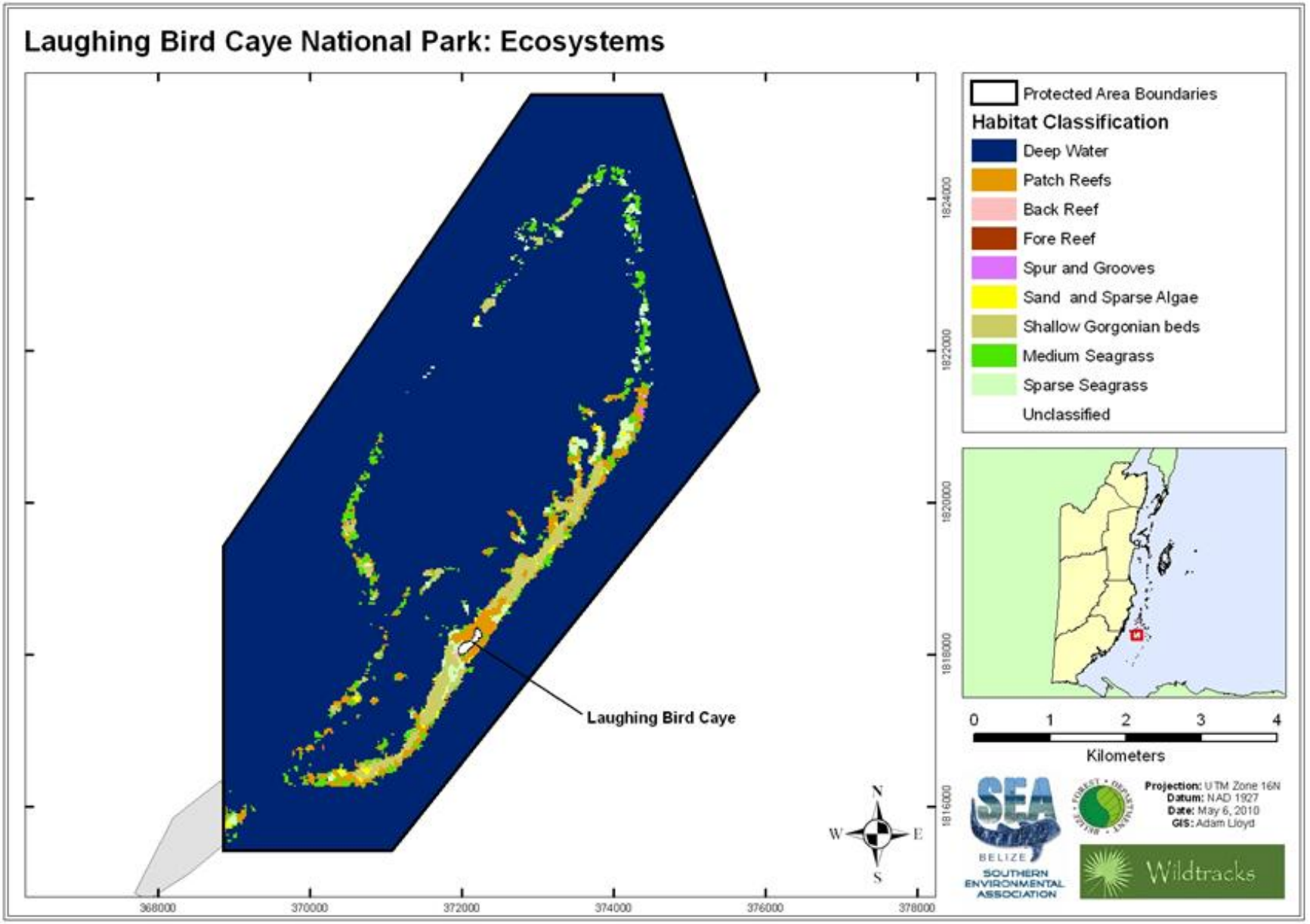
1.5.1 Ecosystems

There is an array of ecosystems within the National Park that have evolved in response to the degree of exposure and impact of wave action, current direction and intensity, light intensity and light spectra, and are defined by their species composition, formation and substrate characteristics. National ecosystem mapping gives a broad overview of the ecosystems to be found in the Laughing Bird Caye National Park (Maps 9 and 10; Meerman, 2004), with the National Park encompassing four broad ecosystems:

- Reef
- Seagrass
- Sparse algae / sand
- Herbaceous Beach Community / Littoral Forest



Map 9: Laughing Bird Caye National Park: Ecosystems (coarse)



Map 10: Laughing Bird Caye National Park: Ecosystems (detailed)

The marine components are further organized into five categories (Meerman et al., 2004) and seventeen sub-categories (Table 13; Mumby and Harborne, 1999). The marine ecosystems of Laughing Bird Caye National Park fall into three main categories: seagrass, coral reefs and sparse algae (Caribbean inner lagoon).

Ecosystems of Laughing Bird Caye National Park				
	Meerman (2004)		**Mumby and Harborne (1999)**	
Terrestrial	Herbaceous Beach Community	Herbaceous Beach Community /Littoral Forest		
	Reef	Patch Reef	Patch Reef	Dense patch reef
				Diffuse patch reef
		Shallow Coral reef	Other Reef	Reef crest
				Low relief spur and groove
Epipelagic	Seagrass	Seagrass beds	Shallow Lagoon Floor – Seagrass dominated	Sparse seagrass
				Medium density seagrass
				Dense seagrass
				Seagrass with distinct coral patches
	Caribbean inner lagoon / Sparse Algae	Fleshy brown Algae / Gorgonians	Algal dominated	Fleshy brown Algae and sparse Gorgonians
		Sparse Algae / sand		Green algae
				Lobophora
				Euchmea and *Amphiroa*
				Bedrock / rubble and dense gorgonians
				Bedrock / rubble and sparse gorgonians
			Bare substratum dominated	Rubble and sparse algae
				Sand with sparse algae
				Mud / bedrock

Table 13: Ecosystems of Laughing Bird Caye National Park

Three transects, conducted in 2006 using the AGGRA methodology, have provided data on benthic cover – two were conducted in the reef flats, and one on the patch reef of Laughing Bird faro (Figure 18).

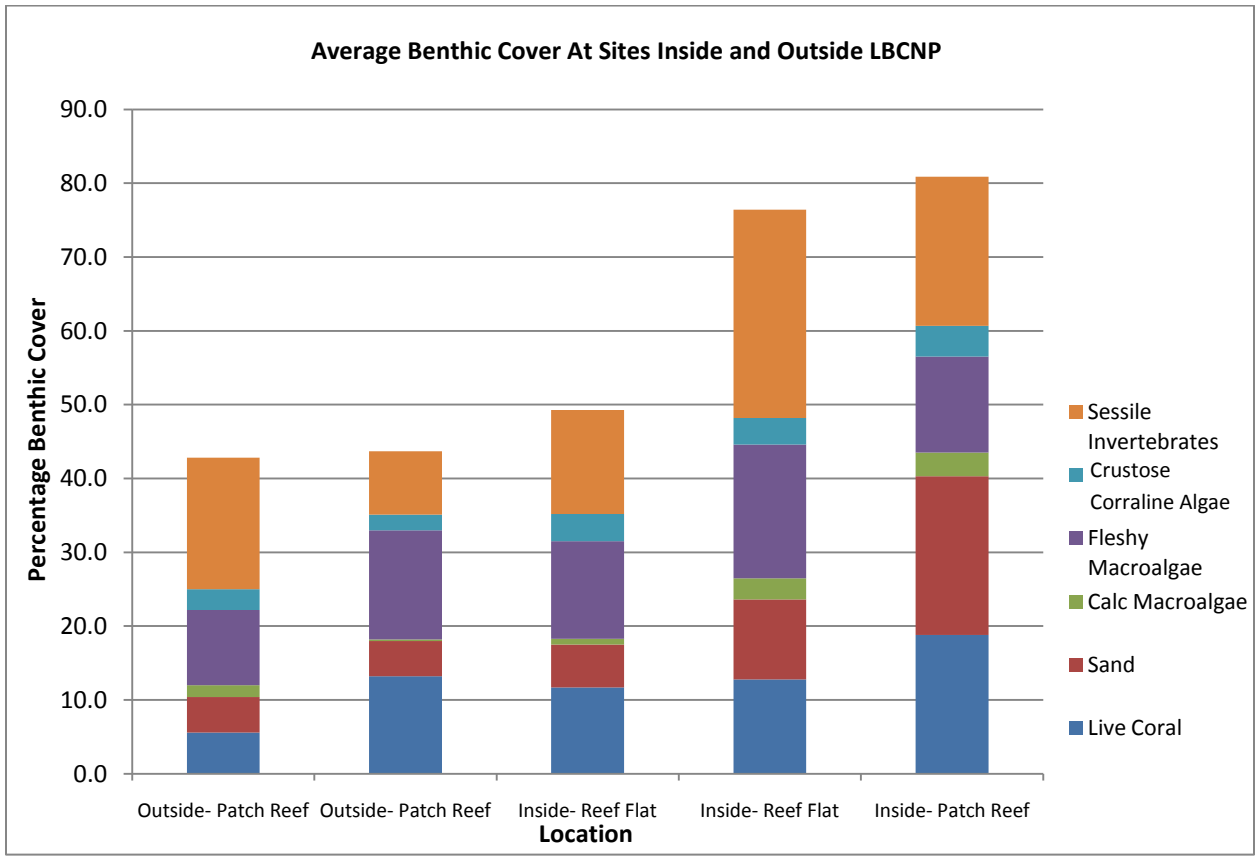


Figure 18: Benthic cover at Laughing Bird Caye National Park (2009)

Percentage live coral cover for the Laughing Bird faro in 2006 ranged from 11.7% at the Reef Flat 1 site, to 18.8% at the Patch Reef site, averaging 15.3% (AGGRA/SEA, 2009). A 2009 study under MMAS estimated average cover at the lower figure of 12.4% – with no significant difference between coral cover inside and outside the National Park (Shank et al., 2010). The most recent results, from 2010, continue this downward trend, demonstrating a decrease in average live coral cover to 7% (SEA data, 2010).

In all cases, the percent live coral cover is very low compared with the 1986 figure of 85% for the Channel Caye faro, situated a few kilometres to the north, or the estimate of 60% live coral cover from LBCNP in the late 1970s (SEA, 2008). The Healthy Reefs Initiative has provided regional-level data, developing a baseline of reef health in 2006, and re-assessment in 2009. The trends are alarming, showing just over a 20% decline in reef condition across the region, mirroring that being seen at Laughing Bird Caye National Park. Three sites were sampled in Laughing Bird Caye National Park for the 2009 survey, with Integrated Reef Health Index scores ranging from 2.21 to 3.33. These all lie within the

'FAIR' range, giving the marine protected area an overall rating of FAIR, with an averaged Reef Health index of 2.61 (Table 14; SEA data / Mcfield, 2010).

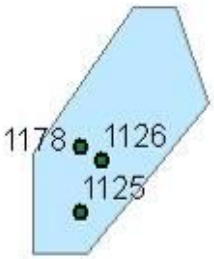
	**Site 1 Pinnacle 1125**	**Site 2 Reef Flat 1126**	**Site 3 Reef Flat 1178**	**IRHI**
Live Coral Cover	2	2	3	2.33
Coral Disease Prevalence	5	5	3	4.33
Coral Recruitment	4	1	4	3.00
Diadema	4	1	2	2.33
Fleshy Macroalgae	5	4	1	3.33
Herbivorous Fish Abundance	1	1	1	1.00
Commercial Fish Abundance	2	1	1	1.33
	3.33	**2.21**	**2.29**	**2.61**
IRHI Index: Very Good: >4.2 – 5.0 - Good: >3.4 – 4.2 - Fair: >2.6 – 3.4 - Poor: >1.8 – 2.6 - Critical: 1 – 1.8				

Table 14: Integrated Healthy Reef Index (IRHI) for Laughing Bird Caye National Park, (Healthy Reefs, 2010)

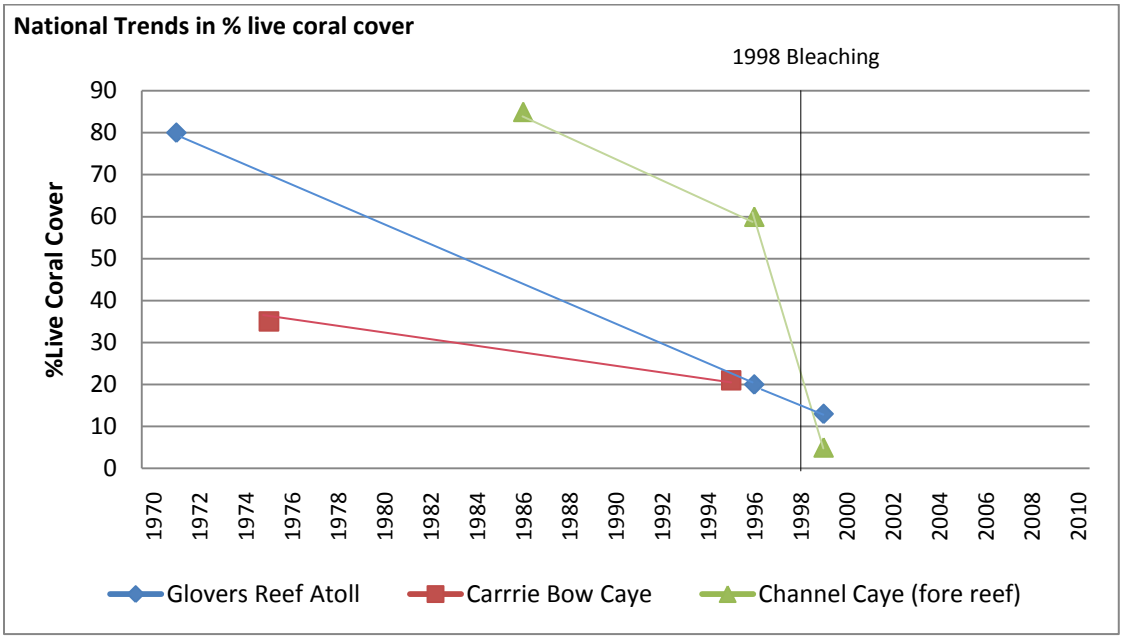


Figure 19: Historical trends in percent live coral cover at three sites within the Belize Reef System. Laughing Bird Caye National Park had an average % live coral cover of 7% in 2010.

Fleshy macroalgae cover ranged from 13%, on the Patch Reef (the lowest percentage cover) to 18% at the Reef Flat 2 site in 2006 SEA surveys. However, the 2010 SEA surveys showed an increase in macroalgal cover to 23%. Generally, in the past, whilst the low percent live coral cover is of concern, the relatively low algal cover has been considered a good sign (Shank et al., 2010). This recent increase in the relative algal cover is not a positive sign. However, the dominant fish species observed at LBCNP are parrotfish, with increasing numbers since 2004. It is hoped that these grazers will help reduce the macroalgal cover in this area, allowing for improved coral cover and diversity in the future.

Coral Reef

The entire marine protected area lies within the Epipelagic (sunlit) Zone, with depths ranging from 0 to 45 m, and includes the shallow waters of the inner faro lagoon and Laughing Bird Caye, as well as a portion of the deeper waters of the surrounding channels – the Victoria Channel to the east and Inner Channel to the west. A large limestone structure, the Laughing Bird faro consists of narrow, steep outer rim walls that enclose a lagoon with depths ranging from 3 to 35 m, and spires or banks projecting up from the lagoon floor for 15 to 18 m (Figure 22). The morphometric complexity at Laughing Bird faro leads to a remarkable diversity of habitats and marine life (Rath, 1996).

The eastern ridge of the faro, adjacent to Laughing Bird Caye, is comprised of a shallow seaward facing crest of *Millepora complanata* and other corals that grow on top of rubble from dead branching *Acropora palmata* (Figure 20). The reef formations along the faro crest are considered patch reefs, forming a modified version of the reef crest of the barrier reef itself. Below this, on the eastward facing slope as it falls into the Victoria Channel, lies a band of the *Montastraea - Acropora palmata* community similar to that found on the main barrier platform. As the water gets deeper and drops towards the lower slopes of the channel, coral becomes more sparse, giving way to gorgonians.

Within the faro lagoon lie numerous patch reefs and banks, some rising from deeper waters. These areas often consist of a mixture of coral (predominantly *Montastraea annularis*), seagrass (*Thalassia testudinum*) and gorgonians. To the west, the rim rises less steeply out of the lagoon to then fall away at a more gentle slope to the west into the Inner Channel, with scattered dense stands of *Acropora cervicornis* and *Porites porites*.

The well developed reef formations that surround Laughing Bird Caye itself are an important tourist attraction, containing a mixture of coral, established on the dead colonies of *A. palmata,* along with larger colonies of *Montastraea annularis*. These reefs are also home to a high diversity of fish species, with a current species list of 234 species, spanning 59 families. The sandy flats and patch reefs surrounding the caye are also home to abundant numbers of conch and lobster and it is not unusual to spot tiger sharks and hawksbill turtles cruising near the caye. In addition to the many coral and fish species, Laughing Bird faro is also well known for its diversity of sponges.

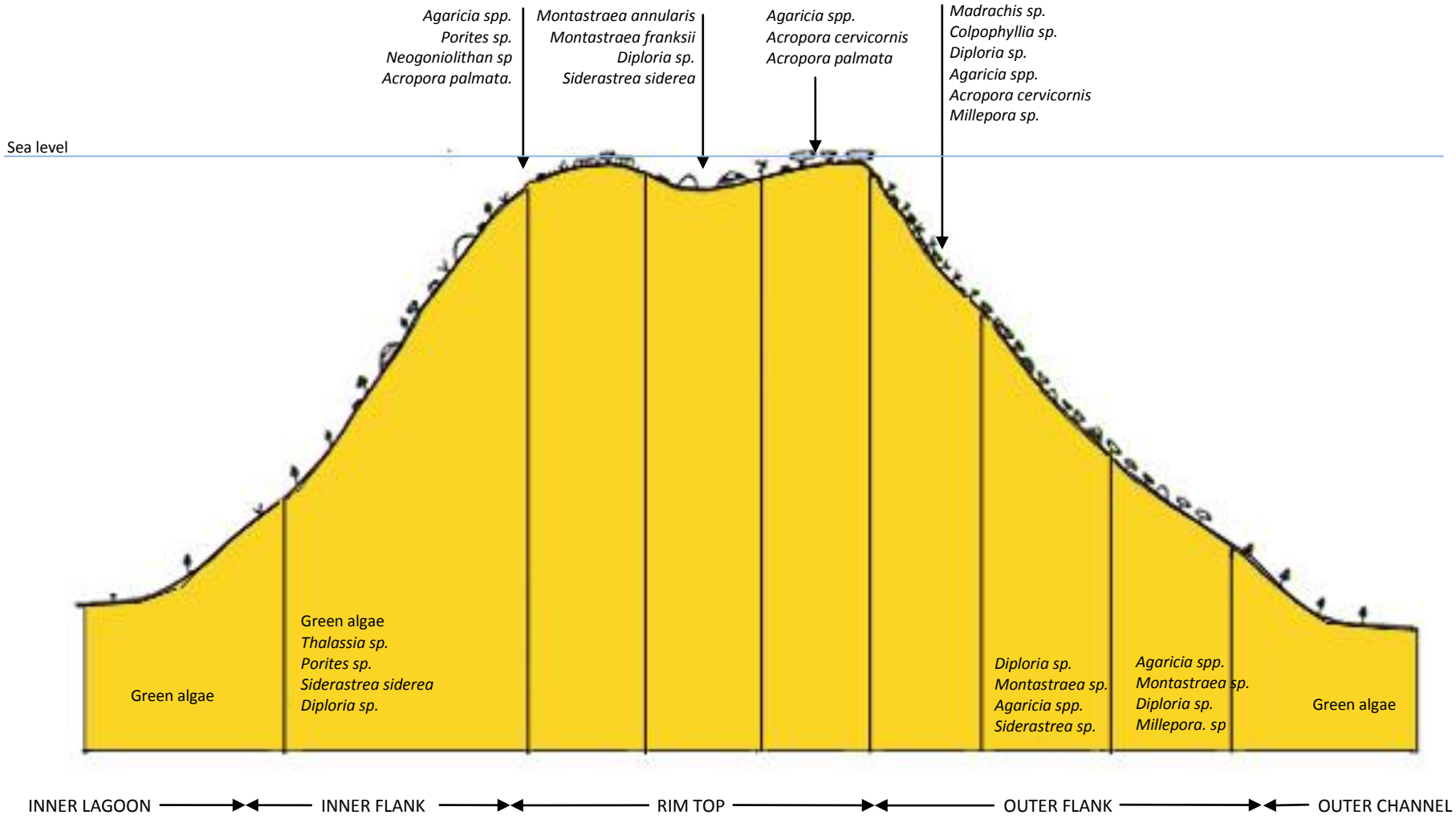


Figure 20: Historical zonation of Faro (adapted from Westphall, 1986; C. Garcia, pers. com., 2010). Since then, there has been a species shift throughout the MAR, with loss of *Acropora cervicornis* (due to band diseases and limited number of viable *A. cervicornis* larvae) and partial replacement with the establishment of the more opportunistic *Agaricia tenuifolia (*Aronson and Precht, 1997), as well as a significant decrease in live coral cover following bleaching.

Coral Diversity

Laughing Bird Caye National Park hosts nine species of coral considered critically endangered, endangered or vulnerable on the global scale (IUCN, 2008; Table 15).

Coral diversity at the National Park was assessed in 2006, with 17 coral species encountered between 0-20 meters of depth, representing the major contributors to live coral cover within the National Park (Figures 21 and 22; SEA data, 2007). Of the species surveyed, the patch reef had the highest diversity, with thirteen of the fourteen species recorded, and was the only site with *Diploria clivosa*. One species, *Stephanocoenia intersepta,* was only recorded outside the marine protected area.

Laughing Bird Caye National Park Coral Species of International Concern	
Critically Endangered	
Staghorn Coral	*Acropora cervicornis*
Elkhorn Coral	*Acropora palmata*
Endangered	
Boulder Star Coral	*Montastraea annularis*
Star Coral	*Montastraea faveolata*
Vulnerable	
Lamarck's Sheet Coral	*Agaricia lamarcki*
Pillar Coral	*Dendrogyra cylindrus*
Elliptical Star Coral	*Dichocoenia stokesii*
Montastraea coral	*Montastraea franksi*
Rough Cactus Coral	*Mycetophyllia ferox*

Table 15: Coral Species of International Concern of Laughing Bird Caye National Park

Based on this data, the two most abundant species within Laughing Bird Caye National Park are the endangered *Montastraea annularis* (an average of 15.5% contribution to total coral cover) and *Montastraea cavernosa* (an average of 11.0%). *Montastraea annularis* is the dominant patch reef species (contributing 28.3% to total coral cover at the survey site), with the vulnerable *Montastraea franksi* as the second most dominant species (13.2%). The Reef Flat 1 site has a number of co-dominant species (*Porites asteroids* and the endangered *Montastraea faveolata* (both 14.6%), and *Montastraea franksi* and *Millepora complanata* (both 12.2%). The Reef Flat 2 site is dominated by *Montastraea annularis* (contributing 29.3% to total coral cover), with *Colpophyllia natans* (12.2%) as the second most dominant species.

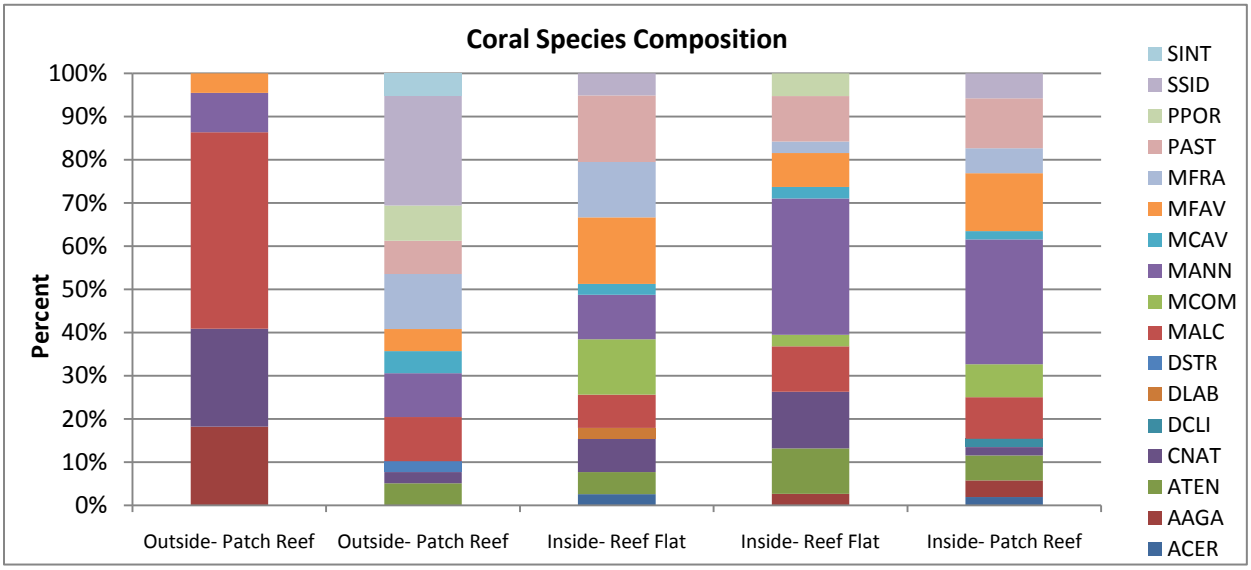
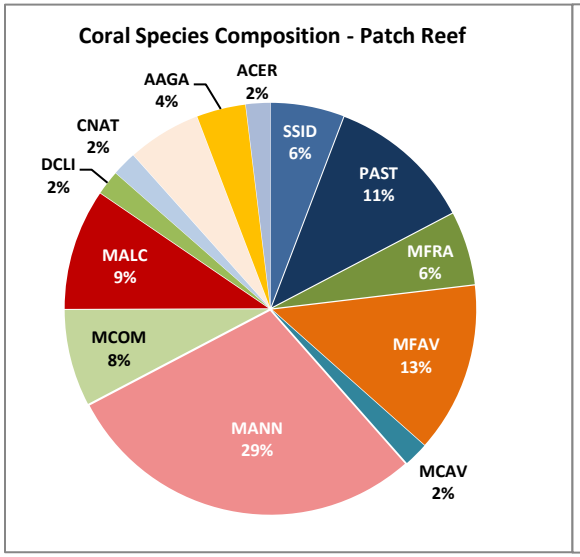
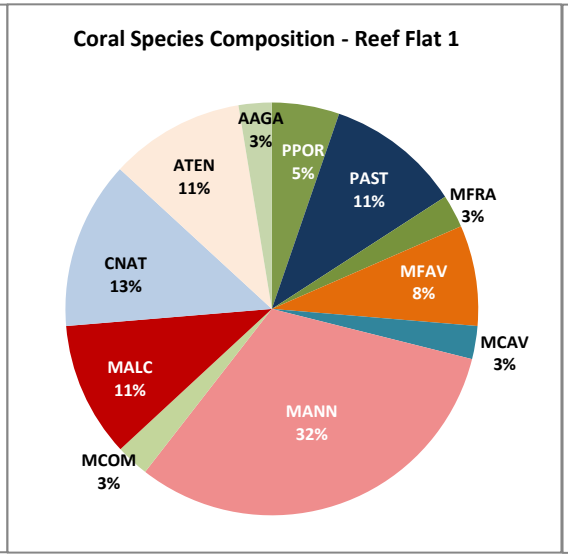
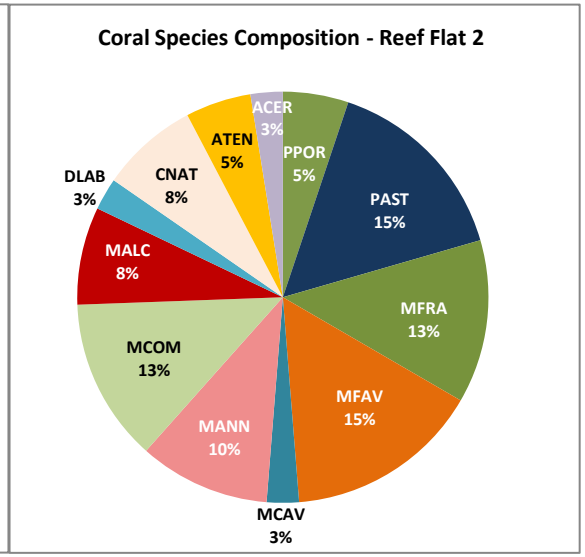


Figure 21: Relative coral species composition and their contribution to overall coral cover in different habitat types at sites within and outside Laughing Bird Caye National Park (SEA data, 2009)







Species	Patch Reef	Reef Flat 1	Reef Flat 2	Average
Acropora cervicornis (ACER)	1.9	0.0	2.4	1.4
Agaricia agaricites (AAGA)	3.8	2.4	0.0	2.1
Agaricia tenuifolia (ATEN)	5.7	9.8	4.9	6.8
Colpophyllia natans (CNAT)	1.9	12.2	7.3	7.1
Diploria clivosa (DCLI)	1.9	0.0	0.0	0.6
Diploria labyrinthiformis (DLAB)	0.0	0.0	2.4	0.8
Millepora alcicornis (MALC)	9.4	9.8	7.3	8.8
Millepora complanata (MCOM)	7.5	2.4	12.2	7.4
Montastraea annularis (MANN)	28.3	29.3	9.8	22.5
Montastraea cavernosa (MCAV)	1.9	2.4	2.4	2.2
Montastraea faveolata (MFAV)	13.2	7.3	14.6	11.7
Montastraea franksi (MFRA)	5.7	2.4	12.2	6.8
Porites astreoides (PAST)	11.3	9.8	14.6	11.9
Porites porites (PPOR)	0.0	4.9	4.9	3.3
Siderastrea siderea (SSID)	5.7	0.0	0.0	1.9

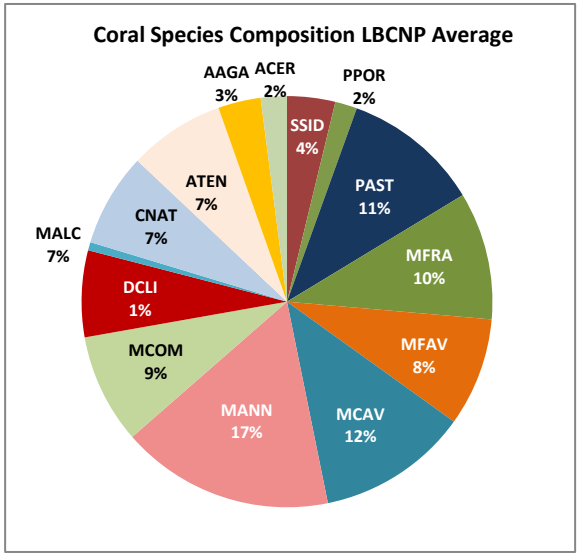


Figure 22: Relative live coral cover at sites within Laughing Bird Caye National Park (SEA data, 2009).

Coral Health

On a regional level, two-thirds of wider Caribbean reefs are said to be at risk from human activities (Burke & Maidens, 2004), a figure that has probably increased since that assessment. In general, reefs in Belize are perceived to be at slightly lower risk, due in part to the small human population, and relatively low levels of coastal development, and were once considered amongst the better reefs of the Caribbean. However, now they are generally on a par with, or slightly below, the rest of the Caribbean, with impacts from a combination of disturbance events (primarily hurricanes) and chronic stressors, leading to declining coral cover and increases in macro-algae (McField et al., 2008 (ed. Wilkinson et al., 2008)). There has been a general ecological shift towards algal dominance on reefs in recent years, attributed to several impacts including a combination of coral diseases (black, white and yellow band diseases), overfishing, the population crash of the herbivorous long-spined sea urchin *Diadema antillarum* and other environmental stressors such as, sedimentation and pollution (Liddell et al., 1986; Aronson et al., 1998). Overfishing of the herbivorous fish has also played a role in the decline of reef health, but more recently, global climate change (with increasing sea temperatures and UV levels) has been identified as the biggest contributing factor (Aronson et al., 2006), overlying all other stresses.

Whilst Belize has always had the enviable reputation of having pristine reefs, in more recent years there would appear to be a shift in species composition of structural corals, with the loss of *Acropora cervicornis* to disease, its replacement by *Agaricia tenuifolia*, and subsequent live-coral loss to bleaching. The increased temperatures caused by global warming results in bleaching - the expulsion of the zooxanthellae, which, if severe and prolonged enough, can affect coral reproduction, growth, and accretion rates and even lead to death (CCRE 2002). The harmful effect of increased levels of UV radiation acts synergistically with increased seas surface temperatures to exacerbate bleaching by producing harmful oxygen radicals, increasing coral mortality (Lesser and Lewis, 1996; Marshall et al., 2006).

Coral Bleaching: Corals are highly sensitive to changes in water temperature, and increases of only 1 to 2°C can have potentially lethal effects. The MAR region has experienced several large-scale bleaching events (e.g., in 1995 and 1998) that caused significant coral mortality in some areas.

Human-induced global warming is widely believed to be responsible for increases in global sea surface temperature.

Diseases: Coral disease outbreaks are one of the single most devastating disturbances to coral reefs in the Caribbean and MAR in the recent past.

Disease has always been a natural process in regulating populations, but the recent increased magnitude of disease and resultant mortality may be unique in the last several thousand years. Diseased organisms tend to thrive in higher temperatures, and some may also benefit from increased ultraviolet (UV) radiation. Both stressors (temperature and UV) may render host organisms more vulnerable to disease.

In addition to these effects related to global climate change, diseases have also been linked to elevated nutrients (especially from sewage), sedimentation and runoff.

Similar to humans, corals seem to be more prone to disease when affected by other stressors.

Healthy Reefs for Healthy People Initiative, 2007

No global bleaching event was recorded before 1979 (McField et al., 2007), and the Belize Barrier Reef experienced mass coral bleaching for first time in 1995 (McField, 1999). Since then, major bleaching events have been recorded in Laughing Bird Caye National Park with increasing frequency - in 1995, 1998, 2005, 2008 and 2009 - and are thought to be accentuated by increased acidification resulting from higher CO_2 levels (Anthony et al., 2008). The first bleaching event in 1995 resulted in large-scale bleaching of hard corals in Belize, especially *Montastraea annularis,* with bleaching of *Agaricia agaricites, Agaricia tenuifolia, Madracis* spp., and *Porites porites* also reported (McField, 2000). Areas in the adjacent South Water Caye Marine Reserve reported loss of up to 50% of the large corals, with partial mortality reported in 10% of corals throughout the country. Although data about the effect of the 1995 bleaching event is not available for LBCNP, the corals within the park would have undoubtedly followed the same trends, and been impacted by the bleaching.

The effects of the 1998 bleaching event have been better recorded at Laughing Bird Caye National Park. The impacts from this event were likely exacerbated by the combination of the major coral bleaching event and a catastrophic hurricane (Hurricane Mitch) which caused dramatic changes in reef community structure, including a 48% reduction in the live coral cover throughout Belize. Laughing Bird Caye suffered an average mortality of 19.6% and 'mechanical' damage to 70.7% of coral colonies (CZMAI, 1998). The Southern Barrier Reef experienced the greatest loss (62%), followed by the Northern Barrier Reef (55%), atolls (45%) and Central Barrier Reef (36%), with *Agaricia tenuifolia* and *Acropora cervicornis* most heavily affected (Wilkinson et al., 2008). In addition the dominant massive *Montastraea annularis* was also highly affected, despite its general resilience to hurricane damage. The variation in these responses is thought to be attributable to varying wave energies from the hurricane, the direction of approach, and differences in the resiliency of the reef communities.

Southern Belize was also hit by Hurricane Iris in 2001, with over 60% of assessed colonies at Laughing Bird Caye National Park showing the highest degree of impact of surveyed sites in the south. 70.7% of critical, reef-building colonies (*Montastraea annularis* complex, *Agaricia agaricites*, *Siderastrea siderea*, *Porites asteroids*) displayed mechanical damage along the faro fore-reef (53% being physically knocked over) and recent coral mortality of 19.6%. The back-reef, more sheltered from the incoming storm, was relatively less impacted, with 26.7% mechanical damage and 6.2% mortality. In comparison, an assessment a month prior to the hurricane indicated a recent mortality of 2.8% and mechanical damage of less than 1% (Bood, 2001).

As no phase-shift from coral to macroalgal dominance was observed following the 1998 event, the prognosis was considered favourable for the potential recovery of these reefs. However, if coral cover is to recover to pre-disturbance levels, sound management will be required to ensure that suitable water quality is preserved through environmentally sound coastal and caye development and that adequate herbivore populations are maintained to control macroalgal growth. A resample of sites in 2005 indicated that recovery from the 1998 event has been slow with no recovery observed between 1999 and 2005 (McField, et al., 2008 (ed. Wilkinson et al., 2008)). The most recent increase in macroalgal cover observed in 2010, following a combination of bleaching and earthquake impacts, is less positive.

Bleaching of Belize's corals was observed in 2001, with 44.8% bleaching at a deep water site (post Hurricane Iris) (Bood, 2001), and again in 2005, with mean bleaching recorded at 27.9% and approximately 6.5% mean mortality (McField et al., 2008 (ed. Wilkinson et al., 2008)). Although bleaching during 2005 was observed at multiple sites the extent and effects of bleaching during the 2005 event was not considered significant (McField et al., 2008 (ed. Wilkinson et al., 2008)).

Since 2008, the Southern Environmental Association has conducted bleaching monitoring, in collaboration with the National Coral Reef Monitoring Network. During the 2008 event LBCNP showed some of the highest levels of impacted corals within the SBRC, 39% bleaching being observed in the shallow sites and 23% bleaching in deeper areas during the peak of the bleaching event (SEA data, 2008). Although these corals have shown signs of recovery, it is expected that bleaching impacts will continue to threaten coral health at Laughing Bird Caye National Park, as it is in other tropical reef sites throughout the world.

Seagrass

The inner rim of the faro of the Laughing Bird faro is shallow, and supports varying densities of turtle grass (*Thalassia testudinum*), interspersed with sparse strands of manatee grass (*Syringodium filiforme*), particularly on the north east, north and north west walls. Small pioneer seagrass such as *Halodule* spp. and *Halophila baillonii* are widely distributed in the area and may also occur in limited patches within the National Park. Algae such as *Halimeda* spp., also considered important components of this ecosystem, are distributed throughout the seagrass beds (SEA data).

Seagrass meadows create high diversity habitats in shallow marine ecosystems, with important roles in nutrient cycling, filtration and sediment stabilization (Bos et al., 2007). Seagrass also provides a critical habitat for many fish and invertebrate species - an acre of seagrass has been shown to support up to 40,000 fish and 50 million small invertebrates (Seagrass Ecosystems Research Laboratory, 2005). This ecosystem fills a critical role as a nursery area for the commercially important conch, many reef fish (including commercial species such as tarpon, hogfish, yellowtail snapper and great barracuda), and for the key herbivore guild species assemblages - the parrotfish. The seagrass beds also provide corridors for juvenile lobsters between habitats and important settlement areas for post-larval stages of commercial species (Acosta, 2001).

Seagrass areas of the Laughing Bird faro are considered to be in very good condition, with minimal human impacts, reflected in the relatively high conch densities within the protected areas (SEA data, 2009). Potential management issues could also arise in high use snorkelling areas where visitors and tourists may frequently stand on living seagrass (Claudett et al., 2009). Impacts from past shrimp trawling activities in the adjacent Inner Channel are expected to continue to affect connectivity between reef and shore for several years to come, with the past destruction of seagrass beds and other benthic habitats, though Government has now placed a ban on any future trawling activities in Belize.

Terrestrial Ecosystems

The terrestrial vegetation of Laughing Bird Caye is constantly changing over time, as current and past storm events change the shape, height and substrate of the caye. Historical records show that the island was previously covered by a 'coconut woodland' with scattered coastal mangroves, and only seven plant species recorded (Stoddart, 1963). Following its designation as a National Park, the caye has been zoned to allow regeneration of the northern end to natural vegetation, promoting a natural herbaceous beach vegetation, with some littoral forest components, whilst the southern portion is maintained for visitor use.

Plant Species of LBC, 2010

Rhizophora mangle
Avicennia germinans
Laguncularia racemosa
Conocarpus erectus
Hymenocallis littoralis
Ipomoea sp. (violacea?)
Sesuvium portulacastrum
Suriana maritima
Chamaesyce mesembrianthemifolia
Chamaesyce blodgettii
Tournefortia gnaphaloides
Coccoloba uvifera
Cyperus plystachyos
Cocos nucifera (introduced)
Casuarina equisetifolia (invasive)

A damage assessment of the caye following Hurricane Iris, in 2001, noted complete defoliation and uprooting of the mangroves, and the emergence of a channel approximately 5 m in width that completely intersected the island. The vegetation on the southern half of the caye – primarily coconuts, was completely removed by the storm (Bood, 2001). A more recent storm – Hurricane Richard, in 2010 – resulted in the reformation of the caye as a single sand caye (SEA, 2010) – these changes are part of the natural processes that shape the cayes, though the removal of natural vegetation has the potential to destabilize the caye and result in greater erosion.

Native caye plant species, however, are very resilient to storms, and re-establish relatively quickly. A more recent site survey identified fifteen plant species on the caye (site visit, 2010), including all three mangrove species – red (*Rhizophora mangle*), black (*Avicennia germinans*) and white (*Laguncularia racemosa*) - as well as buttonwood (*Conocarpus erectus*) the mangrove associate. These, along with the introduced coconuts, form the basis for the higher vegetation structure to the north end of Laughing Bird Caye, important for nesting birds such as brown pelicans and osprey.

The flora can be considered as occurring within two ecosystems (within the UNESCO classification system): mixed mangrove scrub and littoral forest / herbaceous beach community. The very limited extent of the natural vegetation cover on the island dictates that there is no clear boundary between the two vegetation types, but in general the mixed mangrove scrub species occur on rather lower ground, often in and around caye 'bajos'; the components of littoral forest/herbaceous beach community are found on higher, drier sandy soils. Whilst it is possible that Laughing Bird Caye historically supported a rather more typical littoral forest prior to clearance and planting of coconuts, the tree species are now largely absent: the herbaceous ground cover plants and woody shrub species of this ecosystem are all that now exists on the island.

Mixed mangrove scrub and Herbaceous Beach Vegetation/ Littoral forest of the Laughing Bird Caye of the Terrestrial Preservation Zone (*Photo: Dr. Annelise Hagan / SEA*)

As elsewhere in Belize, past clearance of littoral forest for coconut plantations destabilizes the island structure and greatly increases vulnerability to significant erosion and island restructuring during tropical storm events – as demonstrated by Hurricane Iris in 2001. Thus, in line with the designation of the National Park and the remit to conserve biodiversity, and in the interests of stabilizing the island against potential complete loss during one or more tropical storm events, it is critical that un-impeded regeneration of natural vegetation be encouraged on as much of the island as possible: the larger the area of bare white sand and coconut trees, the greater the risk to the island itself. Active rehabilitation / restoration of the littoral forest should be seriously considered, with a focus on increasing the taller woody shrub / tree species cover. Seagrape is still present and could be propagated for transplanting; *Thrinax* palms, *Coccoloba, Bursera* and *Pouteria* spp. seeds / seedlings could be re-introduced to the island from the nearest source, as it can be presumed that these species would have been predominant on the island prior to the establishment of the coconut trees.

The majority of the southern portion of the caye is maintained as sand, with shading provided by coconuts, for visitation, hosting over 100 visitors at a time, on occasion. On this southern portion of the caye, north of the bathrooms, there is more limited scope for regeneration, with greater visitor access, though the area is considered a buffer between the heavy visitor use area and the natural vegetation to the north. A single specimen of the invasive Australian pine or *Casuarina* (*Casuarina equisetifolia*) is present in this buffer area, along with several introduced coconuts (Site visit, 2010). Management recommendations are for the immediate removal of the highly invasive Australian pine, and for the increased use of native flora within the visitor access area - over time it would be possible to replace a number of the coconuts with *Thrinax* palms, seagrape and *Bursera* – retaining visitor appeal, stabilizing the island against storm damage, and strengthening its biodiversity conservation functionality.

1.5.2 Fauna

Laughing Bird Caye National Park encompasses both terrestrial and marine fauna. Whilst not quite littoral forest, the littoral forest component on the northern end of the caye offers habitat for a number of species – particularly birds – that would otherwise not be found within the protected area, and an important stopping point for migratory birds. Hawksbill turtles and ground nesting birds use the sandy beaches of the caye as crucial nesting grounds.

Laughing Bird faro itself is considered to be one of the best examples of faro formation in the Caribbean, and is recognized for supporting high marine diversity, with a wide range of fish, coral and other species. The protected waters of Laughing Bird Caye National Park serve as an important source for conch, with high densities of reproductive adults being recorded. Other species such as lobster and finfish also flourish within the park boundaries, providing a source area for the fisheries industry.

Smooth Trunkfish
(*Photo: CVHK*)

Fish

Of the over 230 species included in the current species list (Annex Four), three are considered to be Critically Endangered or Endangered at global scale, including the critically endangered goliath grouper (*Epinephelus itajara*), endangered Nassau grouper (*Epinephelus striatus*) and the scalloped hammerhead (*Sphyrna lewini*) (Table 16). All three of these species have been, and continue to be, impacted by commercial fisheries.

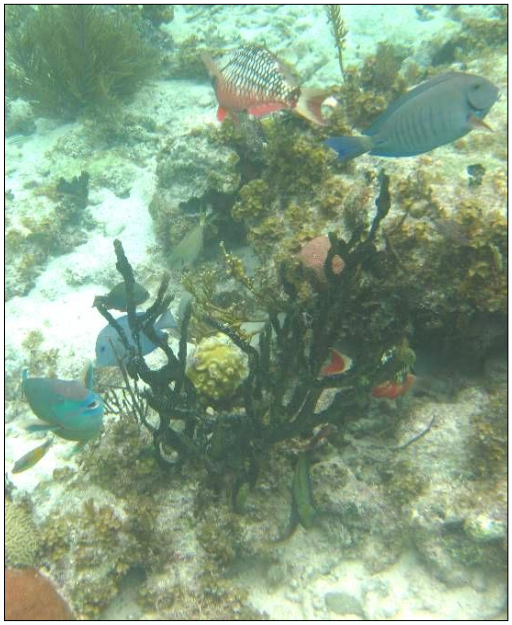
Nassau grouper has declined within Belize by more than 80% since the late 1970s, primarily due to fishing pressure at spawning aggregation sites where it is most vulnerable (Paz and Grimshaw, 2001).

Fish Species of International Concern	
Critically Endangered	
Goliath Grouper	*Epinephelus itajara*
Endangered	
Nassau Grouper	*Epinephelus striatus*
Scalloped Hammerhead	*Sphyrna lewini*
Vulnerable	
Queen Triggerfish	*Balistes vetula*
Hogfish	*Lachnolaimus maximus*
Mutton Snapper	*Lutjanus analis*
Cubera Snapper	*Lutjanus cyanopterus*
Yellowmouth Grouper	*Myctoperca interstitialis*
Whitelined toadfish	*Sanopus greenfieldorum*
Splendid toadfish	*Sanopus splendidus*
Whale Shark	*Rhincodon typus*
Rainbow Parrotfish	*Scarus guacamaia*

Table 16: Fish Species of International Concern of Laughing Bird Caye National Park (IUCN, 2010)

Nassau Grouper
(*Photo: CVHK*)

In 2001 it was predicted that under the existing management conditions, Nassau grouper (once the second most commonly caught fish in Belize) would disappear from Belize waters by the year 2013 (Paz and Grimshaw, 2001). In light of these concerns amendments made to the regulations now impose size limits and make it illegal to take Nassau grouper during the peak spawning months of December to March, though it can still be fished outside of this time. The regional outlook is similarly bleak - it is thought that one-third of all known Nassau grouper spawning aggregation sites in the Caribbean region have disappeared.



Scarids and Acanthurids
(*Photo: CVHK*)

Herbivorous fish populations – such as the parrotfish (Scaridae) and surgeonfish (Acanthuridae) - are considered important for the maintenance of the health of the reef, being the dominant grazers of the ecosystem, keeping algal growth under control. The reefs of Laughing Bird faro have a relatively moderate population of medium parrotfish,[5] with a maximum density of 29g/m^2 and an average of 12g/m^2 (Shank et. al. 2010) – densities of 25.5g/m^2 have been shown to effectively reduce algal cover in the Bahamas (Mumby et al., 2006).

The endangered scalloped hammerhead (*Sphyrna lewini*) is also still fished in Belize, despite its global status. However, the threatened whale shark (*Rhincodon typus*) is protected under the Fisheries Act, with no fishing, or even touching, permitted. This species is an important tourism resource, especially within the spawning aggregation area of the adjacent Gladden Spit and Silk Cayes Marine Reserve, and has been reported passing through the deeper waters of the outer reef rim of the Laughing Bird Caye faro. A further ten shark species have also been confirmed as present within the National Park (SEA data; R. Graham, pers. com.).

Sharks of LBCNP

Bull shark
Caribbean Reef Shark
Silky shark
Lemon shark
Scalloped hammerhead
Bonnethead
Nurse shark
Tiger shark
Black tip
Caribbean sharp-nose
Whale shark

R. Graham, pers. com. 2010

[5] On a scale of None, Low, Poor, Moderate, High (Shank et al., 2010)

Mammals

Four species of dolphin have been reported from within the adjacent South Water Caye Marine Reserve - Atlantic bottlenose dolphin (*Tursiops truncatus*) and the Atlantic spotted dolphin (*Stenella plagiodon*) are commonly seen inside the Belize Barrier Reef (CCC, 1993). The deeper-water rough-toothed dolphin (*Steno bredanensis*) has also been reported, as has Fraser's Dolphin (*Lagenodelphis hosei*).

Antillean (or West Indian) manatees (*Trichechus manatus*) have been reported from the Laughing Bird Caye area, on the outside of the faro, and as far west as the inside of the barrier reef in the Gladden Spit area. The Belize coast is home to the largest population of Antillean manatee in the Caribbean (Morales-Vela et al., 2000), with a population estimated at between 800 and 1,000 individuals (Auil, pers. com.). Historically the manatee has been hunted for meat, with bone middens discovered on archaeological sites, and in the 17th century, it was taken to provide food for privateers and explorers (Self-Sullivan and LaCommare, 2004). This unfortunately still continues, though illegal, with a recent incident in Seine Bight of the capture and butchering of a manatee for its meat (SEA, 2010). Despite the arrest of the offenders, the fines were so minimal that they are not considered a deterrent when compared with the profit from the sale of the meat. Today, the Antillean manatee is considered threatened throughout its range, and is listed as 'Vulnerable' (IUCN, 2008), but is fully protected under the Wildlife Act.

Birds

No long term monitoring of bird species has been conducted for Laughing Bird Caye National Park, with only a token species list of twenty species resulting from single visits. Laughing Bird Caye was named for the presence of a large nesting colony of Laughing Gulls once present on the caye. Impacts by Hurricane Fifi in 1974, coupled with the continuous disturbance and harvesting of eggs by camping fishermen, and increased tourism visitation, drove the colony to relocate to other areas, such as, Middle Silk Caye. The Laughing Gulls have only recently started to return, though there are no signs of nesting (SEA staff, 2010). Pelicans and osprey, however,

Bird Species of Laughing Bird Caye	
Brown booby	*Sula leucogastor*
Brown pelican	*Pelecanus occidentalis*
Magnificent frigatebird	*Fregata magnificens*
Great blue heron	*Ardea herodias*
Green heron	*Butorides virescens*
Osprey	*Pandion haliaetus*
Ruddy turnstone	*Arenaria interpres*
Laughing gull	*Larus atricilla*
Sandwich tern	*Thalasseus sandvicensis*
Bridled tern	*Onychoprion anaethetus*
Yellow warbler	*Dendroica petechia*
Magnolia warbler	*Dendroica magnolia*
Bay-breasted warbler	*Dendroica castanea*
Blackburnian warbler	*Dendroica fusca*
Common yellowthroat	*Geothlypis trichas*
Mourning warbler	*Oporornis philadelphia*
American redstart	*Setophaga ruticilla*
Swainson's thrush	*Catharus ustulatus*
Melodious blackbird	*Dives dives*
Great tailed grackle	*Quiscalus mexicanus*
L. Jones, 1998 *Z. Walker, site visit, 2010*	

Table 17

do use the taller vegetation for nesting, and a number of other resident birds are also present, such as the great tailed grackle, and a number of herons and egrets.

Many thousands of Neotropical migrants, particularly the small warblers, vireos and flycatchers, follow the mainland coast southwards, ending up on Laughing Bird Caye every spring and fall after being blown offshore by shifting winds, often with significant mortalities. Ruddy turnstones, common winter visitors to the cayes, forage along the beaches after migrating from their nesting sites in the Arctic.

Reptiles

The conservation priorities for the herpetofauna of Laughing Bird Caye National Park relate to the three species of sea turtle known to use the area: the critically endangered hawksbill (*Eretmochelys imbricata*) and the endangered green turtles (*Chelonia mydas*), and loggerhead (*Caretta caretta*). As elsewhere, sea turtle numbers have plummeted in recent decades, having been exposed to enormous exploitation for over 250 years in Belize and adjacent countries. In the early 1900s, the size of the turtle industry, harvesting hawksbills for their shells, supported two or more schooners in Belize, based out of Tobacco Caye, having a massif impact on the turtle populations of the entire Belize shelf. As relatively recently as 1925, their numbers were considered inexhaustible in Belize (Smith, *et. al.* 1992) – a far cry from the current situation with only the hawksbill still nesting within the Reserve, and in only very small numbers (four nests recorded for 2010 (SEA). Whilst now afforded full legal protection from harvesting in Belize, turtle populations remain highly threatened by loss or degradation of nesting habitat - the same high, sandy beaches used for millennia by turtles are now being converted into beach properties, with all the impacts associated with human habitation on mainland beaches and inhabited cayes outside of the protected area, increasing the critical importance of maintaining those characteristic of Laughing Bird Caye that increase nesting success, and balancing this with tourism activities in the area.

Hawksbill Turtle (*Photo: CVHK*)

The Hawksbill turtle tends to be more confined to shallow waters than loggerhead and green turtles, where it feeds primarily upon sponges and marine invertebrates. It has a protracted nesting season of 6 months or more – peaking in June and July, with the period between nesting seasons generally being 2-4 years, sometimes longer. With a regional average of 4.5 nests per female in the years they breed, 25 nests in all probability represent only 5-6 females coming ashore to breed. Nesting occurs at night, generally at high tide, with a clutch size of 50-200 eggs. Nests tend to be concealed in beach vegetation quite high on the beach and, except for a faint asymmetrical crawl leading to and from the sea, there is seldom any obvious evidence of the visiting female.

Loggerhead and green turtles still frequent the waters of Laughing Bird Caye National Park, though are not reported as nesting on the caye (Smith *et. al*. 1992). Whilst the green turtle is primarily herbivorous, feeding mostly upon sea grasses and seaweeds, the loggerhead is more omnivorous, feeding on a wide range of marine invertebrates, seaweeds and turtle grass.

1.5.3 Economically Important Species

As a completely protected no-take area, Laughing Bird Caye National Park plays an important role in maintaining a healthy fishery, particularly for the Caribbean Spiny Lobster (*Panulirus argus*) and Queen conch (*Strombus gigas*), two invertebrate species of commercial importance fished extensively throughout Belize. The conch and lobster fisheries form the two most important components of the capture fisheries in Belize, with production representing over 90% of total capture fisheries production in 2008, and an export value of Bz$20.30 million (Ministry of Agriculture and Fisheries, 2009[6]). Lobster landings peaked in 1981 at 2,204,622 lbs, but fell to 457,680 lbs in 2006, with 511,389 lbs harvested in 2008 (tails and head meat combined), with a market value of Bz$13.8 million (Ministry of Agriculture and Fisheries, 2009).

It is significant to note that the general trend of total national lobster production over the period from 1981 to 2008 is a decline of almost 24%, and there are concerns for the continued sustainability of the lobster fishing industry. Whilst in the past there has been continued optimism that lobsters are being harvested at a sustainable level (Gillet, 2003), there is also concern that the average size per lobster appears to be declining, and the catch per fisherman is no longer sufficient to support a fisherman and his family (anecdotal reports, Sarteneja, 2009). During community consultations with traditional lobster fishermen, more than one participant stated that there would not be sufficient lobster or conch to sustain the community of Sarteneja in the future - a community with over 80% of families directly reliant on the lobster and conch fishing industry (Sarteneja community consultation, 2005), and the largest fishing stakeholder community of the Belize reef (Catzim, 2009[7]).

As with lobster, national conch landings have declined significantly, peaking at 1,239,000 lbs in 1972, and subsequently declining by over 50% to 574,756 lbs in 2008 (Ministry of Agriculture, 2008). It has been suggested that the maximum sustainable yield for this species was reached in 2006, with the steep decline of 17% observed in 2007 serving as an indication of the “maturity” of the fishing industry, and the possible overfishing of this fishery resource (Ministry of Agriculture and Fisheries, 2007).

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[6] Ministry of Agriculture and Fisheries Annual Report, 2008

[7] Adele Catzim: Data produced by the Belize ISIS Enterprises Ltd. with support from the Betty Moore Foundation, through Conservation International

Even as far back as 1996, there was evidence that fishing pressure was too high, with the national population consisted primarily of juveniles, resulting in recommendations for capping of the number of fishermen. Strict regulations and quotas are now being implemented towards more sustainable use of this resource, and an increase in production was noted in 2008 (Ministry of Agriculture and Fisheries, 2009), though the number of fishermen has still not been capped.

Laughing Bird Caye National Park is well known throughout Belize for its high densities of mature adult conch. SEA has conducted significant monitoring of conch both within and outside the National Park and has demonstrated that there are greater densities of adult conch within the park when compared to sites located outside the protected area (Figure 23; Finch et al., 2008). More recent data on conch densities support this, with a density of 197.53 conch/hectare recorded within the National Park, and only 11.11 conch/hectare outside (SEA, 2008), indicating a distinct reserve effect for conch within LBCNP. More detailed analysis of size distribution of conch within the marine protected area boundaries showed that conch located within the park were larger and had thicker lips than conch located in other areas. It also appears that the average lip thickness of conch within the MPA has increased from 2005 to 2008 - the only SEA managed marine protected area to show this trend. 2010 figures show a decrease in the number of conch both inside and outside the marine protected area, though no clear cause has been identified to explain this (Figure 24; SEA, 2010).

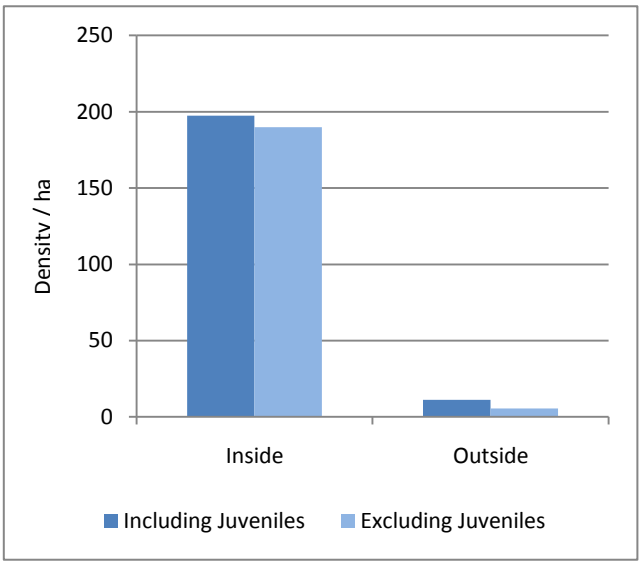


Figure 23: Conch density inside and outside Laughing Bird Caye National Park (SEA data,

Conch densities (SEA data, 2008)		
Survey Location	**Density/ha**	**Survey Component**
LBCNP Inside	197.53	Including juveniles
LBCNP Inside	189.81	Excluding juveniles
LBCNP Outside	11.11	Including juveniles
LBCNP Outside	5.56	Excluding juveniles

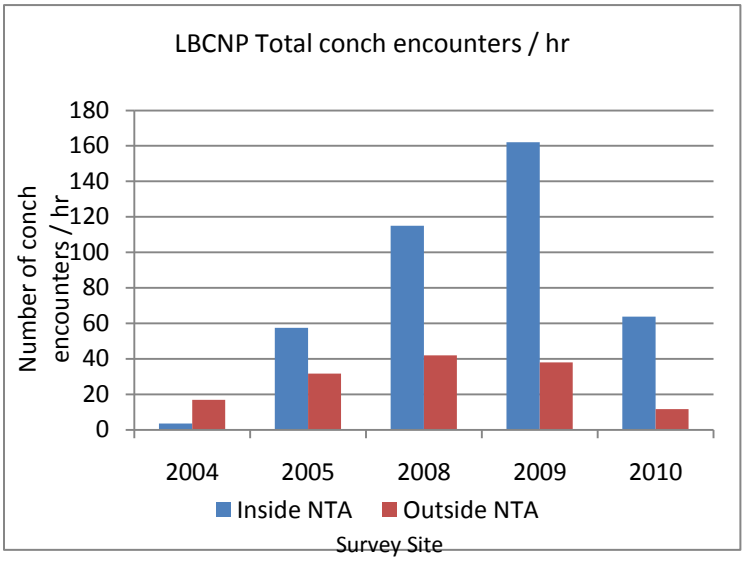


Figure 24: Conch encounters inside and outside Laughing Bird Caye National Park, 2004 - 2010 (SEA data, 2010)

Whilst many fishermen recognize the importance of the Laughing Bird Caye area as a conch replenishment source, there is minimal buy-in to the idea of conservation as a mechanism to manage the fisheries resources.

Finfish are also extracted from the areas around the marine protected area, mostly by spear guns and hand lines, and in general provide an important component of the community level catch. Much of this catch is sold in local markets and directly to hotels rather than through the co-operatives, or more recently, to Jamaican buyers, for export. The targeted export species include groupers (*Epinephelus spp.* and *Mycteroperca* spp.), snappers (*Lutjanus* spp. and *Ocyurus* spp.), hogfish (*Lachnolaimus maximus*), king mackerel (*Scomberomorus cavalla*), great barracuda (*Syhyraena barracuda*), and jacks (*Alectis* spp., *Caranx* spp. and *Trachinotus* spp.) (FAO, downloaded 2010). Snappers are reported to make up the largest single family of fish that are exported, with whole fish and fish fillet exports totalling 113,500 lbs in 2001, and dropping to 52,316 lbs in 2006, (Belize Fisheries Dept. 2002; Ministry of Agriculture and Fisheries, 2007) - a drop of approximately 44% over five years. Species harvested for local consumption include grunts (Haemulidae), mullets (Mugilidae), porgies (Sparidae), triggerfish (Balistidae), and tarpon. Data from Laughing Bird Caye National Park from 2004 to 2010 shows a steady increase in numbers of parrotfish (Figure 25), since their protection under the Fisheries legislation, though it is interesting to note that the number of encounters remains higher outside the protected area than inside. Other species, such as snapper, are steadily decreasing.

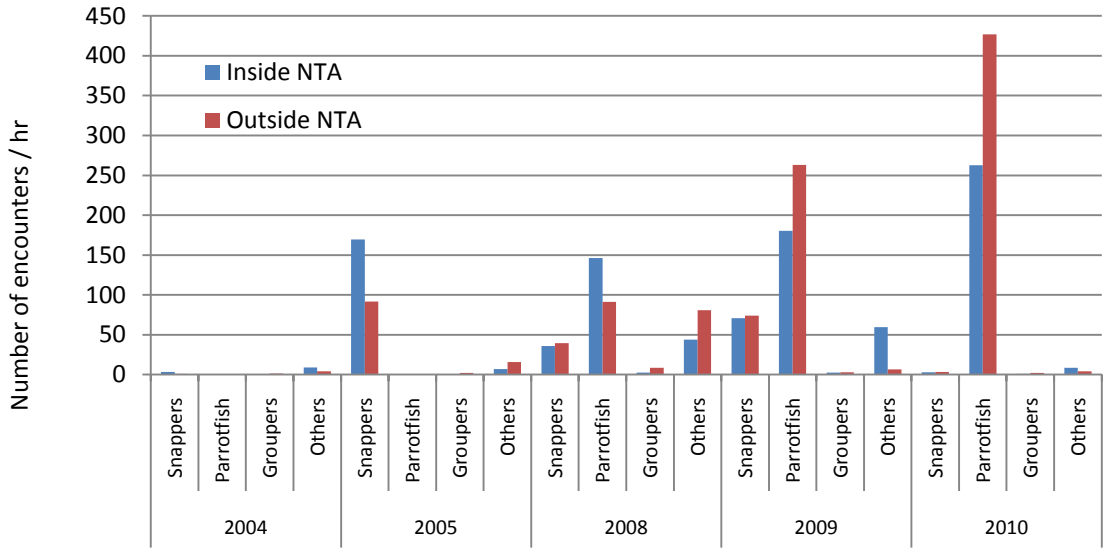


Figure 25: Commercial finfish encounters inside and outside Laughing Bird Caye National Park, 2004 - 2010 (SEA data, 2010)

Except for the whale shark (for which there is a complete ban on fishing under the Fisheries Act), there is the general recognition in Belize that sharks, in general, are under pressure from over-fishing. Sharks have a close stock-recruitment relationship, long recovery times in response to over-fishing produce few offspring and take long to reach sexual maturity, resulting in low biological productivity. This, in combination with complicated patterns of size/sex segregation and seasonal migration, raises national concerns about the sustainability of the shark fishery, particularly at the current unregulated fishing

levels. The Belize Fisheries Department is developing a National Plan of Action for the shark fishery following the guidelines of the International Plan of Action for the Conservation and Management of Sharks (IPOA – Sharks), which is designed to achieve the conservation and sustainable use of shark species through the protection of the marine environment (ecosystems and biodiversity), with the minimization of by-catch, waste and discard, and through the adoption of selective and environmentally safe fishing practices.

Shark fishing is conducted in the waters adjacent to Laughing Bird Caye National Park, and sharks are caught as by-catch in traditional long-line fishing in the deeper channels to the west and east of the protected area. Common species caught include bull, hammerhead, nurse, reef and lemon sharks. The dried shark fins and salted or frozen shark meat is being exported through the co-operatives, or illegally sold directly to buyers in various coastal ports in Guatemala and Honduras. Shark fishing in Belize was assessed in 2005 during the initial drafting of the National Plan of Action – Sharks (Fisheries Department, 2005). At this time, an estimated twenty-five fishermen from various coastal communities were identified as being involved, with the greatest capture activity concentrated between December and March. In 2001, about 9,500 lbs of shark products were exported (Belize Fisheries Dept. 2002) – however, this is accepted as an under-estimation of the fishing level, as the largest market is the illegal trade with Guatemala and Honduras.

1.5.4 Past and Present Research

With the unique structures of the faros of the Southern Belize reef, the general area has attracted research interest on the geological context over many years. Following work by Wantland and Pusey (1971) and Purdy (1974), James and Ginsberg produced a summary of the geological studies of the Southern Belize Reef in 1979, in the 'Seaward margin of Belize barrier and atoll reefs (International Association of Sedimentologists). This work was further interpreted by Choi and Holmes and Choi and Ginsburg in 1982, later re-summarized in Gischler and Hudson (2003), and most recently by Gischler, Ginsberg, Herrle and Prasad in 2010, providing a wealth of information on the geological history of fault lines, barrier reef and faro formation.

This depth of knowledge was not matched by research on the biodiversity of the area in the years before its designation as a National Park. A survey of the caye itself and its vegetation was conducted in the early 1960s (Stoddard, 1963), and a number of reef-based studies were completed in the 1990s that might have the potential to provide valuable comparative baselines for demonstrating the wide-scale ecological shift in the coral species of the faro over recent years. Coral Caye Conservation (CCC) completed eight transects of the faro wall in 1991, and produced a fish species list for the area (FoLBC/TIDE, 2000). A fish survey was also conducted in 1996 under the Fisheries Department (Azueta, 1996). CEDAM International also surveyed the faro in 1999, establishing a transect across the faro, approximately 0.8 km south of Laughing Bird Caye, and recording coral growth (FoLBC/TIDE, 2000). However it would appear that the results of both the CCC and CEDAM surveys are no longer accessible

(CCC, pers. com. 2010; SEA, 2010), negating the use of these transects as baselines for comparative surveys.

In 2001, WWF launched the Meso-American Reef Program, which assessed coral health over the entire Mesoamerican reef system, including Laughing Bird Caye, during the impacts of the 2001 coral bleaching episode (McField, 2001). This was followed a month later by Hurricane Iris, and an assessment of damage to fore reef, back reef and patch reefs of the faro (Bood, 2001). Surveys of reef condition were also conducted using the AGGRA methodology in 2006, providing a baseline for the Healthy Reefs programme. Using data from these surveys as a baseline, a more robust monitoring programme for coral reefs has been developed, implemented first by Friends of Nature, and more recently by the Southern Environmental Association. The Healthy Reefs baseline has recently been updated, using SEA 2009 data (McField, 2010.)

In 2009, Laughing Bird caye National Park was chosen as Belize's first reef restoration site by 'Fragments of Hope', a coral restoration programme seeking a proactive solution to climate change impacts on corals. The National Park was selected partially for its 'no-take' protection regime, considered critical for the maintenance of a healthy coral reef ecosystem, and provides conditions considered ideal for developing resilient corals, with fluctuating daily water temperatures and increased turbidity in the inner faro lagoon. The programme focuses on the endangered, reef-building Acroporidae, with their rapid growth rates, as well as eight other slower growing species. By 2010, over 2000 coral fragments have been planted at Laughing Bird Caye National Park, with the support of local tour guides, the Belize Fisheries Department and local NGOs, with plans to double this annually (Carne, pers. com., 2010). With the increased impacts on the National Park – the earthquake, hurricane damage, and climate change, this proactive approach may provide future hope, not just for increasing reef viability for Laughing Bird faro, but for all the reefs of Belize.

Fragments of Hope coral restoration programme coral nursery frames
(*Photo: Dr. Annelise Hagan / SEA*)

Another recently completed initiative, under the Conservation International, is the Marine Management Area Science Programme (2006 – 2009), focused on providing a framework for long-term monitoring of the Belize reef system, with Laughing Bird Caye National Park identified as one of five survey sites. In the long term, this has the potential to provide important feedback into the adaptive management of the marine protected area, with data on the current status of the reef, commercial fish species, and herbivores (Shank et al., 2010) at all five sites.

The MMAS study also included a range of other aspects, including assessment of the socio-economic context, resource use and visitor impacts. In conjunction with the MMAS program a study of cross-shelf

connectivity is currently being completed. This project will evaluate habitat use by select juvenile commercial fish species across the shelf from Placencia Lagoon to Glovers Reef, including Laughing Bird Caye National Park. Another similar project is also being conducted by Dr. Will Heyman from Texas A & M University.

1.6 Cultural and Stakeholder Use of Laughing Bird Caye National Park

1.6.1 Community and Stakeholder Use

Historically, the Laughing Bird Caye area has been an important fishing location for both conch and lobster for Placencia and Sarteneja until being declared a no-take area. The caye itself served as a camping site during regular fishing trips, as well as for family recreational visits, and culturally important trips, such as the *Adugahatía*, an integral part of the Dugu ceremony, with gathering of specific marine products to fulfil traditional ancestral spirits' requests for the Dugu ceremony. During community consultations on the establishment of the protected area, some participants raised concerns about how restrictions on camping at the caye may affect the ceremony. Access to Buttonwood Caye is now provided by SEA as an alternative, for this purpose.

Community consultations suggest that Seine Bight and Hopkins did not historically use the Laughing Bird Caye area for fishing, as it was considered too far and too expensive to reach (Clarke (MMAS draft, 2009). With the increased economic benefits of tourism, however, villagers from Hopkins are starting to access the area in their capacity as tour guides (Community consultations, 2010).

Of the Sarteneja fishing fleet, the largest fishing stakeholder of the area before its designation, 8 vessels (an estimated 56 fishermen) frequently and predictably fished in the areas around Laughing Bird Caye and the associated faro (Moretti / CI, 2009). These fishermen would join fishing boats when young, learning the specific reef patches and currents of the faro from an early age. Following the establishment of the National Park, a number of these fishermen shifted their area of focus to the reef adjacent to the boundaries, whilst others moved to different areas. Many of the Sarteneja fishermen interviewed stated that whilst the designation of Laughing Bird Caye National Park resulted in a slight shift in fishing effort, as most of the Sarteneja boats work large areas of reef much larger than the protected area, the impact was relatively small on the fishermen in general, and at most had a slight impact on a small number of fishermen who adjusted relatively easily (Moretti). The National Park has been generally respected by stakeholders for its good enforcement.

From the 1980s onwards, until the declaration of the caye as a National Park, both tour operators and fishermen continued to use the area. Once the caye and the surrounding waters were legally declared, in 1991, however, fishing was no longer permitted within the boundaries. From 1991 onwards, tourism has been the primary stakeholder use of the area, with a limited amount of research.

1.6.2 Recreation and Tourism Use

Laughing Bird Caye has been considered a local tourism destination even before its designation as a protected area. Less than 3% of overnight visitors make it to Laughing Bird Caye National Park (SEA, 2009; BTB, 2009), primarily departing from Placencia.

Visitation figures have been maintained by Friends of Nature, and more recently by SEA, since 2006, providing breakdowns of total visitor numbers and activities (Figures 26 and 27).

SEA data shows that visitation peaked in 2006, with over 10,300 visitors using the caye and surrounding waters. Since then, however, numbers have decreased, reaching a low in 2009 of 6,654, possibly tied into the economic recession.

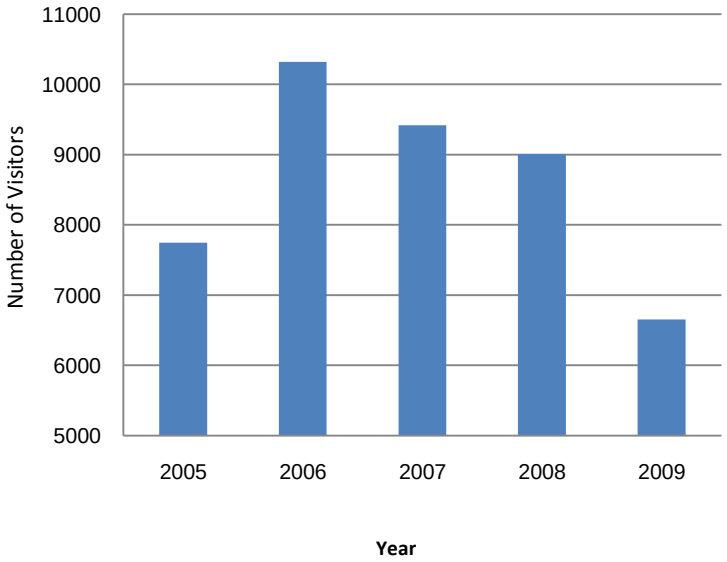


Figure 26: Comparison of Annual Visitation to LBCNP 2005-2009 (SEA data, 2010)

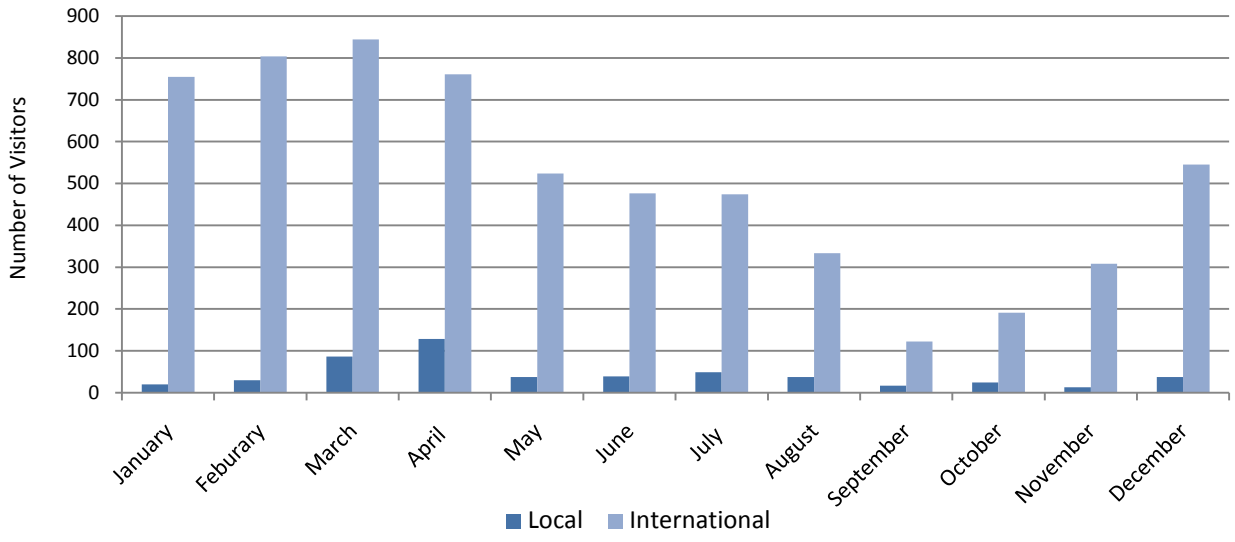


Figure 27: Monthly Visitation to LBCNP 2009 (SEA data, 2010)

Visitation varies across the year, as well, peaking between March and April, with lowest visitation during September (Figure 28).

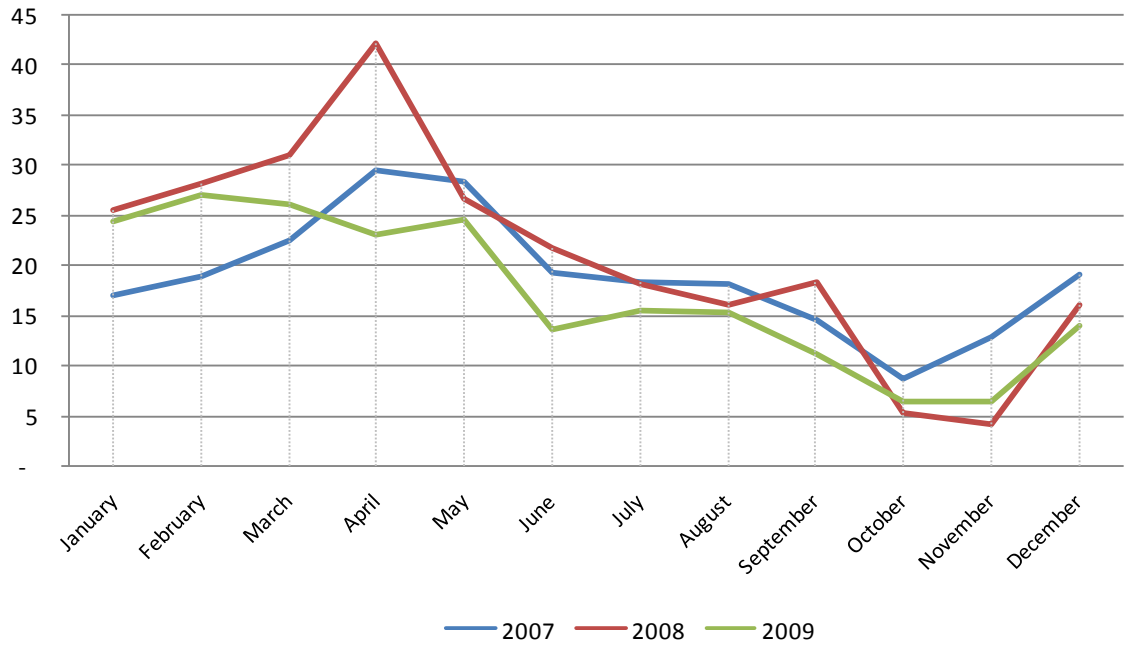


Figure 28: Number of foreign visitors per day from 2007 to 2009. LBCNP (From: SEA Financial Plan, Bravo, 2010)

The majority of visitors are snorkelers (79%) and divers (21%), participating in guided day tours to the National Park, with a small number of kayaking groups and live aboard bareboat charters (Figure 29).

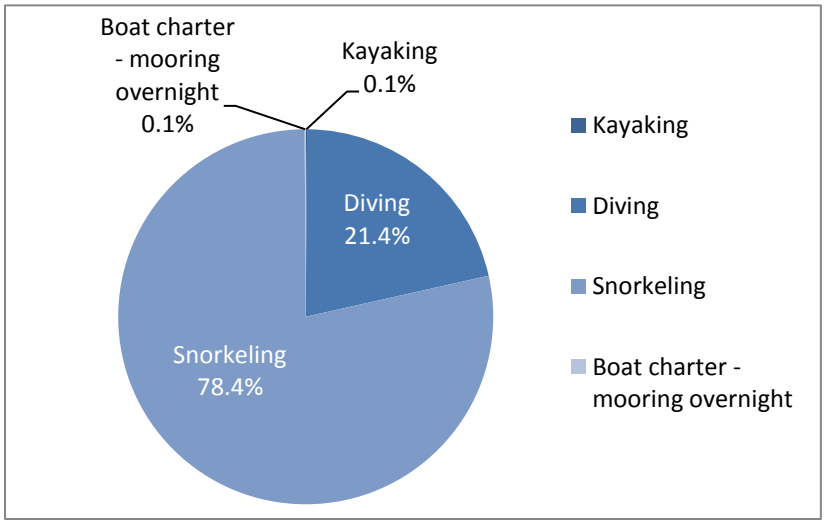


Figure 29: Breakdown of activities for visitors to LBCNP 2009 (SEA data, 2010)

1.6.3 Educational Use

SEA recognizes the importance of hands-on experience in reaching out to its stakeholders, and Laughing Bird Caye National Park is the focus of SEA's Education and Outreach Programme, easy access making it the ideal location for hosting school trips. This activity, which has been ongoing throughout the history of the National Park, was strengthened during 2010 under a COMPACT-funded project that assisted SEA in developing greater understanding among stakeholders of all ages about the importance of marine conservation and marine protected area management. SEA provided over 400 students with field trips to the reef, many to Laughing Bird Caye National Park, to experience the reef environment and discuss management issues.

Students during an educational visit to Laughing Bird Caye National Park (*Photo: J. Mendez / SEA*)

The trips were facilitated by 60 Field Directors – parents and teachers - who were provided with the skills to lead small groups of students in these reef exploration activities, based on a marine ecology curriculum developed by SEA.

These activities have provided SEA with a firm foundation and model for use of Laughing Bird Caye National Park as an educational resource, strengthening stakeholder support for management of the protected area.

2. Conservation Planning

Conservation planning is a structured process that identifies and assesses the species and ecosystems of concern, the threats that impact them, and the strategies that can be used within the management of the area to mitigate these threats.

2.1 Conservation Targets

Conservation targets are species, species assemblages or ecosystems that have been selected as representing the biodiversity of a protected area – such that strategic actions, taken to ensure their continued viability and reduce the pressures impacting them, will adequately address the needs of the system as a whole.

2.1.1 Identification of Conservation Targets

An initial list of potential conservation targets was generated, to represent and encompass the biodiversity values of the area, and to provide a basis for setting goals, developing strategies and actions, and monitoring success.

These potential targets were then reviewed, combined or nested into a list of six conservation targets, each representing or capturing the array of ecological systems, communities and species of the National Park, incorporating those highlighted in the preliminary list.

Potential Conservation Targets for Laughing Bird Caye National Park

- **White Sandy Beaches** - hawksbill turtles
- **Bird Restoration zone** - Ospreys, Pelicans, Laughing Gulls (sometime nest) - lack of habitat for LG. Migration of birds to other areas.
- **Jacks, Yellowtail and Dog Snappers**
- **Bait fishes**
- **Commercial fish species** (conch, lobster, mutton snapper, barracuda, hogfish)
- **Nurse sharks / lemon sharks**
- **Eels**
- **Parrotfish** - play an ecological role on coral reefs
- ***Acropora palmata, Acropora cervicornis*** (coral restoration project)
- **Sea**
- **Bonefish, Permits**
- **Stingrays**
- **Goliath Groupers, Nassau Groupers**
- **Faro** - unique coral formation

Final Conservation Targets for Laughing Bird Caye National Park

- Herbaceous Beach Vegetation / Littoral Forest
- Coral Reef Communities
- Seagrass
- Commercial / Recreational Species
- Sharks

Herbaceous Beach Vegetation /Littoral Forest	
Justification	**Species / ecosystems nested in this target**
Variously called **Tropical Littoral Forest and Beach Communities**, or **Tropical Coastal Vegetation on Recent Sediments**, this ecosystem typically includes herbaceous ground-cover plants and vines on the upper beach, grading into woody shrubs with a relatively open canopy of salt-tolerant trees. On the landward side, this ecosystem tends to grade into Mixed Mangrove Scrub. Littoral forest / herbaceous beach vegetation is highly under-represented under the current National Protected Areas System - the target protected coverage is 60%, but in fact only 8.6% is included within current protected areas, and even this is often poorly protected because of the economic pressure to provide white sandy beaches and (non-native) coconuts for visitor appeal. Laughing Bird Caye is no exception: natural vegetation is largely confined to the relatively small northern end of the island, where it is regenerating from past natural and anthropogenic impacts, whilst a significant portion of the southern end of the island is maintained as visitor beaches, preventing natural regeneration. This ecosystem is recognized as critical nesting habitat for endangered marine turtles, as well as an important re-fuelling station for migratory birds. The above and below ground structure of littoral forest /herbaceous beach vegetation is important in providing protection against the potentially massive beach erosion by tropical storm events. When cleared and maintained as sandy beaches with coconut trees, the caye is significantly destabilized and exposed to greatly increased risk of erosion or complete loss.	The sandy beach provides nesting sites for **critically endangered** hawksbill turtle (*Eretmochelys imbricata*) ((IUCN, 2010), with an average of between 4 and 8 nests reported each year. 11 nests were reported for 2009, and 4 for 2010 (SEA staff, 2010), possibly representing only one or two adult laying females. Community consultations suggest that the caye may have been used in the past by the endangered loggerhead and green turtles, but these species have not been recorded nesting in recent history (Smith et. al, 1992; Majil, 2007). Historically, the caye used to be the nesting site for a large colony of laughing gulls, giving the caye its name. This species stopped nesting on the caye by 1998 (Jones, 1998), but more recently, individual birds have been seen on the caye, and it is hoped that the colony will become re-established. Nested within the Littoral Forest target are a series of associated plant species (Annex: 4). A number of resident birds are found on the caye – the great tailed crackle, brown pelican and osprey among them. Seasonally, migratory bird species use the coastal forests and cayes as they pass through (Annex 4: Jones, 1998; Jones, 2002).

Herbaceous Beach Vegetation /Littoral Forest						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Size Size / extent of characteristic community	Total area of littoral forest ▪ ***SBRC Indicator***	Reduced extent of Littoral Forest	Current extent of Littoral Forest	Increased extent of littoral forest, extending into south part of caye	Natural vegetation, free of exotic species, covering >75% of the island	**Current Status: FAIR** **(lower end of fair)** because of continued anthropogenic actions preventing natural regeneration on much of the island.
Condition Community architecture	% Littoral Forest in natural condition ▪ ***SBRC Indicator***	75% - 99% of Littoral Forest shows human impacts	50 - 74% of Littoral Forest shows human impacts	<50% of Littoral Forest shows human impacts	No Littoral Forest shows human impacts	**Current Status: POOR** >75% of littoral forest is impacted by introduced (invasive and non-native) coconuts and/or active prevention of regeneration.
Condition Abundance of food resources	Number of birds nesting in Littoral Forest	Significant decrease in number of nesting birds	Number of nesting birds is reduced	Current number of nesting birds	Increased number of nesting birds	**Current Status:** Default rating - Not known
Condition Community architecture	Presence of invasive species - *Casuarina*	*>5 Casuarina* on caye	2-5 *Casuarina* on caye	Current level of *Casuarina* on caye – one specimen	No *Casuarina* on caye	**Current Status: GOOD**
Condition Community architecture	Presence of invasive species – coconut in Littoral Forest	Coconuts established on northern tip of island and/or increased numbers in buffer area	No coconuts on northern tip, current number of coconuts in buffer area	No coconuts on northern tip, 50% of current coconuts in buffer area removed, no young coconuts remaining	No coconuts in littoral forest on northern tip of island, nor in northern regenerating buffer area	**Current Status: FAIR**
Condition Presence of active turtle nesting	Number of turtle nests	<5 nests	6-15 nests	16-25 nests	>25 nests	**Current Status: FAIR** 2009 11 nests 2008 4 nests 2007 Limited data

Herbaceous Beach Vegetation /Littoral Forest						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Presence of active turtle nesting	Number of successful turtle nest hatches	<50%	50 – 74%	75 – 99%	100%	**Current Status:** Not known
Condition Presence of laughing gull nests	Number of nests	No nests	1 - 5 nests	6 - 15 nests	Nesting colony re-established (> 16 nests)	**Current Status: POOR**

Coral Reef Communities	
Justification	**Species / ecosystems nested in this target**
The Laughing Bird faro is one of a unique series of faroes in the Barrier Reef lagoon, and is considered a conservation priority, resulting in the designation of this MPA as part of Belize's World Heritage Site (UNESCO, 1996). The faro is formed from reef building corals critical to the maintenance of local biodiversity. This is one of the few fully protected lagoonal reefs, with higher temperatures, rapid temperature fluctuations and increased turbidity, leading to a stressful environment that promotes a more genetically robust coral community, and includes an identified resilient site under the TNC-WWF surveys. These conditions make Laughing Bird Caye National Park an important recruitment source for other adjacent reef areas as climate change impacts increase. Socio-economically, it is also one of the more important tourism resources Belize has to offer, and supports a significant percentage of employment in Placencia and other adjacent coastal communities. The 'non-extractive' designation of LBCNP allows the reef community to act as a source, both for larvae (e.g. coral and fish) and adults, through natural movement across the park boundary. This is essential to the maintenance of the traditional fishing industry. A healthy reef can be characterized by relatively high live coral cover, moderate cover by crustose coralline calcareous algae and short turf algae, and low cover by fleshy macroalgae (Healthy Reef Initiative, 2007). In 1997, coral cover in the southern SBRC, from Laughing Bird Caye southwards, ranged from 22-25%, but was severely affected by Hurricane Mitch and coral bleaching (Kramer and Kramer, 2000), dropping to 3-15% coral cover in 1999 (McField, 2001). The current regional MAR live coral cover averages 14%, with Laughing Bird Caye National Park reporting 16.6% in 2007-2008, rating as FAIR (Wilkinson, 2008; Status of Protected Areas report, 2009).	The reef ecosystem of LBCNP includes back-reef, reef slope and patch reef in a faro formation. These reef areas comprise many scleractinian coral species, including four IUCN listed species (Critically Endangered (**CR**); Endangered (**EN**) or Vulnerable (**VU**): **Staghorn Coral** *Acropora cervicornis* **CR** **Elkhorn Coral** *Acropora palmata* **CR** **Star Coral** *Montastraea annularis* **EN** **Star Coral** *Montastraea faveolata* **EN** This provides a diverse range of habitats for a multitude of fish species and invertebrates, including commercially important species, of which at least eleven are on the IUCN redlist, with the goliath grouper (*Epinephelus itajara*) listed as critically endangered and the Nassau grouper (*Epinephelus striatus*) as endangered IUCN, 2010). Herbivores such as the large parrotfish (Scaridae – *Scarus coelestinus, Sparisoma chrysopterum* and *S. virida)* are critical in maintaining the balance between live coral reef and algal cover, ensuring coral recruitment sites are available for continued coral health, particularly in recovery following bleaching episodes. LBCNP rates as FAIR for parrotfish. LBCNP 2008 average live coral cover: 10 - 19.9% (FAIR) LBCNP 2008 Coral recruitment: 5.0 – 9.9 recruits/m^2 (GOOD) LBCNP 2008 recent coral mortality: estimated at < 2% (GOOD) LBCNP 2008 macroalgal cover: 11-21% (GOOD) LBCNP highest % coral bleaching (2008): 26% (full and partial bleaching) LBCNP TNC-WWF bleaching results (October, 2008): 2 sites 20.5 – 30.5% bleaching; 1 site 10.5 – 20.5% bleaching LBCNP Parrotfish biomass: 1250.01-4650 g/100m^2(FAIR).

Coral Reef Community Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Landscape Context Connectivity among communities & ecosystems	Current IRHI of resilient site identified in the 2006 WWF/ TNC rapid reef assessment : ▪ ***SBRC Indicator***		**Site 1125:** IRHI 2.61 (2009)			**Current Status:** This site was identified as potentially resilient due to its high coral cover, low macroalgae abundance, low disease, high fish populations, low recent mortality, large number of herbivores, and high recruitment. The resilient sites were generally healthy and recovered from localized bleaching events (NCRM). One site (1125) **IRHI =** Integrated Reef Health Index (Healthy Reefs, 2007)
Landscape Context Environmental Factors	Water quality ▪ ***SBRC Indicator***					**Current Status:** Unknown. In the MAR, optimal water temperature for corals is 25 - 29°C. Monthly averages that exceed 0.5°C above the historical average for that month may cause bleaching (Healthy Reefs, 2007).
Condition Population Structure and Recruitment	% Average live coral cover ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	<10%	**10 - 19.9%**	20 - 39.9%	>40%	**Current Status:** FAIR (16.6%). SEA data, 2008; Shank, 2010
Condition Presence / abundance of key species	% Recent coral mortality ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	>4%	2-4%	**< 2%**	0%	**Current Status:** SEA data, 2008. Healthy reefs goal is to maintain MAR average of below 2% recent mortality, 20% old mortality and standing dead below 5%. (Shank, 2010)
Condition Presence / abundance of key species	Level of coral recruitment ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	> 2 / m^2	2 recruits /m^2 – 4.99/m^2	**5 recruits/m^2 – 9.99/m^2**	≥10 recruits/m^2	**Current Status:** Figures range from 5 – 9.9/m^2 (SEA data, date?) to 6.0/m^2 (Shank, 2010)

Coral Reef Community Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Presence / abundance of key species	Commercial fish biomass ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	<700 g/100m^2	700 - 1399 g/100m^2	**1400–2799 g/100m^2**	>2800 g/100m^2	**Current Status:** SEA data, 2008 (MBRS); MAR averages about 4600g/100m^2; with about 1100g /100 m^2 for commercial fish. Target is a 20% increase.
Condition Presence / abundance of key species	Parrotfish biomass ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	1-1250g /100m^2	**1250.01 - 4650g /100m^2**	>4650g / 100m^2		**Current Status:** SEA data, 2008
Condition Species Dominance	% Macroalgal cover ▪ ***SOPA Indicator***			**11-21%**		**Current Status:** SEA data, 2008
Condition Coral Bleaching	Average % coral exhibiting bleaching per annum ▪ ***SOPA Indicator***					**Current Status:** SEA data, 2008
Condition Coral Bleaching	% survey sites showing coral bleaching per annum ▪ ***SOPA Indicator***	>10%	5-10%	<5		**Current Status:** SEA data, 2008

Seagrass	
Justification	**Species / ecosystems nested in this target**
Seagrass meadows are essential for maintaining the ecological health of the shallow marine ecosystems, with an important role in nutrient cycling and sediment stabilization. They are also a critical ecosystem for many fish and invertebrate species, with an acre of sea grass being shown to support up to 40,000 fish and 50 million small invertebrates (Seagrass Ecosystems Research Laboratory, 2005). Seagrass beds are especially important as a nursery habitat. This target focuses on the seagrass beds of Laughing Bird Caye National Park. 90 – 100% of the sea grass beds are considered to be intact, with only marginal impacts from tourism and boat impacts in the shallow waters around the caye itself.	Two species of seagrass are present at Laughing Bird Caye – Turtle Grass (*Thalassia testudinum*) and Shoal Grass (*Syringodium filiforme*). Seagrass beds are essential for the **Queen Conch** *(Strombus gigas)*, one of the most important commercial species extracted from the sea. They are also important for the juveniles of the **Caribbean Spiny Lobster** (*Panulirus argus*) and many commercial fish species. **Parrotfish,** herbivores that play a critical role in maintaining the reef, also rely on the seagrass beds as juveniles. Nested targets also include the **West Indian Manatee** (*Trichechus manatus)*, the largest of Belize's herbivorous marine mammals, which have been recorded from the adjacent Little Water Caye, as well as marine turtles. These species play an important role in the maintenance of seagrass beds and increase the productivity of this ecosystem through grazing.

Seagrass Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Size Size / extent of characteristic community	Extent of seagrass				***90 – 100% Current status***	**Current Status:** >90%. Possibly some boat impacts, but minimal
Size Size / extent of characteristic community	% seagrass cover	< 50%	50% - 75%	75% - 90%	***90%- 100%***	**Current Status:** > 90%. % cover = average of % of $1m^2$ quadrat in seagrass monitoring sites within LBCNP occupied by seagrass
Landscape Context Environmental Factors	Water quality ▪ ***SBRC Indicator***					**Current Status:** Unknown. ▪ Prefers salinities b/w 25-40 ppt. Begins to die when salinity reaches 20 ppt or lower, and will not grow in 17 ppt or less. Intolerant of salinities 45 ppt or higher for extended periods ▪ Prefers temperature b/w 20-30˚C. Temperature above 35˚C will kill it ▪ Prefers light levels 18 – 40.5 lumens/m^2
Condition Community architecture	% seagrass not impacted by anthropogenic activities				***Current Status***	**Current Status:** Unknown. Thought to be >90%, but no data
Condition Presence / abundance of key species	Abundance of hawksbill and green turtles within LBCNP per annum / ha					**Current Status:** Unknown. Not yet included within monitoring programme
Condition Primary Productivity	Seagrass density	0 - 29%	30-49%	50-79%	80 - 100%	**Current Status:** Unknown, Seagrass monitoring just starting

Commercial and Recreational Species	
Justification	**Species / ecosystems nested in this target**
Whilst Laughing Bird Caye National Park is a non extractive marine protected area, this target has been included for its importance in the maintenance of these species, and the spill-over effect an effectively managed protected area can provide. Most commercially important marine species have complicated life cycles that rely on the health of the entire marine ecosystem – not just the reef, but also the seagrass beds and the mangroves. The role of many of the target fin-fish species as top predators is essential in maintenance of reef community structure, and removal of these species has resulted in fishermen targeting key herbivore species such as the Scarids, even further disrupting the ecological balance on the reef. The **Caribbean Spiny Lobster** (*Panulirus argus*) and **Queen conch** (*Strombus gigas*) are both fished extensively throughout Belize. The lobster fishery is the largest capture fishery in Belize, with production representing approximately 42% of total capture fisheries production in 2008, and an export value of Bz$14.8million (Fisheries Department, 2009). Lobster landings (tails) peaked in 1981 at 2,204,622 lbs, stabilizing between 1985 and 1995, but then fell to 470,485 lbs by 2008 (Fisheries Department, 2009). The general trend is a decline in stock (Fisheries Department, 2009), and there are concerns for the continued sustainability of the lobster fishing industry. Conch, too, have declined significantly, though strict regulations and quotas are being implemented towards more sustainable use of this resource. LBCNP is known historically by fishermen for its high conch population, and for its importance in recruitment, with higher adult conch densities than the adjacent areas of the Southern Belize Reef Complex.	This target, commercial marine species, covers finfish, lobster and conch – important for the fishing industry in Belize. Nested targets include **Caribbean Spiny Lobster** (*Panulirus argus*) and **Spotted Lobster** (*Panulirus guttatus*), as well as **Queen conch** (*Strombus gigas*). The density of conch within LBCNP is estimated at 197.53/ha, compared with 11.11/ha outside the protected area. SBRC averages 44/ha for conch in open fishing areas, and 255/ha in no take zones – population viability is thought to be above 50/ha (Stoner and Ray-Culp, 2000). The Healthy Reef target is 300 – 400 adults per hectare. Lobster density is low – 5.79 per man hour in 2008, Commercial finfish are also nested under this target, including hogfish, grouper, snapper and grunts. The targeted export species include groupers (*Epinephelus* spp. and *Mycteroperca* spp.*)*, snappers (*Lutjanus* spp. and *Ocyurus chrysurus*), hogfish (*Lachnolaimus maximus*), king mackerel (*Scomberomorus cavalla*), great barracuda (*Syhyraena barracuda*), and jacks (*Alectis* spp.*, Caranx* spp. and *Trachinotus* spp.) LBCNP Commercial fish biomass: 2100 - 2799 g-100m^2 (GOOD) SEA data, 2008

Commercial / Recreational Species Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Landscape Context Environmental Factors	Water quality ▪ ***SBRC Indicator***					**Current Status:** Unknown. Optimal water temperatures lie within 25 - 29°C. Monthly averages that exceed 0.5°C above the historical average for that month are likely to cause bleaching
Size Population Size and Dynamics	Commercial fish biomass ▪ ***SBRC Indicator*** ▪ ***SOPA Indicator***	<700 g-100m^2	700 - 1399 g-100m^2	***1400–2799 g-100m^2***	>2800 g-100m^2	**Current Status:** SEA data, 2008. MBRS data; Healthy Reefs data differs on ratings - MAR averages about 4,600g/100m sq; with about 1,100g /100m sq for commercial fish. Target is a 20% increase.
Size Population Size and Dynamics	Conch density	< 50/ha	50 – 200/ha	***200 – 500 / ha***	>500 / ha (Incl. nursery)	**Current Status: 2009:** 197.53/ha (SEA data, 2008)

Sharks	
Justification	**Species / ecosystems nested in this target**
Sharks are the top predators of the marine environment - wide ranging species that are critical for the maintenance of the coral reef ecosystem. Nationally, sharks are under increasing fishing pressure, with demand for shark meat from neighbouring countries, especially during the Lenten season, and growing international demand from countries like China for both the shark meat and fins. The National Park has been home to a wide variety of shark species including the commonly encountered nurse and lemon sharks as well as more seasonal sightings of whale sharks (February / March/September / October), thought to be attracted by spawning yellow-tail snappers, and even the occasional great hammerhead and tiger shark. Sharks and rays have been an important attraction for tourists who visit Laughing Bird Caye, with juvenile and adult lemon sharks seen with regularity on the western side of the island in the past, often attracted by feeding of lunch scraps by the guides (an activity that is now banned). However the three adult lemon sharks once frequently seen at LBC were fished in 2006 and have not yet been replaced by mature individuals. Despite the protected status of sharks within the National Park there is growing concern that these wide ranging species are declining within the park boundaries due to fishing pressure outside - particularly in the deeper channels around the faro. There has been a noticeable shift in the species and numbers of sharks using Laughing Bird Caye National Park, with more nurse sharks being seen in the snorkelling areas, but fewer young sharks, once seen frequently in the shallow waters off Laughing Bird Caye.	***Sharks*** Bull shark – *Carcharhinus leucas* Lemon shark – *Negaprion brevirostris* Caribbean reef shark – *Carcharhinus perezii* Tiger shark – *Galeocerdo cuvier* Caribbean sharpnose shark – *Rhizoprionodon porosus* Whale shark – *Rhincodon typus* Nurse shark – *Ginglymostoma cirratum* Black tip shark – *Carcharhinus limbatus* Silky shark – *Carcharhinus falciformis* Scalloped hammerhead – *Sphyrna lewini* Bonnethead – *Sphyrna tiburo* Great hammerhead – *Sphyrna mokarran* Blacknose shark – *Carcharhinus acronotus* ***Rays*** Southern stingray – *Dasyatis americana* Caribbean whiptail stingray – *Himantura schmardae* Longnose stingray – *Dasyatus guttata* Yellow stingray – *Urolophus jamaicensis* Giant manta – *Manta c.f. birostris* Chilean devil ray – *Mobula tarapacana* Devil ray – *Mobula hypostoma* Spotted eagle ray – *Aetobatus narinari*

Shark Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Size Size / extent of population	Number of sharks per species per annum	Current Status				**Current Status: POOR** R. Graham, input into SEA Conservation Planning
Condition Presence / abundance of key species	Diversity of sharks recorded	Current Status				**Current Status:** R. Graham, input into SEA Conservation Planning

2.2 Assessing Biodiversity Viability

The Viability Assessment, as conducted under the Conservation Planning process, provides:

- A means for determining changes in the status of each focal conservation target over time, allowing SEA to measure the success of its conservation strategies, compare the status of a specific focal target with future conditions, and compare regionally with other projects in Belize / Central America that focus on that target.

- A basis for the identification of current and potential threats to a target and identification of past impacts that require mitigating actions.

- A basis for strategy design and the foundation for monitoring.

Each Conservation Target was assessed using the following viability ratings:

- **Very Good** – The Indicator is considered to have an ecologically desirable status, requiring little or no intervention for maintenance.

- **Good** – The indicator lies within the acceptable range of variation, though some intervention is required for maintenance.

- **Fair** – The indicator lies outside the acceptable range of variation, and human intervention is required if the viability of the target is to be maintained.

- **Poor** – Restoration of the conservation target is increasingly difficult, and impacts may result in extirpation from the conservation area.

Table 18: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Herbaceous Beach Vegetation /Littoral Forest	**FAIR**	**GOOD**	***Justification:*** The beach is used as a nesting site by hawksbill turtles, with successful nesting reported in 2009. There is still a relatively large area with herbaceous beach vegetation providing good ground cover, with no recent net loss of vegetation cover in the northern and central buffer area. However, there is increased beach erosion, exacerbated by vegetation clearance in the southern end of the caye, to maintain the island's aesthetic qualities for tourists – removal of natural vegetation will destabilize the caye and increase erosion in storm events. This may also affect the number of turtles that return to nest, and the nesting success. The herbaceous beach vegetation / littoral forest / mangrove component on the northern part of the caye, includes all three mangrove species, as well as the mangrove associate – buttonwood. Species composition is too poor and the vegetation lacks a clear canopy, so does not qualify as littoral forest in its own right. On the southern portion of the caye, north of the bathrooms, there is a more limited scope for regeneration, with greater visitor access. A single specimen of the invasive *Casuarina* is present in this area. The remainder of the caye has coconuts, kept cleared to the sand for visitation, catering for over 100 visitors at a time.
			Goal: To maintain or increase the value of the sandy beach for nesting species, and littoral forest components
			Indicators: Number of turtle nests; number of successful turtle nest hatches; number of Laughing Gull nests; number of beach nesting bird species using the caye; level of beach erosion; net loss of remaining herbaceous vegetation; number of birds using woody vegetation for nesting; number of *Casuarina* trees; number of red mangroves on caye;

Table 18: Conservation Target Assessment			
Conservation Target	**Current Rating**	**Goal**	**Justification for Rating, Goal and Indicator**
Coral Reef Communities	**FAIR**	**FAIR**	***Justification:*** The coral reefs at Laughing Bird Caye are in similar condition to those across the country of Belize. Live coral cover is estimated at 16.6%, with 26% showing some degree of paling or bleaching (SEA data, 2008). In addition the reef surrounding the faro was badly impacted by the May 2009 earthquake with approximately 30% of the reef area completely wiped out and over 25% significantly damaged (Shank et. al. 2010). The coral reef adjacent to the caye is directly impacted by tourists, with a trend of increasing numbers. Trawling activity outside the protected area in the adjacent Victoria Channel is also thought to have significant impact. Despite these statistics recent coral mortality was rated as GOOD at only 2%, and recruitment as 13.5% - all species (Shank et. al. 2010). Macroalgal cover at 23% is considered a significant decrease in condition to FAIR (SEA data, 2010) compared with the 2008 figures of 11-21%, rated as GOOD (SEA data, 2008). Populations of Parrotfish - key herbivorous fish species – are considered to be FAIR.
			Goal: Maintain coral reef communities at Fair, with implementation of strategies for reduction of impacts
			Indicators: Live coral cover; Recent mortality recent coral recruitment; Herbivorous fish density; *Diadema* density
Seagrass	**VERY GOOD**	**VERY GOOD**	***Justification:*** There are very few current impacts on seagrass extent and condition within the protected area. Conch and sea cucumber, both commercial species dependent on seagrass, are present in good numbers, as are marine turtles.
			Goal: To maintain seagrass as VERY GOOD
			Indicators: Extent of seagrass; condition of seagrass; density of conch; % of seagrass area impacted by anthropogenic activities

Table 18: Conservation Target Assessment			
Commercial and Recreational Species	**GOOD**	**GOOD**	***Justification:*** LBCNP is a 'No take' MPA, and considered to have effective enforcement. Conch: Data from 2004, 2005 and 2008 demonstrates that conch size has increased in LBCNP since enforcement began, and a higher proportion of larger conch is now present. Lobster: LBCNP is not known for its importance for lobster, and populations are low. There is no significant difference between lobster populations within and outside the National Park - however there are significantly more lobster within LBCNP when compared to GSSCMR. There are 31% more finfish inside the boundary than as survey sites outside (Shank et. al. 2010). LBCNP also has a higher density of target finfish than either GSSCMR or SCMR. LBCNP: 2100 - 2799g-100m2 GSSCMR: 1400 - 2099 g-100m2 SCMR: 700 - 1399 g-100m2
			Goal: To maintain and improve current population levels of identified commercial species
			Indicators: Densities of conch, lobster and specific finfish; number of fishing incursions
Sharks	**POOR**	**FAIR**	***Justification:*** Sharks and rays play an important role as top predators within the reef ecosystem. Anecdotal reports suggest that shark abundance has decreased within the National Park, thought to be due to increasing fishing pressure outside the reserve boundaries, and to regional decreases in populations of shark species that use the reef lagoon areas.
			Goal: To maintain and improve current population viability of shark and ray species within the National Park
			Indicators: No. species sharks/rays recorded per year; No. individuals and size per species per year; No. whale sharks; number of fishing incursions

Table 19: Conservation Targets – Current Ratings and Goals		
Conservation Target	**Current Rating**	**Goal**
Seagrass	**VERY GOOD**	**VERY GOOD**
Herbaceous Beach Community /Shrub Component of Littoral Forest	**FAIR**	**GOOD**
Commercial and Recreational Species	**GOOD**	**GOOD**
Coral Reef Communities	**FAIR**	**FAIR**
Sharks	**POOR**	**FAIR**

Table 20: Conservation Target Viability across SEA MPAs			
Conservation Target	**LBCNP**	**GSSCMR**	**SCMR**
Littoral Forest			**FAIR**
Herbaceous Beach Vegetation / Littoral Forest	**FAIR**	**GOOD**	
Coral Reef Communities	**FAIR**	**FAIR**	**FAIR**
Seagrass	**VERY GOOD**	**VERY GOOD**	**VERY GOOD**
Commercial / Recreational Species	**GOOD**	**FAIR**	**FAIR**
Sharks	**POOR**	**FAIR**	**POOR**
Spawning Aggregation		**FAIR**	**FAIR**
Whale Sharks		**FAIR**	**FAIR**
Sea Cucumbers / Seaweed			**POOR**

2.3 Threats to Biodiversity

Laughing Bird Caye National Park is often cited as an example of an effective protected area, with rules, regulations and guidelines in place for visitor use, along with effective enforcement. Despite this, the National Park is facing impacts outside the control of the site-level and national management bodies. The greatest impacts come from climate change, a major overarching threat facing most marine protected areas of the Caribbean today, as is evidenced by increased incidence of mass coral bleaching over the past 20 years. Other identified threats include fishing pressure, tourism impacts, poor boating practices and agricultural runoff and, more recently, oil exploration and extraction from near- and off-shore exploration activities, with the National Park lying within one and adjacent to several off-shore oil exploration concessions, and shipping of crude oil from the current inland oil extraction industry.

A threat assessment was conducted in 2010 for the conservation planning process, with input from a wide range of stakeholders – including protected area site management staff, researchers, tour guides and fishermen with local and technical knowledge of the area.

2.3.1 Identified Threats

Outputs from the threat assessment meetings identified seven primary issues. These were prioritized using three criteria to direct resources toward mitigation of the most critical threats.

This assessment rated:

- The area affected by the threat
- The severity of the threat
- The urgency of actions needed to mitigate the threat

Key Threats impacting Laughing Bird Caye National Park

- Climate Change
- Unsustainable Fishing Practices
- Tourism Impacts
- Poor Boat Handling and Management
- Oil exploration / extraction / transport
- Invasive species - lionfish

Rating Critical Threats

The critical threats are assessed by Area, Severity and Urgency, using the following criteria:

Area: The area of the threat (how much of the conservation target area it affects)

Proportion of Area Affected (adapted from WCS)		
Criteria	**Score**	
Area	**4**	Will affect throughout >50% of the area
	3	Widespread impact, affecting 26 – 50% of the area
	2	Localized impact, affecting 11 – 25% of the area
	1	Very localized impact, affecting 1 – 10% of the area

Severity: The severity of the threat – how intense or great the impact is

Severity Ranking (adapted from WCS)		
Criteria	**Score**	
Severity	**3**	Local eradication of target possible
	2	Substantial effect but local eradication unlikely
	1	Measurable effect on density or distribution
	0	None or positive

Urgency: The likelihood of the threat occurring over the next five years

Urgency Ranking (adapted from WCS)		
Criteria	**Score**	
Urgency	**3**	The threat is occurring now and requires action
	2	The threat could or will happen between 1 – 3 years
	1	The threat could happen between 3 – 10 years
	0	Will not happen in > 10 years

<table>
<tr><th colspan="5">Threats to biodiversity of Laughing Bird Caye National Park / 1</th></tr>
<tr><td rowspan="8">Climate Change</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): All</td></tr>
<tr><td colspan="4">Threats (Direct):
Reduced live coral cover
Erosion of beach
Reduction in extent of herbaceous beach vegetation communities
Ecological shifts in benthic communities
Reduced biodiversity
Reduced coral growth rates</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
Increased water temperatures
Increased storm events / hurricanes
Sea level rise
Changes in currents
Ocean acidification
Removal of herbivorous species through illegal fishing practices
Other local anthropogenic threats</td></tr>
<tr><td>Area</td><td>4</td><td colspan="2">Climate change is a global phenomenon, and is affecting biodiversity throughout the National Park</td></tr>
<tr><td>Severity</td><td>3</td><td colspan="2">The impacts of climate change are currently expressed at LBCNP through increased bleaching. Storm frequency and severity is expected to increase over the coming years</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">Although the effects of climate change are occurring over an extended time period the cumulative effect of this stressor poses significant risk to a wide range of species and ecosystems</td></tr>
<tr><td colspan="4">Management Goal: Continue to implement adaptive management strategies that identify and maintain resilient ecosystems

Management Strategies:

Strategy 1: Identify resilient coral species and areas within LBCNP
Strategy 2: Identify coral recruitment sources for LBCNP, and identify mechanisms to ensure that these are adequately protected, if necessary
Strategy 3: Characterize and understand water currents critical for coral and fish recruitment at LBCNP
Strategy 4: Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions
Strategy 5: Reduce local anthropogenic threats through community engagement and awareness programs, and effective enforcement
Strategy 6: Continue to ensure effective management of local anthropogenic threats through community engagement and awareness programs
Strategy 7: Work closely with national and international partners to monitor climate change effects and identify appropriate national and regional management strategies</td></tr>
</table>

<table>
<tr><th colspan="5">Threats to biodiversity of Laughing Bird Caye National Park / 2</th></tr>
<tr><td rowspan="10">Unsustainable Fishing Practices</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): Commercial / Recreational Species; Coral Reef Communities; Sharks;</td></tr>
<tr><td colspan="4">Threats (Direct):
Reduced commercial / recreational fish populations
Reduced coral reef health (reduced herbivorous fish populations)
Regime shifts and disruption of the trophic structure
Physical damage to corals from fishing activities
By catch from long-lines</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
Insufficient buoys for effective demarcation
Low income in fishing communities
Traditional occupation
Increase in demand for seafood by tourists
Fishing incursions
Poor fishing practices in adjacent areas (fishing out of season, harvesting undersized product, use of gill nets)
Subsistence fishing by visiting live-aboard boats moored within protected area
Increasing number of Belize fishermen
Increasing illegal fishing pressure from Guatemala and Honduras, and lack of political will to address transboundary issues
Market for illegal product
Increasing fishing pressure and market demand from Jamaica and other CARICOM nations</td></tr>
<tr><td>Area</td><td>4</td><td colspan="2">Although incursions are limited, the affect of external fishing pressure is felt throughout the fish populations of the MPA</td></tr>
<tr><td>Severity</td><td>2</td><td colspan="2">Severity is considered substantial for some species such as Nassau grouper while others, such as shark species, are disappearing from the National Park completely. Conch, a less mobile species, is considered the exception.</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">It is an ongoing, active threat</td></tr>
<tr><td colspan="4">Management Goal: Effective management of LBCNP to ensure functionality as an important source area for commercial fish stocks

Management Strategies:

Strategy 1: Effective demarcation of park boundaries to ensure visual recognition of boundaries at all points

Strategy 2: Collaborative enforcement (fishermen, SEA, Fisheries Dept., TIDE Coastguard, BDF, Police Dept. etc.) against transboundary incursions both within and outside the MPA – and strengthen Special Enforcement Team

Strategy 3: Improve collaboration between SEA and Fisheries Department and strengthen effective enforcement – application of laws and regulations</td></tr>
</table>

Threats to biodiversity of Laughing Bird Caye National Park / 2	
Unsustainable Fishing Practices	**Strategy 4:** Ensure LBCNP has the human resources, equipment and training for effective surveillance and enforcement **Strategy 5:** Strengthen enforcement by development of specific site-level policies and regulations and enhance data management to be able to identify and penalise repeat offenders **Strategy 6:** Strengthen the collective voice of MPA stakeholders by exploring coordination and collaboration with other MPA NGOs to reduce competition, increasing potential success in lobbying against common threats, and attracting larger scale funding opportunities **Strategy 7:** Continue education and awareness activities in stakeholder communities, focusing on the value of LBCNP as a no-take area and its ability to help maintain the sustainability of commercial species **Strategy 8:** Identify and implement effective mechanisms to reduce local community dependence on marine resources, targeting those communities most impacting the National Park **Strategy 9:** Increase awareness on visiting live-aboard boats of the rules and regulations within Laughing Bird Caye National Park - specifically the non extractive designation **Strategy 10:** Investigate certification system for local restaurants that follow best practices in purchasing lobster, conch and fin-fish species (size, season and species regulations), with information for tourists on how to dine 'ethically' in Placencia **Strategy 11:** Continue to work closely with the Government to develop and implement effective mechanisms to ensure a sustainable Belize fishing industry **Strategy 12:** Collaborate with WCS to increase awareness of non-consumptive value of sharks (tourism and ecosystem) – targeted at fishermen in stakeholder communities
Strategies for Sharks	**Strategy 13:** Increase awareness of high mercury levels in sharks and other large predator fish, and the associated health risks of those mercury levels **Strategy 14:** Reduce shark by-catch through gear modification or compromise by working with fishermen using the deeper channels adjacent to the park

Threats to biodiversity of Laughing Bird Caye National Park / 3

Tourism Impacts

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): Herbaceous beach / littoral Forest, Sandy Beach, Seagrass, Coral Reef Communities, Sharks

Threats (*Direct*)*:*

- Erosion of beach
- Reduced viability of turtle nesting sites
- Reduced extent of littoral forest
- Reduced extent of herbaceous beach community
- Coral mortality from mechanical damage
- Coral mortality from sedimentation
- Increased algal growth
- Altered animal behaviour
- Reduction / pollution of freshwater lens

Source (Indirect Threat)***:***

- Increasing tourism
- Insufficient tourism infrastructure
- Increased garbage
-
- MPA reliance on tourism for financial sustainability
- Pollution from sun blocks and insecticides
- Poor tour guiding practices / unguided groups
- Limited enforcement of visitor regulations

Area	***2***	The caye and the area around the caye have been used extensively by tourists, both historically and currently, but other parts of the faro are less impacted
Severity	***1***	Impacts to the terrestrial area are more significant with the potential for continued degradation of the targets, while marine impacts are more diffuse
Urgency	***3***	Visitation is considered stable but constant

Management Goal: To develop and implement strategies, policies and regulations for maintaining the integrity of terrestrial and marine environments and ecosystem functions through effective visitor management

Management Strategies:

Strategy 1: Develop best practices and guidelines for tourism at Laughing Bird Caye National Park, with participation of tour guides and park rangers

Strategy 2: Train and engage rangers for increased effectiveness in enforcement of tourism best practices and guidelines

Strategy 3: Develop and implement a 'Limits of Change' programme, with associated carrying capacity guidelines, for effective tourism management at Laughing Bird Caye – with integrated monitoring and enforcement, and covering monitoring of impacts from educational use

Threats to biodiversity of Laughing Bird Caye National Park / 3	
Tourism Impacts	**Strategy 4:** Develop and implement guidelines for managing marine turtle nesting on the caye, with training for rangers, demarcation of turtle nesting areas, strengthened through visitor awareness information, to prevent direct impacts from tourism **Strategy 5:** Ensure continued effective waste management through development and implementation of an effective waste management plan for LBCNP **Strategy 6:** Run refresher courses on tourism policies and best practices for tour guides using LBCNP **Strategy 7**: Integrate marine tourism best practices into Best Practices planning for LBCNP, including re-visiting tour guide-visitor ratios for snorkelling and diving within the protected area **Strategy 8:** Put in place adequate infrastructure - moorings buoys – at caye and dive sites to prevent damage from anchors **Strategy 9:** Design and install signs and literature to educate visitors and promote best practices **Strategy 10:** Continued effective collection of visitor data, including number, origin, nationality, activities, duration of stay and gender

<table>
<tr><th colspan="5">Threats to biodiversity of Laughing Bird Caye National Park / 4</th></tr>
<tr><td rowspan="8">Poor Boat Handling and Management</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): Coral Reef Communities, Seagrass</td></tr>
<tr><td colspan="4">Threats (Direct):
Reduced live coral cover
Increased algal growth (in response to coral mortality)
Reduced extent of seagrass
Reduced viability of marine biodiversity</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
Mechanical damage to coral reef communities and nursery sites (seagrass beds) from anchor damage, sedimentation and propeller impacts from shallow water boat traffic and vessel groundings
Potential for fuel and oil spills from poor outboard maintenance and / or vessel groundings
Inexperienced boat captains / poor practices and / or a lack of local knowledge
Contamination by bilge water
Contamination by solid waste and sewage from live-aboards and larger vessels
Subsistence fishing within National Parks by live-aboards moored in the area overnight</td></tr>
<tr><td>Area</td><td>2</td><td colspan="2">The area used by boats is restricted primarily to access the front of the Caye and specific dive sites</td></tr>
<tr><td>Severity</td><td>1</td><td colspan="2">The impacts are measurable</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">Concern about boat traffic is currently low, but that threat may grow substantially over the next 3 to 10 years, with increasing cruise ship and other traffic in the adjacent shipping lane</td></tr>
<tr><td colspan="4">Management Goal: Maintain integrity of marine environments and ecosystem functions through effective prevention and mitigation of boat impacts

Management Strategies:

Strategy 1: Install /maintain appropriate demarcation and mooring buoys

Strategy 2: Implement policies within the MPA to ensure that all charters have a qualified, licensed and experienced local captain and tour guide / dive guide

Strategy 3: Develop best practices and guidelines for boats entering Laughing Bird Caye National Park, with participation of live-aboard companies, boat captains, tour guides and park rangers

Strategy 4: Develop outreach program specifically for the live-board companies, employees, and clients with literature on rules and guidelines, and maps relevant to all SEA protected areas</td></tr>
</table>

Threats to biodiversity of Laughing Bird Caye National Park / 4	
Poor Boat Handling and Management	**Strategy 5:** Train and engage rangers for increased effectiveness enforcing boating best practices and guidelines **Strategy 6:** Develop and implement a 'Limits of Change' programme, with associated carrying capacity guidelines, for effective tourism management at Laughing Bird Caye – with integrated monitoring and enforcement **Strategy 7:** Ensure an adequate number of mooring buoys are available in key boating areas **Strategy 8:** Develop strategies in collaboration with Port Authority and DoE to improve management of waste generated by visiting boats **Strategy 9:** Develop contingency plan for vessel groundings, including sources of equipment identified for dealing with this

<table>
<tr><th colspan="5">Threats to biodiversity of Laughing Bird Caye National Park / 5</th></tr>
<tr><td rowspan="8">Oil Exploration/Extraction/ Transport</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): All Targets</td></tr>
<tr><td colspan="4">Threats (Direct):
▪ Reduced viability of all conservation targets
▪ Potential for contamination and loss of ecosystem function for all ecosystems</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
▪ Water contamination from drilling and transportation activities
▪ Water contamination from inadequate fuel storage / management
▪ Seismic testing impacts on biodiversity
▪ Noise pollution impacts on biodiversity
▪ Increased human and boat presence and activity within the National Park
▪ Revenue potential and the increasing global demand for oil
▪ Political interference and current national economic situation</td></tr>
<tr><td>Area</td><td>4</td><td colspan="2">Any seismic testing or oil spill within or near LBCNP would affect the whole MPA, its biodiversity, and its tourism values</td></tr>
<tr><td>Severity</td><td>3</td><td colspan="2">Given the fragile nature of the ecosystems involved the potential impacts of oil exploration could be severe.</td></tr>
<tr><td>Urgency</td><td>2</td><td colspan="2">Concessions for oil exploration have already been awarded to Sol Oil Belize Ltd. within the MPA and to Island Oil Belize Ltd. directly to the south of the MPA boundary.</td></tr>
<tr><td colspan="4">Management Goal:
Lobby for a complete ban on offshore drilling/exploration within the National Park, and the marine environment as a whole

Management Strategies:
Strategy 1: Collaborate with all key stakeholders in addressing this issue at a national level

Strategy 2: Lobby for exclusion of Laughing Bird Caye National Park from oil exploration concession areas (as per WHS recommendations)

Strategy 3: Maintain close communication with Department of Geology and Petroleum and concession holders to provide accurate information for management

Strategy 4: Develop a proactive strategy to address imminent implementation of oil exploration activities within or adjacent to the National Park

Strategy 5: Work with local and national partners to develop an oil spill response plan and ensure necessary equipment and response personnel are in place</td></tr>
</table>

Threats to biodiversity of Laughing Bird Caye National Park / 6

Invasive Species
Lionfish

Status:	***Historical***	***Active***	***Potential***

Conservation Target(s): Commercial / Recreational Fish; Coral Reef Communities; Sharks

Threats (*Direct*):
- Reduced viability of fish populations
- Reduced coral reef health
- Reduced abundance of herbivores
- Increased algal growth

Source (Indirect Threat)***:***
- Invasive species (lionfish)

Area	***4***	Lionfish have increased exponentially since being reported from LBCNP in early to mid 2009. (A previous report in 2001 from the same area exists, but appears to have been an isolated individual (ECOMAR, 2010)).
Severity	***1***	The total impact of invasive lionfish cannot be predicted, but they could have a significant impact on local fish populations
Urgency	***3***	Lionfish have increased from a single report in early 2009 to become common in 2010. This trend is expected to continue

Management Goal: To reduce and manage the impacts of invasive lionfish within LBCNP

Management Strategies:

Strategy 1: Work with national partners to develop and implement a comprehensive action plan for lionfish management

Strategy 2: Strengthen stakeholder awareness, support and involvement in lionfish removal and management, prioritizing key sites with high juvenile fish abundance

Strategy 3: Research lionfish impacts on coral reef ecosystems and fish populations

Strategy 4: Promote regular, controlled lionfish removal activities by eradication teams comprised of local stakeholders, within the National Park

Strategy 5: Train fishermen in preparation of lionfish fillets

Strategy 6: Develop a market for lionfish in collaboration with local stakeholders

2.3.2 Other Impacts

Also identified under the Southern Belize Reef Complex were a number of additional threats within the seascape, including caye development outside of the National Park boundaries, agricultural and industrial runoff from watersheds and pollution from vessels (Table 21).

Table 21: Other Identified Threats in the Wider SBRC	
Clearance of Mangrove	Removal of important marine nursery areas
	Removal of important habitat for nesting and migrating birds
	Erosion of caye soils
	Removal of important habitat for lizards
	Removal of important nutrient source within the marine system
Destruction of Coral	Live and dead coral used as land fill in poorly planned caye development within SBRC (e.g Bread and Butter Caye (SWCMR).
	Destruction of coral to provide boat access to cayes, and impacts of boat access on corals within seagrass beds
Human Impacts on Sandy Beaches	Removal of herbaceous beach vegetation – an ecosystem that is under-represented within the national protected areas system, and which is essential for good turtle nesting success
	Removal of critical turtle nesting habitats
	Light pollution, impacting turtle nesting and hatching success
	Presence of introduced predators - dogs and cats, reducing hatching success
Dredging and Associated Sedimentation	Destruction of seagrass habitat, supporting many vertebrate and invertebrate species
	Sedimentation of coral, reducing coral viability
	Sedimentation of seagrass, reducing seagrass viability
	Re-suspension of pollutants
Pollution	Contamination of waters near developed cayes and from boats throughout the SBRC, due to inappropriate sewage and grey water treatment, leading to eutrophication
	Inappropriate solid waste disposal from boats, adjacent cayes and the Belize mainland
	Contamination of waters by runoff containing herbicides, insecticides/detergents from adjacent cayes and the mainland
Threats from Adjacent Shipping Lane	Blackwater: Sewage, waste water from toilets and medical facilities. Release of untreated or inadequately treated sewage
	Ballast Water: With potential to introduce invasive species
	Greywater: Wastewater containing a variety of contaminants such as detergents, oil, grease, metals, petroleum hydrocarbons
	Bilge Water: Oil-contaminated water from engine oil leaks, which is flushed out at intervals
General Human Impacts	Increased nutrient and sediment runoff into water, with associated accelerated algal growth and coral loss
	Reduction and pollution of freshwater lenses beneath cayes
	Introduction of exotics – *Casuarina,* coconut palms

- **Caye Development in the wider Southern Belize Reef Complex**

Human activities on adjacent cayes will impact the long term viability of the biodiversity of Laughing Bird Caye National Park. Habitat loss through caye development for tourism has resulted in the removal of mangroves, littoral forest and coastal strand communities throughout the Southern Belize Reef Complex. In addition, shoreline structures such as piers, dredged access routes, marinas and seawalls have lead to loss and/or alteration of habitats. In cases of poor development practices, live and dead coral have been used as land fill.

Red mangrove, littoral forest and herbaceous beach communities play a critical role in stabilizing island structure, reducing coastal erosion, beach loss and sedimentation as well as providing nursery functionality for many marine species. Among the most threatened ecosystems within the protected area system of Belize, their loss is accelerating as the developmental value and demand for beach frontage escalates. The sandy beaches are critical for nesting sea turtles and American Crocodiles, and the littoral forest for numerous migratory bird species.

Clearance of herbaceous beach vegetation on the cayes greatly reduces connectivity within an already seriously fragmented ecosystem, reducing the scope for gene-flow and recolonization after natural and anthropogenic impacts. It also greatly undermines the stability of the islands themselves, making them, and any infrastructure thereon, a great deal more susceptible to the impacts of hurricanes and sea level rise. The long-term sustainability of caye-based tourism and residential developments can be made significantly more financially viable through the maintenance of these natural ecosystems.

Recommendations:

- Development / adoption and distribution of 'Best Practices' guidelines to caye-based establishments within the SBRC, with a 'best practices' recognition for those that follow required criteria (see Glover's Reef / WCS guidelines)
- Increase surveillance and monitoring of identified turtle nesting beaches outside of the SEA managed MPAs, and address human impacts, following WIDECAST guidelines
- Develop baseline and monitor environmental impacts of use of Laughing Bird Caye has on the adjacent ecosystems
- Develop an Environmental Sustainability Plan for Laughing Bird Caye to mitigate current impacts, and look at synergies for reducing ecological footprint
- Develop closer links with Department of the Environment for rapid response to pollution events
- Ensure all EIAs in the SBRC are adequately vetted and approved, and that Forest Department plays a vocal part in NEAC in relation to environmental sustainability of any development on cayes adjacent to Laughing Bird caye National Park
- Monitor development activities on adjacent cayes within the SBRC

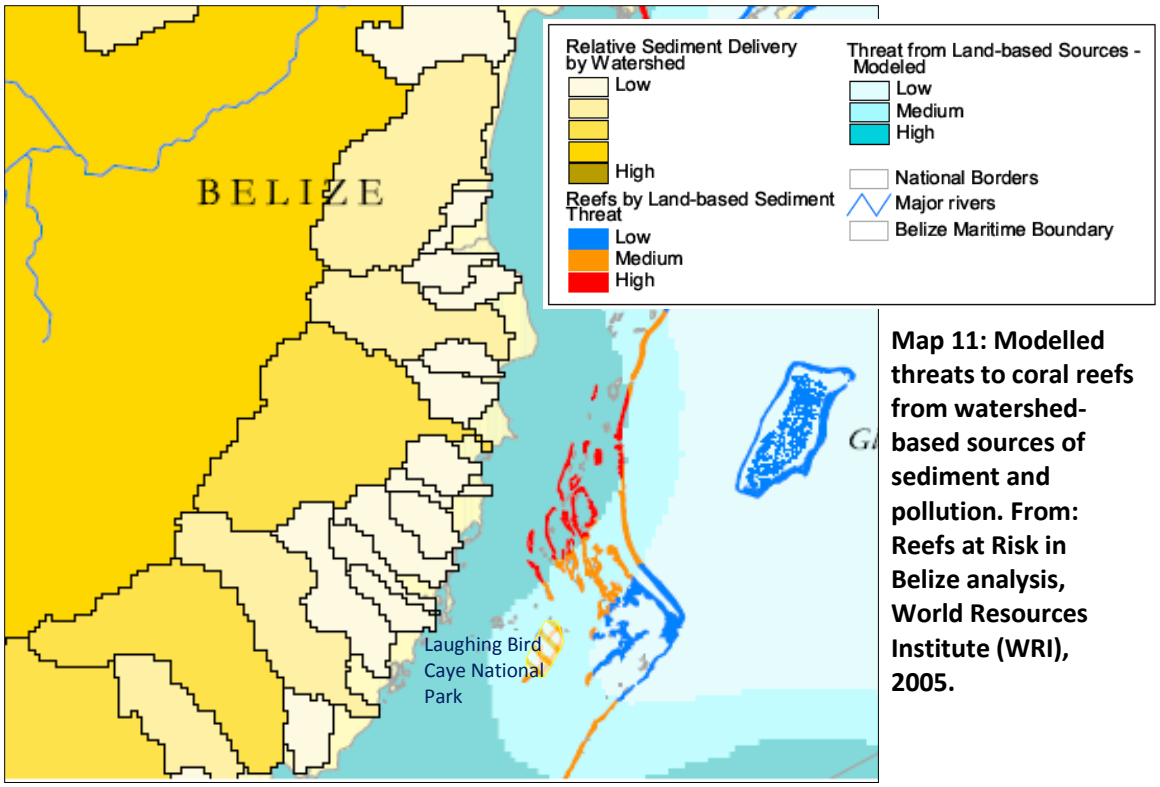
- **Agricultural and Industrial Runoff from watersheds**

CZMAI and the WRIScS project both conducted water quality testing in coastal waters in the late 1990s and early 2000s (CZMAI, 1999; WRIScS, 2002) and concluded that agricultural runoff was not a significant impacting stress to the SBRC at that time. The WRIScS project was investigating the transport of fine sediments and associated contaminants through the river systems and coastal zone of the Stann Creek district, and concluded that

> "*…there is no evidence to suggest that changed sedimentary processes resulting from farming activity to date in the Stann Creek area are having a negative impact on the Barrier Reef. The natural coastal system would appear to be effective in dealing with the impact of increased sediment yield and sediment contaminant loading produced by current land usage.*"

However, both studies emphasized the need for monitoring of future agricultural activities and impacts, with the predicted increase in agriculture, and the decreasing ability of the coastal zone to provide a buffer with the current accelerating land-use change, particularly for coastal tourism development.

A more recent assessment of risks from land based sources of pollution highlighted the reefs of Laughing Bird Caye National Park as at medium risk from runoff from mainland agricultural areas, manifested in the form of sediment-laden river plumes rich in nutrients (effluents) that at times extend to the National Park, with the potential to cause algal blooms and coral death. Definitive research to characterize the effects of pesticides and nitrate and phosphate nutrients from agriculture and aquaculture is in its early stages, but initiatives under WWF, YCT and Wildtracks are focusing on identifying and mitigating agrochemical impacts in Belize, both on terrestrial and marine ecosystems, with concerns associated with the use of agrochemicals on the banana and citrus plantations and shrimp farms in the Stann Creek area, due west of Laughing Bird Caye National Park. There have also been growing concerns, given prevailing water currents, that the vast banana and pineapple plantations in Honduras are introducing pesticide and nitrification pollutants in the Belize Reef system (Map 11; WRI, 2005).



Map 11: Modelled threats to coral reefs from watershed-based sources of sediment and pollution. From: Reefs at Risk in Belize analysis, World Resources Institute (WRI), 2005.

Recommendations:

- Prioritise monitoring of agrochemical content in water and of fish tissue samples to identify key contaminants and current levels of contamination
- Support key research that identifies the land based sources of contamination
- Partner with organizations seeking to mitigate agrochemical contamination of water bodies through better practices for agricultural chemical use

2.3.2 Prioritizing Threats

Once the threat assessment has been completed, the threats are prioritized, to effectively focus financial and human resources. This occurs through a standard prioritization process, with the threat scores being transferred from the threat assessment (Table 22).

Table 22: Prioritization of Identified Threats

Threat	Criteria Ratings			Total AxSxU	Rank
	Area	Severity	Urgency		
Climate Change	4	3	3	36	1
Unsustainable Fishing Practices	4	2	3	24	2
Oil Exploration	4	3	2	24	2
Invasive Species (Lionfish)	4	1	3	12	3
Tourism Impacts	2	1	3	6	4
Poor Boat Handling and Management	2	1	3	6	4

The threat with the highest total threat score is ranked as the highest threat. This places ***Climate Change*** as the highest priority, as an active threat, with the potential to reduce the viability of all conservation targets of Laughing Bird Caye National Park.

Unsustainable Fishing Practices is highlighted as the second highest active threat, equal with the threat of **Oil Exploration**, followed by the ***Invasive lionfish***.

2.3.3 Strategies to Reduce Threats

The primary cross cutting mitigation strategies were identified during the threat assessment (Table 24).

Strategies	Seagrass	Commercial Species	Shrub / Littoral Forest comp.	Sandy Beach	Coral Reef Communities	Sharks	*Score*
Continue to ensure effective management of local anthropogenic threats through community engagement and awareness programs							*6*
Work closely with national and international partners to monitor climate change effects and identify appropriate national and regional management strategies							*6*
Increase awareness of visitor of the rules and regulations of Laughing Bird Caye National Park							*6*
Develop and implement best practices and guidelines for visitors at LBCNP, with participation of tour guides, live aboard operators, and park rangers							*6*
Train and engage rangers for increased effectiveness in enforcement of visitor best practices and guidelines							*6*
Develop and implement a 'Limits of Change' programme for effective visitor management at LBCNP							*6*
Develop outreach program for live-board companies, employees and clients with literature on rules, guidelines and maps relevant to all SEA protected areas							*6*
Investigate the potential to designate SBRC as a traditional, managed fishing area							*4*
Ensure effective waste management through an established waste management plan for LBCNP							*4*
Identify and implement effective mechanisms to reduce local community dependence on marine resources							*3*
Investigate certification system for local restaurants that follow best practices in purchasing lobster, conch and fin-fish species							*3*
Continue to work closely with the Government to develop and implement effective mechanisms ensuring a sustainable Belize fishing industry							*3*

Table 23: Cross-cutting Strategies

2.4 Monitoring of Success of Conservation Strategies

The series of indicators allocated to each conservation target provides a framework for site level monitoring, which has been incorporated into the Science and Monitoring Programme. A system level monitoring programme has also been developed under the SBRC to measure the success of conservation strategies, as an integrated component of the conservation planning process (SBRC, 2010).

2.5 Planning for Climate Change

2.5.1 Site Resilience Assessment

Managing for Climate Change is a fundamental necessity in this ever changing environment. Therefore it was crucial for SEA to conduct an assessment of the three protected areas under its co-management agreement to determine their resilience to climate change. The following attributes were highlighted for each protected area within the SBRC:

Laughing Bird Caye National Park

- Considered one of the best examples of faro formation in the Caribbean
- Supporting extraordinarily high biological diversity
- Wide range of habitats
- At least twenty two species of international concern (critically endangered, endangered or vulnerable)
- An important source for conch, with high densities of reproductive adults
- Critical nesting grounds for hawksbill turtles
- Significant damage to the corals during the earth tremors in 2009

Gladden Spit and Silk Cayes Marine Reserve

- One of the best formed examples of barrier reef structure in the region
- Unique geological promontory dropping to a depth of 250 m to the east, resulting in conditions for highest priority spawning aggregation site in Belize. And the largest in the ecoregion
- Acts as an important source for national and regional populations of commercial finfish species
- Important seagrass beds
- One of the largest predictable whale shark congregations in Belize - an important tourism resource for coastal communities.

Sapodilla Cayes Marine Reserve

- Distinctive, unique hook-shaped reef formation
- Highest coral biodiversity in Belize
- Littoral forest provides an important connectivity point for migrating birds
- At least twenty two species of international concern (critically endangered, endangered or vulnerable)
- Three spawning aggregation sites (Nicholas Caye, Rise and Fall Bank and Seal Caye), important for national and regional viability of several commercial fish species
- Nesting sites for hawksbill and green turtles

2.5.2 Identified Resources of SBRC

Identified Resources of SBRC	
The Fisheries Sector (including aquaculture) ranks 4th in its contribution to the national GDP (Ministry of Agriculture and Fisheries, 2008). Belize's traditional fishing industry provides employment for over 2,240 fishers, reliant primarily on free diving for lobster and conch, or catching finfish on hand lines.	
▪ Conch, Lobster	Laughing Bird Caye National Park – no-take recruitment source Rocky Head (conch nursery). All no-take zones assist with maintenance of these species; presence of mangroves at Sapodilla Cayes Marine Reserve – important nursery ecosystem for lobster
▪ Snapper / Grouper	Gladden Spit (regionally important spawning aggregation site) Sapodilla (three spawning aggregation sites - Nicholas Caye, Rise and Fall Bank and Seal Caye) Upwelling areas, bringing nutrient rich waters
▪ Sea Cucumber	Newly exploited marine product - Laughing Bird faro – no take area known for good populations of sea cucumbers
▪ Starfish (dried, for tourism – Guatemala)	New marine product marketed as a tourism curio in Guatemalan coastal communities
The Tourism Sector ranks 3rd in its contribution to the national GDP, and is one of the fastest growing industries, rapidly becoming the major foreign exchange earner, with over 840,000 tourists arriving in Belize in 2008 (BTB, 2009). Laughing Bird Caye National Park and Gladden Spit and Silk Cayes Marine Reserve in particular, are important tourism resources for communities in southern Belize.	
▪ Healthy reef	Sapodilla Cayes Marine Reserve – highest live coral cover and coral diversity Laughing Bird Caye National Park – highest recruitment
▪ Whale sharks	Gladden Spit and Silk Cayes Marine Reserve
▪ Sandy beaches	All three MPAs
▪ Fly-fishing / sport fishing	Sapodilla Cayes Marine Reserve
▪ Sea turtles	Nesting Beaches – Sapodilla Cayes, Laughing Bird Caye, Silk Cayes
Ecosystem Service: The health of the marine environment is critical to the social and economic health of Belize. The ecosystem services provided by the coral reefs and mangroves, in particular, cannot be over-estimated. The protection they provide coastal communities of southern Belize from tropical storms and their support of the traditional artisanal fishing industries have been important in the development of Belize. Climate change places these ecosystem services at risk.	
▪ Mangroves	Sapodilla Cayes Marine Reserve (Frank's Caye, Seal Caye)
▪ Seagrass	All MPAs
▪ Corals	Sapodilla Cayes Marine Reserve / Laughing Bird Caye National Park
▪ Littoral forest	Cayes of Sapodilla Cayes Marine Reserve

2.5.3 Climate Change Impacts	Current Status	25 – 50 yrs	100 yrs
Sea level rise	Increased global average sea level rise rate of 1.8mm per year from 1961 – 2003. Current average increase in sea level rise in the Mesoamerican region is estimated at 2mm per year		Predicted increase of between 0.6m and 1.0m over next 100 years
Sea surface temperature rise	Water temperature has increased by 0.75˚C between 1906 and 2005		Predicted regional increase of temperature by up to 5˚C by 2080, with the greatest warming being experienced in the north-west Caribbean (including Belize) (WWF, 2009).
Increased frequency of storms	Increased storms from 1999 onwards, with annual fluctuations. More storms during El Nina, fewer El Nino. Stronger storms >Cat 4 / 5		
Ocean acidification (corals, lobster / conch)	Atmospheric CO_2 concentration has increased from 280 parts per million (ppm) in 1880 to nearly 380 ppm in 2005 – 30% of all atmospheric CO_2 resulting from burning of fossil fuels has been taken up by the ocean (IPCC 2007).	Predicted 30% decrease in pH Predicted decrease in calcification rate by 20 – 50% by 2050	Decrease of 0.5 unit pH for 100 years (UNDP, 2009)
Decreased Precipitation	Mean annual rainfall over Belize has decreased at an average rate of 3.1mm per month per decade since 1960 (UNDP)	Predicted ecological shifts up the altitudinal gradient of the Maya Mountains Massif may remove the cloud forest, and the catchment functionality important for maintaining rivers in dry season in the south of Belize, and providing nutrients to the reef environment.	Predicted decrease in precipitation of 9% by 2099 (IPCC, 2007), with significant fluctuations, attributed to El Niño
Air Temperature	Mean annual temperature has increased in Belize by 0.45°C since 1960, an average rate of 0.10°C per decade. Average number of 'hot' days per year in Belize (days exceeding 10% of current average temperature) has increased by 18.3% between 1960 and 2003 (NCSP/UNDP).		Predicted mean annual temperature increase is 3.5° by 2099 (UNDP, 2009)

Climate Change Impacts	Ecosystem		
	Coral Reef	Seagrass	Mangrove
Sea level rise	Coral reefs should be able to keep up with sea level rise, barring other impacts (bleaching/mortality and erosion). Change in dispersal / recruitment routes / sources. There may be a loss of deeper corals, shift in distribution, as light availability decreases. Increased sedimentation and reduced light availability due to shore erosion. Possible reduction in water temperature with increased water exchange between deep water and coastal lagoon.	Increases in water depths above present meadows will reduce light) availability and changes in currents may cause erosion and increased turbidity of water column. Shifts in distribution of seagrass beds.	Greatest climate change challenge that mangrove ecosystems. Inundation, habitat loss, distribution shift. Inundation of lenticels in the aerial roots can cause the oxygen concentrations in the mangrove to decrease, resulting in death Damage to coral reefs may adversely impact mangrove systems that depend on the reefs to provide shelter from wave action. Where inland migration cannot occur (i.e. Low lying cayes), mangroves may disappear.
Sea surface temperature rise	Increased coral bleaching, potential mortality and erosion, and eventual loss of ecosystem functionality. Increased prevalence of coral disease. Possible impacts from new invasive species and algal blooms. A shift towards more tolerant, opportunistic species, and reduced biodiversity.	Temperature stress on seagrasses will result in distribution shifts, changes in patterns of sexual reproduction, altered seagrass growth rates, metabolism, and changes in their carbon balance. When temperatures reach the upper thermal limit for individual species, the reduced productivity will cause plants to die (above 35˚C for *T. Testudinum*). Higher temperatures may increase epiphytic algal growth, increasing shading and reducing available sunlight.	Loss of reef may reduce protection from erosion and storm events, increasing risk to mangroves.
Increased frequency and intensity of storms	Increased mechanical damage of corals, increased sedimentation. Reduced ability of colonies to re-establish after storm events.	Massive sediment movements that can uproot or bury seagrass. Increased frequency of storms may increase annual turbidity, reducing light availability for deeper water seagrasses beyond their limits. It may also become harder for seagrasses to become re-established. Decreased salinity from increased storm events may adversely affect seagrass	Destruction, inundation, changes in sediment dynamics. Possible increase in nutrients / growth. Large storm impacts result in mass mortality. Projected increases in the frequency of high water events could affect mangrove health and composition due to changes in salinity, and inundation. Inundation is also projected to decrease the ability of mangroves to photosynthesize

Climate Change Impacts	Ecosystem		
	Coral Reef	Seagrass	Mangrove
Ocean acidification (corals, lobster / conch)	Decreases in coral calcification rates, growth rates and structural strength	Possible direct positive effect on photosynthesis and growth, as in some situations, seagrass is carbon limited. Higher CO2 levels may also increase the production and biomass of epiphytic algae on seagrass leaves, which may adversely impact seagrasses by causing shading. The acidification of seawater could counter the high pH formed by photosynthesis in dense seagrass stands, thus increasing seagrass photosynthesis and productivity.	Increase in growth. However, damage to coral reefs may adversely impact mangrove systems that depend on the reefs to provide shelter from wave action.
Decreased Precipitation			Reduction of freshwater lens, affect on carbon uptake, photosynthesis. Decreased precipitation results in a decrease in mangrove productivity, growth, and seedling survival, and may change species composition favouring more salt tolerant species. Projected loss of the inner caye to unvegetated hypersaline flats
Air Temperature			May alter phenological patterns – timing of flowering and fruiting. At temperatures above 25°C, some species show a declining leaf formation rate. Above 35°C have led to thermal stress affecting. Mangrove root structures and establishment of mangrove seedlings. At leaf temperatures of 38-40°C, almost no photosynthesis occurs (IUCN, 2006)

Climate Change Impacts	Resource		
	Conch	Lobster	Snappers / Groupers
Sea level rise	May experience shift in range or habitat loss linked to changes in seagrass – critical habitat	Shift in range / habitat loss of both adult and juvenile lobster – linked to inundation of mangrove, shift in seagrass distribution, changes in coral reef	Shift in range / habitat loss of both adult and juvenile fish (inundation of mangrove, shift in seagrass distribution, changes in coral reef). Potential changes in water currents affecting viability of spawning aggregation sites
Sea surface temperature rise	Reproduction in seagrass is temperature-driven, so may be affected. Temperature may affect spawning, which increases as a linear function of bottom water temperature, but declines once a temperature threshold is reached. Possible impacts from new invasive species and algal blooms. Disease may become more prevalent.	Reproduction in seagrass is temperature-driven, so may be affected. Possible effects of increased water temperature on larval and adult lobsters and reproduction. Possible impacts from new invasive species and algal blooms. Disease may become more prevalent.	Habitat loss (impacts on reef). Reproduction in seagrass is temperature-driven, so may be affected Thermo-tolerance...possible effect on juveniles and larger species. Decrease of upwelling currents – decrease in ocean productivity with potential loss of spawning aggregation sites. Possible impacts from new invasive species. Disease may become more prevalent.
Increased frequency and intensity of storms	Habitat destruction and increased sedimentation; possible impacts on larval dispersal / survival	Habitat destruction - seagrass and mangroves; sedimentation, possible impacts on larval dispersion / survival	Habitat destruction - seagrass and mangroves; sedimentation, possible impacts on larval dispersion / survival
Ocean acidification (corals, lobster / conch)	Habitat loss (impacts on reef). Impacts on larval viability and adult growth rates. Possible increase in seagrass productivity	Habitat loss (impacts on reef). Impacts on larval viability and adult growth rates. Possible increase in seagrass productivity	Habitat loss (impacts on reef). Potential impacts on larval viability and adult growth rates
Decreased Precipitation	Possible changes in salinity impacting larval dispersal	Possible changes in salinity impacting larval dispersal	Possible changes in salinity impacting larval dispersal
Air Temperature		Impacts on mangrove productivity	Impacts on mangrove productivity

Climate Change Impacts	Resource		
	Sea Turtles	Parrotfish	Whale Sharks
Sea level rise	Inundation of nesting beaches	Shift in range / habitat loss of both adult and juvenile parrotfish – linked to inundation of mangrove, shift in seagrass distribution, changes in coral reef	Potential changes in water currents affecting viability of spawning aggregation sites, and therefore presence of whale sharks
Sea surface temperature rise	Effects on food sources – shifts in distribution / abundance of seagrass, decreased health of coral reef. Extended nesting season, with earlier onset of nesting. Higher incidence of disease	Shifts in distribution / abundance of seagrass, decreased health of coral reef, Distribution shift into deeper, cooler waters	Decrease of upwelling currents – decrease in ocean productivity with potential loss of spawning aggregation sites. Changes in migration routes. Disease may become more prevalent.
Increased frequency and intensity of storms	Habitat destruction and increased sedimentation; possible impacts on dispersal / survival. Inundation of nests from higher groundwater	Habitat destruction - seagrass and mangroves; sedimentation, possible impacts on larval dispersion / survival	During storm events, feeding areas may shift – shift of salinity and nutrient content
Ocean acidification (corals, lobster / conch)	Habitat loss (impacts on reef). Possible increase in seagrass productivity.	Habitat loss (impacts on reef). Impacts on larval viability and adult growth rates. Possible increase in seagrass productivity	Potential impacts to food availability
Decreased Precipitation	Possible changes in humidity, altering hatch sucess	Possible changes in salinity impacting larval dispersal	Possible changes in salinity impacting feeding areas
Increased Air Temperature	Female biased sex ratio >31˚C leads to more females; 29 – 30˚C 50:50 sex ratio; <29˚C leads to more males. Warming of beaches, resulting in increased egg mortality, shorter hatching time with smaller average hatching size, reducing survival potential.		

2.5.4 Socio Economic Impacts		
Fisheries	**Tourism**	**Key Environmental Services**
Current Status: The traditional industry provides employment for over 2,240 fishers and over 120 processing plant personnel in Belize (Ministry of Agriculture and Fisheries, 2008). Capture fisheries export earnings totalled approximately Bz$20.5 million dollars in 2008, primarily from the traditional lobster and conch capture fisheries (Ministry of Agriculture and Fisheries, 2008).	**Current Status:** Tourism is the third ranking productive sector in Belize, contributing 28.2% (Bz$816.3mn) in 2009, with projections suggesting that this will increase to 31.4% (Bz$1,601.2mn) by 2020. The tourism sector provided an estimated 34,000 jobs in 2009, 28.3% of total national employment or 1 in every 3.5 jobs. This is predicted to increase to 53,000 jobs, 31.6% of total employment or 1 in every 3.2 jobs by 2020 (WTTC, 2010).	**Current Status:** Reefs and mangroves also protect coastal and cay properties from erosion and wave-induced damage, providing an estimated Bz$462 to Bz$684 million in avoided damages per year.
Predicted Impacts: Loss of revenues generated from fisheries resources through loss of fishing grounds and of reef-associated species (e.g. lobster, conch and finfish). Potential shift to off shore species, requiring more sophisticated equipment / greater economic investment. Increase in illegal activities due to lack of viable employment opportunities. Some community economies will be more vulnerable than others – but all will be affected. **Limitations/Barriers:** The financial market is not favourable to small scale entrepreneurs making access to the level of capital investment required for off shore fisheries inaccessible. Lack of capital limits fishers' ability to diversify income base. No national strategies exist to address increased unemployment.	**Predicted Impacts:** Tourism (Diving and snorkelling): Loss in revenues caused by loss of aesthetics of reef and charismatic reef species through loss of coral habitats and reef-associated species (e.g parrotfish, corals, colourful fish). Loss in revenue due to loss of sandy beaches which could result in increased dredging pressures or land reclamation. Declining tourism industry affecting local economies, and resulting in increasing fishing pressures, with increased conflict. Shift of sport fishing to deep sea species. Potential increase in illegal activities with the reduction of viable employment opportunities. Some community economies will be more vulnerable than others – but all will be affected. **Limitations /Barriers:** No national strategies exist to address increased unemployment. Limited current market demand for inland tours. Limited capacity to conduct inland tours.	**Predicted Threat:** Increased risk to coastline and caye infrastructure due to inundation, potential long term loss of coastal protection functionality if reef can't keep up with sea level rise. Potential increased wave action on central barrier reef with reduction of wave shadow functionality of atolls with increased sea level. Possible increased lagoon - open sea water exchange, with reduced sea water temperature. **Limitations / Barriers:** Limited scientific knowledge / experience of climate change impacts – few models available for successful adaptation.

2.5.5 General Strategies

General Strategies

Because of the global nature of climate change, the strategies needed to address impacts go beyond the level of intervention available to SEA. Successful interventions will require collaboration with government and civil society partners to address a wide range of socio-economic issues. However SEA also needs to adapt to local changes through identified general strategies.

- Increase institutional expertise and capacity for addressing climate change issues and management of adaptation strategies.
- Active participation in national and regional planning for climate change adaptation
- Strengthen coastal protection through participation in and support of coastal zone development planning for southern Belize
- Increase stakeholder awareness and understanding of climate change and the potential to increase reef resilience, by reducing impacts of identified threats.
- Increase stakeholder capacity to participate in climate change adaptation strategies.
- Identify, build and strengthen partnerships with organizations targeting reduction of watershed threats (including transboundary efforts)
- Establish a policy framework and identify a funding mechanisms specific to implement climate change adaptation strategies
- Identify and partner with major climate change focused organization for skills transfer and mentoring

2.5.6 Targeted Strategies		
Fisheries	**Tourism**	**Key Environmental Services**
▪ Increase surveillance and enforcement effort against fisheries infractions, particularly hotspots identified using SEA's enforcement data ▪ Implement managed access for traditional fishermen to address fishing impacts ▪ Collaborate with partners to develop supplemental / complimentary income generation opportunities for fishing stakeholders ▪ Develop and strengthen partnerships with the Ministries of Human Development, Health, Education and Agriculture and Fisheries to identify and implement climate change adaptation strategies for SEA stakeholder communities	▪ Ensure infrastructure is in place to minimize tourism impacts on the reef – signs, mooring buoys, designated dive sites ▪ Increase surveillance and enforcement effort against tourism infractions, particularly in identified hotspot threat and resilient areas ▪ Engage BTB and BTIA in climate change adaptation planning ▪ Educate visitors about the impacts of climate change ▪ Conduct market survey to determine the feasibility of promoting more inland based tourism ▪ Based on outputs of market study, diversify focus of training to include inland tourism destinations, reducing dependence on reef resources ▪ Promote and facilitate marketing for diversification of tourism focus – away from dependence solely on the reef ▪ Collaborate with partners in lobbying for passing the revised mangrove legislation.	▪ Identify resilient areas within the SEA's marine protected areas in the context of the greater Southern Belize Reef Complex ▪ Review and re-evaluate MPA boundaries and zoning in the Southern Belize Reef Complex ▪ Identify and increase protection of resilient reefs, source populations and key larval dispersal routes ▪ Establish monitoring protocols that inform management for building reef resilience ▪ Engage coastal / caye landowners in climate change adaptation strategies – including shoreline protection through conservation / re-planting of mangroves ▪ Investigate mechanisms for direct interventions – e.g. coral nurseries, shading of key sites, promoting higher herbivore densities ▪ Strengthen protection of trophic structure - maintenance of top predators (e.g. feasibility of declaring SBRC as a shark sanctuary)

3. Management Planning

3.1 Management Goals

Laughing Bird Caye National Park is managed through a co-management agreement between the Southern Environmental Association (SEA), the day-to-day management body, and the Forest Department, as the legislative body. The protected area was created

> "*to protect the unique biodiversity associated with the Laughing Bird Caye faro, and to manage, protect and promote the sustainable use of Laughing Bird Caye National Park for the benefit of present and future generations*"

Friends of Laughing Bird Caye / TIDE (2000)

This is to be achieved through a series of five objectives:

1. *Protect and maintain the natural and scenic values of Laughing Bird Caye National Park*

2. *Provide environmentally sustainable, well managed recreational opportunities for local, national and international visitors*

3. *Increase awareness of the marine ecosystems and conservation benefits of Laughing Bird Caye National Park, to promote a supportive environment for effective management*

4. *Act as a model of co-management, as part of the World Heritage Site, and within the framework of the system level management of the Southern Belize Reef Complex*

5. *Provide opportunities for economic benefit for local stakeholder communities*

Adapted from FLBC /TIDE, 2000

The protected area was established under the National Parks System Act of 1981, which states that the purpose of a National Park is "protection of nationally important recreation areas," with the "protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public."

The management goal of the marine protected area is also aligned with the vision for the Southern Belize Reef Complex:

> *A collaborative stewardship of the internationally recognized Southern Belize Reef Complex, through strategic partnerships to conserve and improve the integrity of these socio-economically and biologically important ecosystems for the benefit of future generations*
>
> ***A collective Vision for the Southern Belize Reef Complex, Belize CAP Workshop, May, 2008***

3.2 Management and Organizational Background

Laughing Bird Caye National Park is managed under a co-management agreement between the Forest Department (Ministry of Natural Resources) and the Southern Environmental Association (SEA). SEA has site-level management responsibility, including hiring of staff, surveillance and enforcement, research and monitoring, education and outreach and administration, and reports to the Forest Department.

The Southern Environmental Association (SEA) was established in 2008 through the merging of two existing non-Governmental organizations – Friends of Nature (FoN), based in Placencia (Stann Creek District), and the Toledo Association for Sustainable Tourism and Empowerment (TASTE) based in Punta Gorda (Toledo District). Friends of Nature, established in 1991 as Friends of Laughing Bird Caye, originally had co-management responsibility for Laughing Bird Caye National Park (LBCNP) through an agreement with Forest Department. It also had a similar co-management agreement with the Fisheries Department for Gladden Spit and Silk Cayes Marine Reserve (GSSCMR). TASTE, established in 2001, provided the science/monitoring and educational component management for the Sapodilla Cayes Marine Reserve (SCMR), in partnership with the Fisheries Department.

Southern Environmental Association

Vision: The Southern Environmental Association will be a leader in effective resource management and responsible stewardship for southern Belize's strategically important marine areas thus creating benefits for all stakeholders

Mission: The Southern Environmental Association is a non-governmental organization that continuously works towards improving stewardship and the environmental integrity of key marine areas in southern Belize through effective, collaborative protected areas management, community involvement, and strategic partnerships for the benefit of all stakeholders

In 2006, an assessment was conducted to determine the feasibility of merging of the two organizations to increase management effectiveness by optimizing the organizational synergies and strengths, and reduce overlaps, particularly in the areas of operational processes, community stakeholder footprint and engaging funding partners.

The two organizations worked closely together throughout 2008, participating in the development of a Conservation Action Plan for the system-level management of the Southern Belize Reef Complex (SBRC), in collaboration with Fisheries Department (as manager of the South Water Caye Marine Reserve, the fourth MPA within the SBRC). The Southern Environmental Association (SEA) was officially incorporated in December 2008 as the new management organization.

Outputs of 2006 Assessment on Merger Decision

Organizational efficiencies

Given the challenges of MPA management and the limited resources to support such management, a merger of FoN and TASTE would consolidate fundraising efforts and personnel, and would improve efficiencies in administration, fundraising, finance/accounting, community outreach, scientific monitoring, and enforcement.

Increasing the scope of management

The creation of SEA would create an opportunity to consolidate the management of the LBCNP, GSSCMR and the SCMR. Currently, FoN has full co-management for the LBCNP and GSSCMR, while TASTE has not been delegated full authority over the SCMR. With the management of these three MPAs under one institutional umbrella, there would be greater opportunities to increase the financial resources to support MPA management, and to develop an integrated management plan for the three MPAs and the areas between them. Very little monitoring and patrolling activities take place in these latter areas, and consequently anthropogenic pressures on the marine resources have been increasing. A consolidated and integrated regional management plan would increase enforcement of existing regulations at the MPAs and the waters between these protected areas.

Improving community representation

Both FoN and TASTE work closely with communities, and so there is considerable overlap in the communities that the organizations work with. SEA would have an augmented community outreach and education program and "would allow the communities to amplify their collective voice and influence a broader area important to their livelihoods.

Friends of Nature: Southern Environmental Alliance Planning Document

(California Environmental Associates, August 2006)

The Southern Environmental Association undertakes a wide range of tasks from law enforcement to community outreach and scientific research. It works closely with the eight stakeholder communities of Hopkins, Sittee River, Seine Bight, Placencia, Independence, Monkey River, Punta Negra and Punta Gorda, and is starting to engage Sarteneja, its most northern stakeholder community. Under the co-management agreements with the Government of Belize, SEA assumes control of zoning enforcement and visitor behaviour, and is authorized to police within and between parks, within the Southern Belize Reef Complex.

SEA currently has a staff of seventeen, including rangers, administrative, outreach, and science staff (Table 24). SEA's Board of Directors consists of fifteen members, including seven community leaders, representatives from the fishing communities and tourism industries, and technical members, who assist in the formulation of policy for the management of the Marine Reserve (Figure 30).

Organizational Representation	Position	Representative (2011)
Placencia Village Council	Chairman	David Vernon
Punta Gorda Town Council	Vice-Chairman	Victor Jacobs
Independence Village Council	Treasurer	Albert Leslie
Belize Tourism Industry Association (Placencia)	Secretary	Steve Christensen
Placencia Tour Guide Association	Member	Warren Garbutt
Toledo Tour Guide Association	Member	Bruno Kuppinger
Placencia Fishermen Cooperative	Member	Carlton Young Sr.
Toledo Fishermen Cooperative	Member	Armando Ramirez
University of Belize	Member	Stanley Nicholas
Seine Bight Village Council	Member	Hassan Palacio
Monkey River Village Council	Member	Richard Pitts
Punta Negra Village Council	Member	Paula Williams
Hopkins Village Council	Member	Albert Nunez
At-Large (Finance Expert)	Member	Darius Avila
At-Large (Science Expert)	Member	Melanie McField

Table 24: Structure of SEA's Board of Directors

The Board of Directors has ultimate responsibility for all aspects of SEA, including:

- Safeguarding the vision, integrity, objectives and policies of SEA;
- Ensuring high standards of planning, operation, administration, evaluation and reporting in SEA;
- Ensuring that statutory obligations are met;
- Ensuring that adequate resources are available to SEA for all aspects of its work and administration;
- Ensuring that resources provided to SEA are used for their intended purpose and are properly accounted for.

For the past eighteen years, SEA, (or as its two constituent organizations), has been working, and continues to work with, community members to improve management of the marine resources, with a focus on effective enforcement, and involvement and participation of community stakeholders in programs such as science and monitoring, enforcement, environmental education, community development and outreach.

SEA Organizational Chart

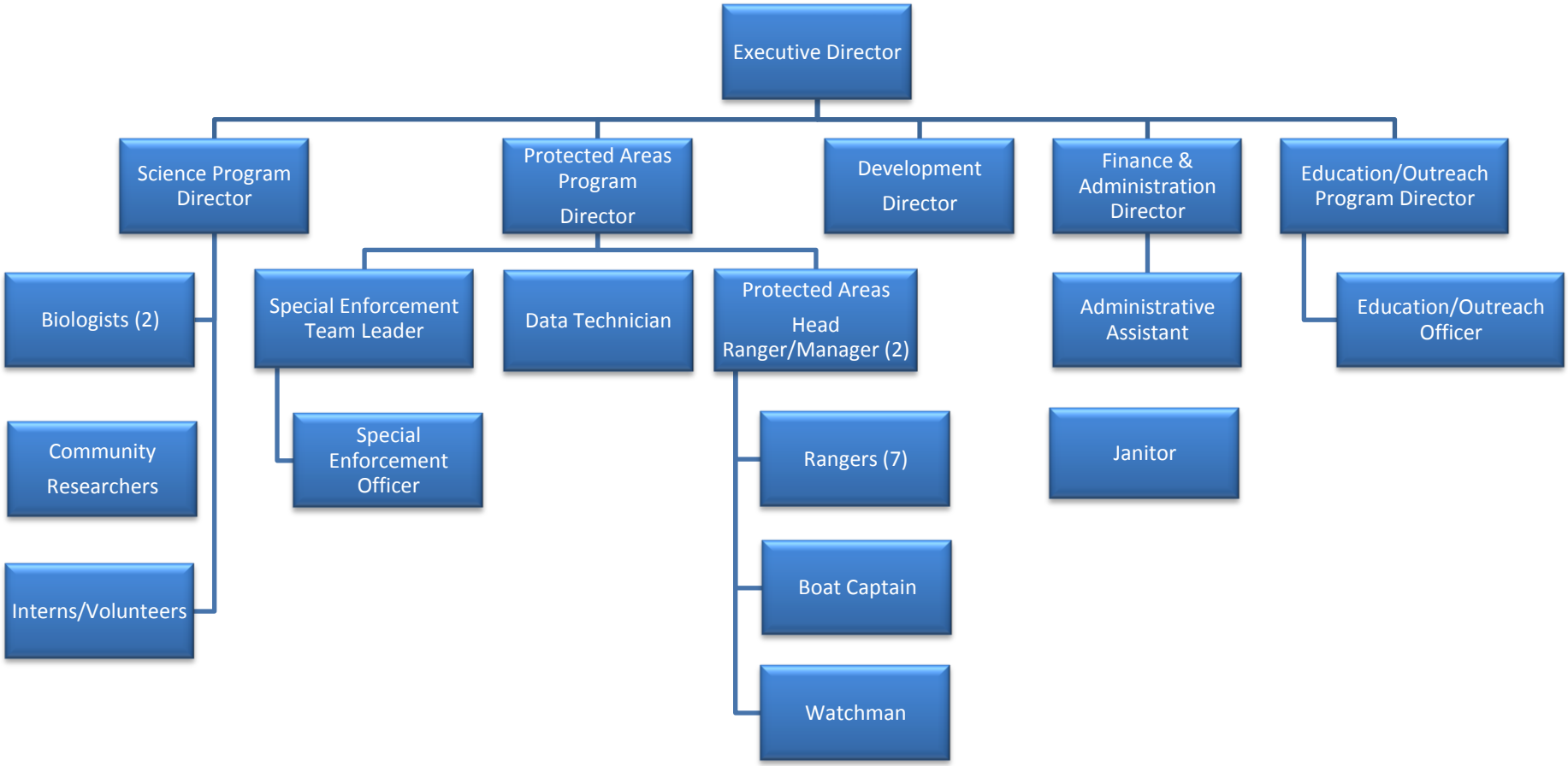


Figure 30: SEA Organization Structure (2011)

3.3 Review of Previous Management Effectiveness

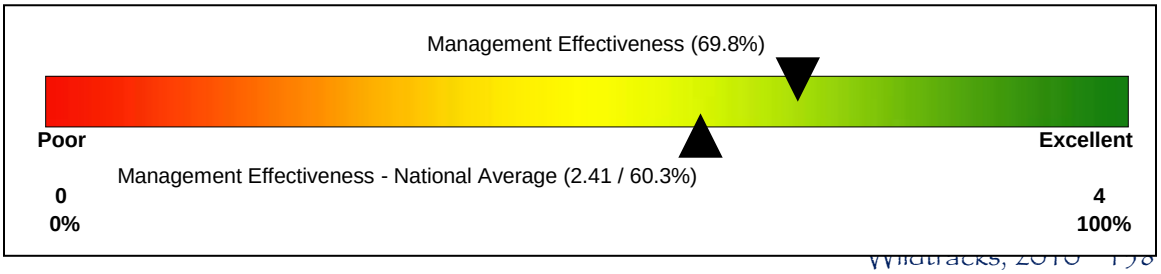
A national assessment of management effectiveness was conducted in 2009, under the Association of Protected Area Management Organizations (APAMO). This included a site-level self-assessment of Laughing Bird Caye National Park, completed by technical staff of the Southern Environmental Association and the management partners. The assessment was based on the indicators of the **Monitoring Package for Assessing Management Effectiveness of Protected Areas** (Young et al., 2005), developed under the framework of Belize's National Protected Areas Policy and System Plan (NPAPSP). Additional indicators were also included to facilitate alignment to the regional Mesoamerican Barrier Reef System (MBRS) indicators (**Manual for the Rapid Evaluation of Management Effectiveness in Marine Protected Areas of Mesoamerica** (Corrales, 2004) and the global IUCN/WCPA initiative. The data has been used to provide a snapshot of the state of Laughing Bird Caye National Park in mid-2009, contributing towards the national-level assessment, with site-level recommendations for use by protected area managers for adaptive management (Walker and Walker, 2009).

It should be noted that since the assessment, which was conducted whilst SEA was in a transitional stage, between Executive Directors, the organization has been strengthened considerably, with a new Executive Director, and an active Board of Directors, and motivated management and operational staff.

National Indicator Categories: Under the National Protected Areas Policy and System Plan, management effectiveness is evaluated through the **Monitoring Package for Assessing Management Effectiveness of Protected Areas** (Young et al., 2005), based on 64 indicators, and divided between seven indicator categories:

1. Resource Information
2. Resource Administration, Management and Protection
3. Participation, Education and Socio-economic Benefits
4. Management Planning
5. Governance
6. Human Resources
7. Financial and Capital Management

The management effectiveness of Laughing Bird Caye National Park, as assessed in mid-2009, was rated at the upper end of **MODERATE,** with an overall Management Effectiveness of score of 2.79 out of 4.00 (69.8%).



Outputs of Indicator Categories		
Indicator Category	**Average Score (as a %)**	**Rating**
1. Resource Information	75.0	Moderate
2. Resource Administration, Management and Protection	83.3	Very Good
3. Participation, Education and Socio-Economic Benefit	64.3	Moderate
4. Management Planning	70.8	Moderate
5. Governance	70.8	Moderate
6. Human Resources	43.8	Fair
7. Financial and Capital Management	81.3	Very Good
Overall	**69.8%**	**MODERATE**

Table 25: Results for indicator Categories

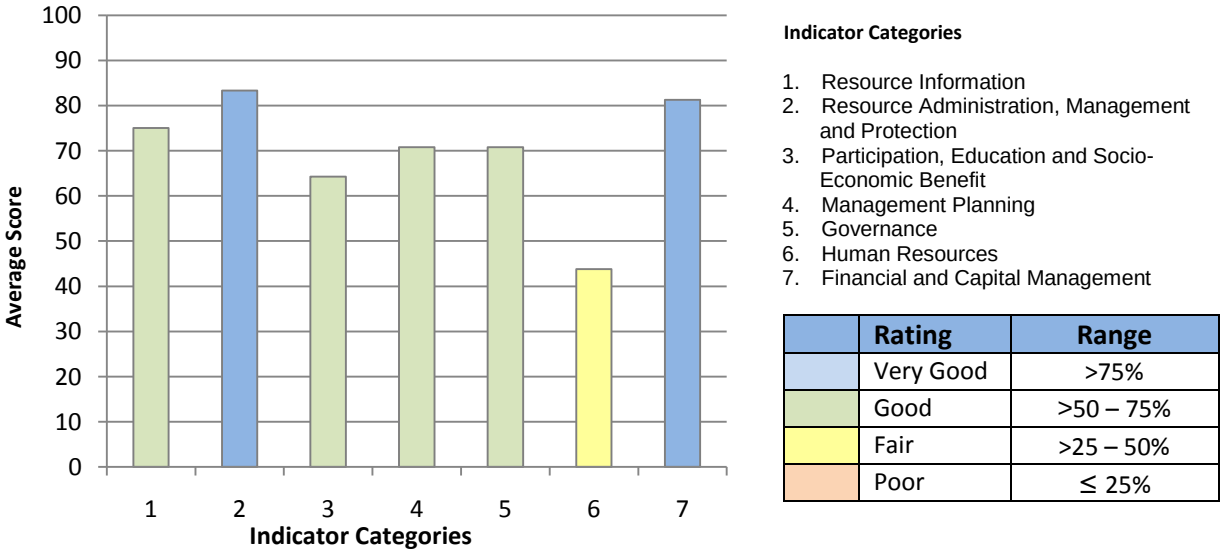


Figure 31: Results per Indicator Category

Two indicator Categories rate as **VERY GOOD – Indicator Category 2: Resource Administration, Management and Protection** (with a score of 83.3%) and **Indicator Category 7: Financial and Capital Management** (scoring 81.3%), reflecting the strengths of SEA, as an established organization, in the areas of administration and financial planning (Table 25, Figure 31).

Human Resources rates as **FAIR**, the weakest Indicator Category, with strengthening of human resource management highlighted as a critical requirement. Team building activities, a change in leadership, more active human resource management, and increased staff numbers and capacity were highlighted as mechanisms to assist in strengthening this Indicator Category. This is now being strengthened under the new Executive Director.

Of the 64 national indicators, seventeen show particular strength, scoring 4.00, whilst eight demonstrate areas that would benefit from strengthening, with scores of 1.00.

Two indicators (**Indicator 1.6: Inventory: Tenures and Claims** and the associated **Indicator 2.4: Tenure claim and conflict resolution**) were not considered relevant for the National Park by the staff, and were therefore not included within the assessment.

A number of recommendations were developed per Indicator Category based on the outputs of the assessment:

Strengths
1.7 Site Assessment: Conservation Target
1.8 Site Assessment: Systematic Threat Assessment
1.11 Environmental Monitoring Activities
2.1 Legal Status
2.2 Boundary Survey and Demarcation
2.4 Tenure Claim Conflict Resolution
2.6 Natural Resource Management
2.8 Protection: Enforcement Activities
2.10 Visitor and Tourism Monitoring Activities
4.3 Regulation and Implementation of Management Zones
4.6 Research Planning
5.1 Protected Areas Objectives
6.4 Technical, Scientific, and Professional Staff Availability
7.4 Infrastructure Adequacy
7.5 Equipment Adequacy
7.6 Internal Accessibility
7.8 Maintenance Adequacy

Weaknesses
1.3 Inventory: Cultural and Archaeological Resources
3.6 Participation: Local Actors Leading Management
4.2 Operational Plan
6.1 Site Manager Preparation
6.2 Site Manager Availability
6.3 Administrative Staff Availability
6.5 Operations Staff Availability
6.8 Staff Satisfaction

3.3.1 Resource Information

Laughing Bird Caye National Park rates at the high end of **MODERATE** for Section One: Resource Information, with a mean score of 3.00 (75.0%), higher than the average for the National Protected Areas System, which scores 2.31 (57.7%)**.** The scores per indicator for Laughing Bird Caye National Park for Section One range from 1.00 for the weakest indicator (**Indicator 1.3: Inventory of cultural and archaeological resources**), to 4.00 for the three strongest indicators, which rate as **VERY GOOD**. **Indicator 1.6: Tenures and Claims** was not considered applicable and is therefore not included. All other indicators rate as **FAIR** or **MODERATE**, with scores of either 2 or 3, suggesting that resource information is available for management, though a number of information gaps still exist.

Recommended Management Actions

- Ensure cultural and archaeological resource information is included within the revision of the management plan
- Revise the biodiversity information available in the management plan, and ensure it is structured for guiding management decisions

3.3.2 Resource Administration, Management and Protection

Laughing Bird Caye National Park rates as **VERY GOOD** for Section Two, with a mean score of 3.33 (83.3%). Scores within this section range from 2.00 (**FAIR**) to 4.00 (**VERY GOOD**), reflecting the strength of administration management capacity within the SEA and Fisheries Department structures. One indicator (**2.4: Tenure Claim Conflict Resolution**) is not considered relevant by the assessor, and is therefore not included in the assessment.

Recommended Management Actions

- Ensure clear permit and approval processes are in place, with communication between SEA, Forest Department and Fisheries Department where permission is required
- Ensure clear guidelines exist and are available to staff, and that best management practices are implemented for Laughing Bird caye National Park

3.3.3 Participation, Education and Socio-Economic Benefits

Management effectiveness of Laughing Bird Caye National Park rates as **MODERATE** for Indicator Section Three, with a mean score of 2.57 (64.3%) – above the overall system average of 2.13 (53.4%). Of the fourteen indicators, one indicator scores 1.00 out of 4.00 (**POOR**) - **Indicator 3.6: Local actors leading protected area management**). No indicator rates as **VERY GOOD**, the majority scoring 2.00 or 3.00

Recommended Management Actions

- Ensure that there is balanced representation of local stakeholders on the Board of Directors
- Identify mechanisms for increased stakeholder benefit

3.3.4 Management Planning

Laughing Bird Caye National Park rates as **MODERATE** for Section Four, with a mean score of 2.83 (70.8%), higher than the national average of 2.20 (55.1%). The National Park rates as **VERY GOOD** on **Indicator 4.3: Regulation and Zoning Implementation**, and **4.6 Research Programme**, but less well on planning – with no strong management planning framework on which to base management activities. One indicator, **Indicator 4.2: Operational Planning –** scores 1 **(POOR),** reinforcing the need for an improved planning framework.

Recommended Management Actions

- Strengthen management through use of Operational Planning / annual workplans, with integrated monitoring and evaluation
- Finalize, submit and implement the revised management plan

3.3.5 Governance

Overall, Laughing Bird Caye National Park scores an average of 2.83 (70.8%), rating as **MODERATE** for Indicator Section Five: Governance, higher than the national average of 2.75 (68.8%). Under Indicator Section 5, Laughing Bird Caye National Park has one indicator rating as **VERY GOOD (Indicator 5.1 Protected Area Objectives)** but has no indicator rating as **POOR**. The remaining five indicators lie between 2 (**FAIR**) and 3 (**MODERATE**). The two weakest indicators are **Indicator 5.3: Administrative Autonomy** and **Indicator 5.4: Advisory Committee,** both rating as **FAIR**.

3.3.6 Human Resources

Laughing Bird Caye National Park rates as **FAIR**, scoring an average of 1.75 (43.8%), lower than the national average across the protected area system, of 2.51 (**MODERATE)**. Under Section 6, one indicator scores 4.00 (**VERY GOOD**) – **Indicator 6.4: Technical, scientific and professional staff**, reflecting the strong science team SEA had in mid-2009. Five indicators rate as **POOR**, with a score of 1.00, reflecting the transition period SEA is going through, following the merging of

TASTE and FoN, and the limited finances available to maintain staffing levels in the current economic climate.

Recommended Management Actions

- Identify and recruit qualified staff for all vacant positions
- Investigate the potential for using international volunteers to fill identified technical skills gaps
- Identify non-monetary mechanisms for increasing staff satisfaction

3.3.7 Financial and Capital Management

Laughing Bird Caye National Park scores **3.25 (81.3%)** for Financial and Capital Management, rating as **VERY GOOD,** higher than the average protected areas system score of 2.49 (62.4%) – **MODERATE**. Under Section 7, no indicator rates as **POOR**, though **Indicator 7.1: Funding Adequacy** and **Indicator 7.7 Signage Adequate for Management** both rate as **FAIR**. Four indicators rate as **VERY GOOD**, reflecting the structured financial management systems that SEA has in place, the presence of a financial sustainability mechanism, and the extensive past investment in infrastructure.

Recommended Management Actions

- Identify and implement mechanisms for greater financial sustainability
- Investigate the potential for using international volunteers to fill identified technical skills gaps
- Identify, source and install essential MPA signs

3.4 Management Strategies

3.4.1 Rules and Regulations

SEA rules and regulations for visitor management are guided by the National Park Systems Act of 1981, which outlines the legislated regulations for protected areas designated as National Parks. All National Parks are non-extractive, resulting in the entire area of Laughing Bird Caye National Park being a no-take zone within the Southern Belize Reef Complex. The most relevant points within the legislation are:

4(a) no person shall be entitled to enter any national park except for the purpose of observing the flora and fauna therein and for the purpose of education, recreation and scientific research;

4(c) no animal shall be hunted, killed or taken and no plant shall be damaged, collected or destroyed in a national park;

5(1) No person shall enter or remain within any national park except under the authority and in accordance with the conditions of a permit issued by the prescribed officer on payment of the prescribed fee.

6. No person shall, within any national park:

(a) permanently or temporarily reside in or build any structure of whatever nature whether as a shelter or otherwise;
(b) damage, destroy or remove from its place therein any species of flora;
(c) hunt any species of wildlife;
(d) remove any antiquity, cave formation, coral or other object of cultural or natural value;
(e) quarry, dig or construct roads or trails;
(f) deface or destroy any natural or cultural features or any signs and facilities provided for public use and enjoyment;
(g) introduce any organic or chemical pollutants into any water;
(h) clear land for cultivation;
(i) graze domestic livestock;
(j) carry firearms, spears, traps, or other means for hunting or fishing;
(k) introduce exotic species of flora or fauna;
(l) catch fish by any means whatsoever;
(m) do any other act which may be prohibited by any order made by the Minister from time to time.

...unless with the permission of the Forest Department and / or the Minister of Natural Resources.

There are also a series of general rules and regulations for Laughing Bird caye National Park, which are disseminated to tour guides and visitors through different media – particularly leaflets and signs:

- All trash brought on to the island is to be bagged and removed at the end of the visit
- Visitors are NOT ALLOWED to fish, remove, move or destroy any objects / organisms found in the park
- Shoreline access is limited due to shallow corals, so visitors must ask their guides or rangers where to enter / exit the water.
- No activities are allowed within the Preservation Zone

3.4.2 Management Constraints and Limitations

During recent assessments of the organization over 2009 /2010, the transition period from FoN/TASTE to SEA (Walker, 2010), a number of management limitations and constraints were identified, and have been addressed within the management programmes. These include:

- The high staff turnover associated with the transition in management during and immediately after the merger provided challenges in maintaining continuity in some programme areas, and in reporting.

- Communication between Programmes is weak, with programme managers being unaware of other Programme activities, and limited sharing of information and collaboration between Programmes. This is particularly evident between the Education and Outreach and Science and Research Programmes.

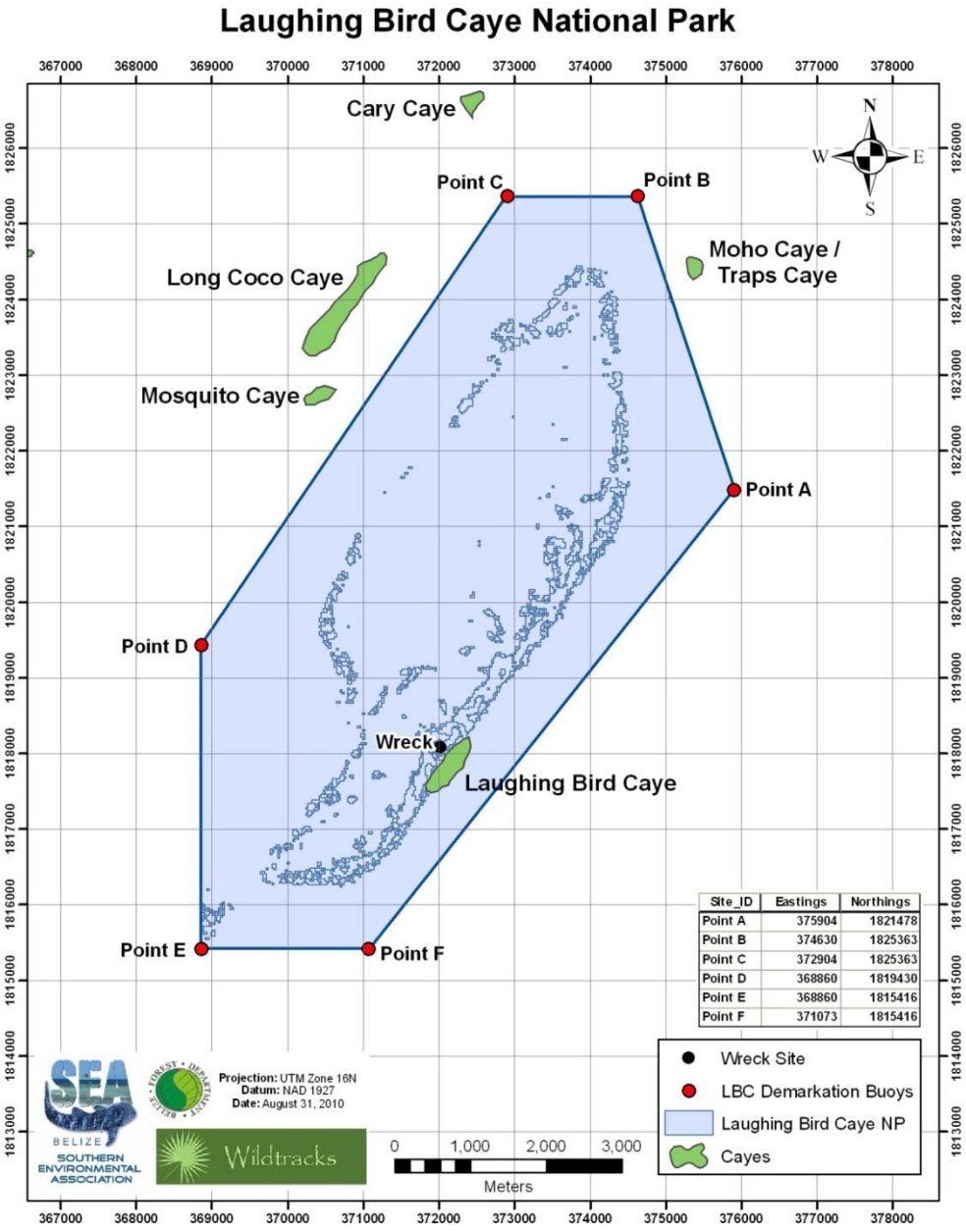
- Stakeholder recognition of SEA as an organization was still relatively low. Primary stakeholders – fishermen, tour guides and the educational sector now recognize the new organization and its management and staff members. However, the wider local stakeholder community is not so familiar with the amalgamation, change in name, and roles and responsibilities. Even within Placencia, where the SEA office is located, many of the secondary stakeholders interviewed were unaware of the new organization.

- Dissemination of results was a weak area, with the delay of both the 2009 Annual Report and the State of Parks report. Dissemination of research, monitoring and management results to local community stakeholders, whilst flagged as an area requiring strengthening during management planning and management evaluation in 2009, still needs to be integrated effectively into the management framework.

3.4.3 Management Zones

Boundaries

The Laughing Bird caye National Park encompasses a total area of 10.119 acres (4,095 ha), with boundary demarcation by marker buoys (Map 12).



Map 12: Laughing Bird Caye National Park Boundaries and Demarcation Buoys

Zoning

Laughing Bird Caye National Park does not have legislated zones, but four distinct areas have been identified, based on current use patterns and two sets of criteria:

Conservation Criteria

- The need for protection of representative marine ecosystems of the National Park
- The need to protect resilient reef sites
- The need for protection of commercial marine species
- The need for protection of the marine turtle species, foraging areas and nesting beach
- The need for protection for the littoral forest and associated species
- The need to maintain the stabilizing herbaceous beach vegetation required for turtle nesting
- The need to minimize visitor impacts on the environment

Human Use Criteria

- Providing a resource that is of benefit to tour guides and tour operators
- Providing recreation areas for divers and snorkelers
- Providing an educational resource and interpretive information
- Providing access for research
- Providing designated anchoring points to minimize impact to reef
- Providing staff and visitor facilities

Table 26: Provisional Laughing Bird Caye National Park Terrestrial Management Zones			
Zone		**Objective**	**Regulations/Guidelines**
Zone One	**Recreational Zone** Core area with LBCNP infrastructure and facilities	▪ To provide an access area, visitor registration, information and park interpretation for visitors ▪ To provide facilities for day visitors (visitor centre, barbeque stands, palapa and picnic tables) ▪ To provide staff facilities ▪ To provide protection for nesting turtles during nesting season	▪ Boats to follow designated, marked access routes ▪ Boats to moor and disembark only in designated areas ▪ Recreation allowed on designated beach areas ▪ Prevention of disturbance of turtles during nesting season ▪ All trash to be removed by visitors
Zone Two	**Buffer Zone** Begins at the ranger station and ends where the cut / sand bar existed that once separated the north part of the island from the south	▪ To provide a low use area between the heavily accessed southern half of the caye, and the preservation zone on the north of the caye	▪ No vegetation clearance (except invasives) ▪ No disturbance of wildlife ▪ Removal of *Casuarina* ▪ Removal of coconuts
Zone Three	**Terrestrial Preservation Zone**	▪ To protect and maintain biodiversity and ecosystem function of the littoral forest and herbaceous beach vegetation ▪ To protect resident and non-resident birds ▪ To protect turtle nest sites during nesting season	▪ No access for visitors ▪ No vegetation clearance (except invasives) ▪ No disturbance of wildlife ▪ Removal of *Casuarina* ▪ Removal of coconuts
Zone Four	**Recreational Area** Snorkelling and diving	▪ To protect and maintain biodiversity and ecosystem function ▪ To provide an area for recreational diving and snorkelling.	▪ Non extractive use only ▪ Recreational snorkelling and diving permitted ▪ Boat mooring only at recognized mooring points ▪ Education activities permitted ▪ Authorised research activities permitted

A fifth zone – a Marine Preservation Zone - should be considered, to provide complete protection to identified resilient reef sites (e.g. that identified by TNC-WWF (2007)), with regulations limiting access, except for MPA staff for management activities.

3.4.4 Limits of Acceptable Change

At present there are no carrying capacities set for tourism activities within Laughing Bird Caye National Park. It has been recognized that this needs to be addressed, particularly in key dive sites and on the caye itself. Funding has been identified for limits of acceptable change planning, with strategies and monitoring activities to be defined during 2011.

3.5 Management Programmes and Objectives

Management programmes are a means of grouping management objectives within related areas – for example, grouping objectives related to natural resource management, or to public use. The strength of the combined programmes is greater than the sum of the individual programmes, as each supports the others over space and time, with areas of overlap that strengthen the overall management of the protected area. It is recognized that a number of strategies need to be included to strengthen communication and collaboration between programme areas, inter-programme collaboration mechanisms for greater adaptive management effectiveness.

Six general management programmes are identified under the National Protected Areas Policy and System Plan framework (NPAPSP, 2005). This has been adapted to reflect the four SEA's Management Programmes:

A. Protected Areas Programme
B. Science Programme
C. Education and Outreach Programme
D. Administration Programme

The conservation strategies outlined for Laughing Bird Caye National Park in the conservation planning section of this management plan are integrated into the management programmes, contributing towards the adaptive management process are the strategies defined during the conservation planning process. The strategies of the Southern Belize Reef Complex (of which Laughing Bird Caye National Park is a component) are also integrated, to assist Fisheries Department, Forest Department and the Southern Environmental Association in ensuring the long-term conservation of the SBRC.

Also taken into consideration are the recommendations from the recent World Heritage Site assessment team, which placed the Belize Barrier Reef Reserve System on the 'Sites in Danger' list, with serious concern as to the future viability of the Belize Barrier Reef Reserve System if certain steps aren't taken in the near future to safeguard the unique values of the seven nominated sites.

Areas of concern from the World Heritage Site assessment team

- Inclusion of Laughing Bird Caye National Park within an oil exploration concession
- Need to maintain terrestrial vegetation
- Requirement for strengthening of tourism management
- Improved coordination between Government and NGO co-management partners
- Finalization of the co-management agreements
- Need to address the problems of invasive species – *Casuarina,* lionfish

Laughing Bird Caye National Park Management Programme Areas			
Protected Areas Programme	**Science Programme**	**Education and Outreach Programme**	**Administration Programme**
Surveillance and Enforcement	Research	Environmental education	Administration Procedures
Public Use Management	Monitoring	Dissemination of information	Human resource management
Infrastructure	Data Management and Dissemination of Information	Stakeholder engagement	Development
Conservation target management	Collaboration with national / international partners	Sustainable livelihoods and training	Inter-programme communication
Inter-programme communication	Inter-programme communication	Inter-programme communication	

Table 27: Laughing Bird Caye National Park Management Programme Areas

3.5.1 Protected Areas Programme

The Protected AreasProgramme focuses on ensuring the maintenance of healthy, functional ecosystems in the face of climate change, through surveillance and enforcement, direct biodiversity management interventions and, where required, through visitor management. This Programme comes under the responsibility of the Protected Areas Program Director and rangers (Figure 32), and deals with direct management of the marine environment, surveillance and enforcement, and public use management. It is administered under five sub-programmes:

- **Surveillance and Enforcement**
- **Public Use Management**
- **Infrastructure**
- **Conservation Target Management**
- **Inter-programme communication**

The **Surveillance and Enforcement Sub-Programme** at Laughing Bird Caye National Park is focused on supporting and upholding the National Park no-take legislation, and ensuring that tourism rules and regulations are enforced, in combination with communication, education and public awareness activities, to ensure that all visitors to the protected area are familiar with the restrictions.

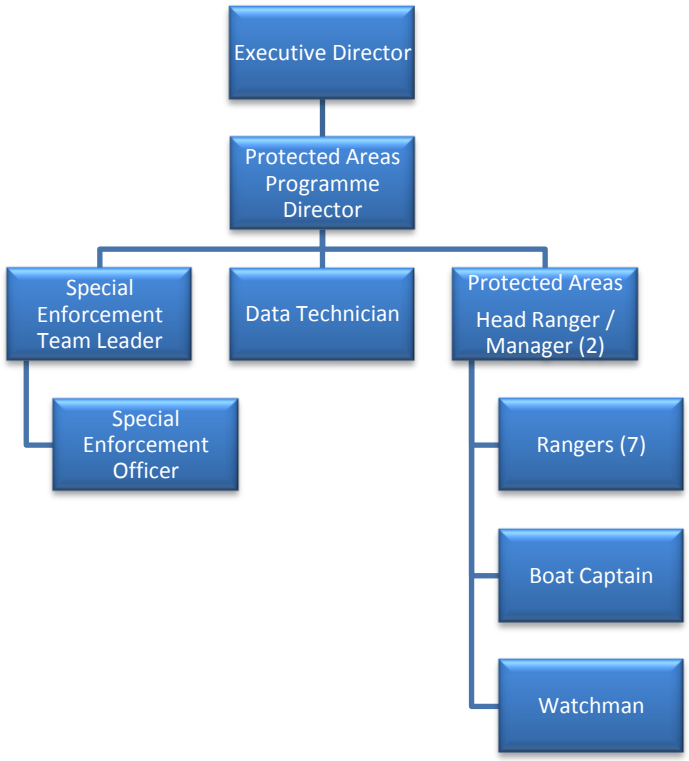


Figure 32: SEA Protected Areas Management Programme staff structure

The SEA Special Enforcement Team is also active in the adjacent seascape, with patrols guided by mapping of enforcement hotpots (Map 13), and focusing on enforcing the Fisheries Legislation (Figure 33).

CORAL:

- It is Illegal for any person to take, buy, sell or have in his possession any type of coral.
- An exception is made in the case of Black Coral (Order ANTIPATHARIA) which may only be bought, sold or exported with a licence from the Fisheries Administrator.

BONE FISH (*Albulba vulpes*) locally known as MACABI**:**

- No person should buy or sell, any Bone Fish.

CONCH (*Strombus gigas*)**:**

- Shell length should exceed 7 inches.
- Market clean and fillet weight should exceed 3 and 2.75 ounces respectively.
- Closed season is from 1st July to 30th September.
- No fisherman shall buy, sell or possess diced conch meat

LOBSTER (*Panulirus argus*):

- Minimum cape length is 3 inches.
- Minimum tail weight is 4 ounces.
- Closed season is from 15th February to 14th June.
- No fisherman shall buy, sell or possess fillet or diced lobster tail, soft shell berried lobster or lobster with tar spot

MARINE TURTLES:

- No person should interfere with any turtle nest
- No person should take any species of marine turtle
- No person shall buy, sell, or have in his possession any turtle or articles made of turtle parts.

NASSAU GROUPER:

- No person shall take in the waters of Belize, buy, sell, or have in his possession any Nassau Grouper (*Epinephelus striatus*) between 1st December and 31st March
- No person shall take, buy, sell, or have in his possession any Nassau Grouper which is less than 20 inches and greater than 30 inches
- All Nassau Grouper are to be landed whole

GRAZERS:

- No person shall take in the waters of Belize, buy, sell, or have in his possession any grazer (of the genera *Scarus* and *Sparisoma*, commonly known as parrotish) and *Acathuridae* Family, commonly known as surgeonfish and tangs

FISH FILLET

- All fish fillet shall have a skin patch of at least 2 inches by 1 inch.

SEA CUCUMBER:

- No person shall fish for sea cucumber (donkey dung) without a special permit issued by the Fisheries Administrator and from July 1st to December 31st in any one year

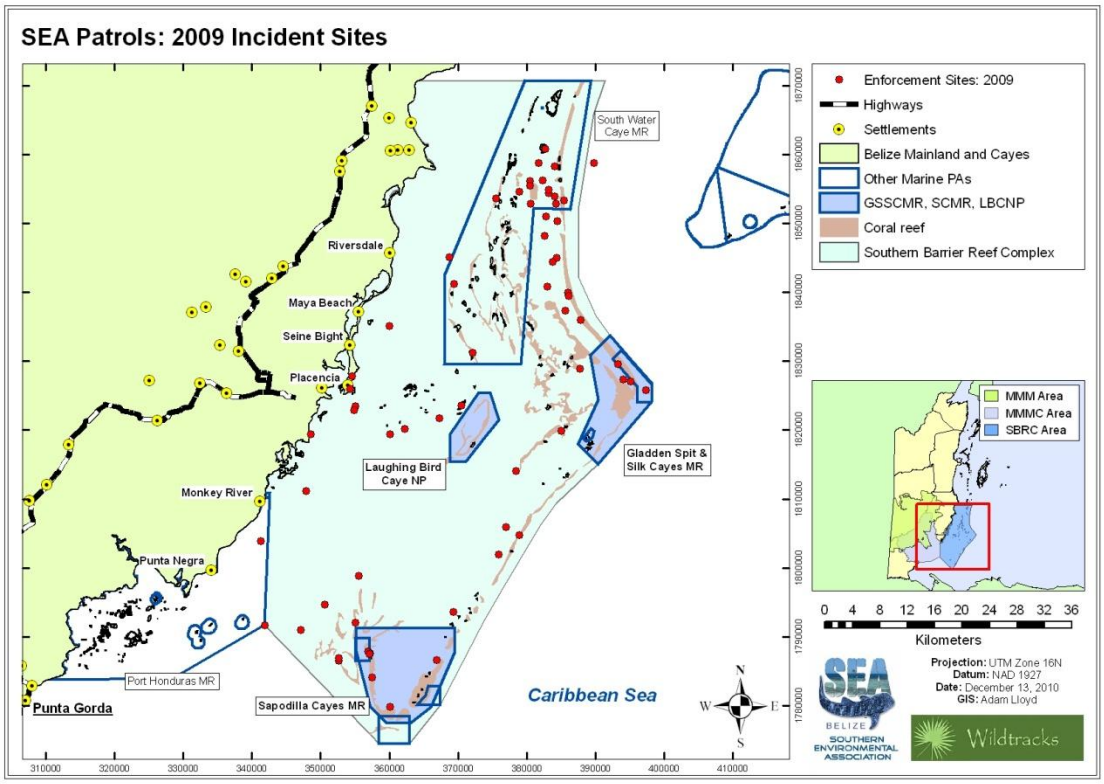
GENERAL

- No person shall set traps outside the reef or within 300 feet of the Barrier Reef
- No spear fishing within marine reserves
- No fishing without a valid fisher folk or fishing vessel license
- No one should fish with scuba gear

Figure 33: Fisheries Legislation Regulations

Specific activities to address identified limitations under this programme include:

- Improved demarcation of boundaries
- Increased surveillance and enforcement presence in the adjacent SBRC through doubling the current Special Enforcement Unit
- Implementation of more effective mechanisms for management of the invasive lionfish within the MPA and adjacent waters and other invasive species
- Impact mitigation within and adjacent to Laughing Bird Caye National Park
- Identification of specific management strategies for addressing climate change
- Management activities for specific conservation targets



Map 13: 2009 Patrol Incident Sites (SEA data)

The **Public Use Sub-Programme** covers a number of different responsibilities, administered largely under the Protected Areas Programme Director, through enforcement of visitor regulations, with input from the Education and Outreach Programme and the Science Programme (for monitoring visitor impacts and developing limits of acceptable change).

The Public Use Sub-Programme focuses on three areas:

- **Visitor Management**
- **Visitor Education and Interpretation**
- **Visitor Safety and Protection**

Under current legislation, visitor management and safety is, to some extent, the responsibility of the tour guides and tour operators, with regulations covering the need for certified guides and dive instructors, and the requirement for boat captains and dive guides to explain the rules of the Reserve to a diver within the Reserve, and ensure that all visiting divers are adequately qualified.

The tour guides using Laughing Bird Caye National Park have been recognised in recent assessments for achieving lower visitation impacts than in other assessed protected areas (McField et al., 2010), suggesting that the training SEA provides is mitigating visitor damage to the reef. However it is also recognized that this needs to be ongoing, and that there still needs to be greater education of visitors and tour guides as to Best Practices for tourism use of the marine resources for sustainability.

Physical management of the natural resources, particularly those highlighted as **conservation targets**, is the responsibility of both the Protected Areas Programme staff (the on-site rangers and surveillance and enforcement teams) and the Science Programme staff, with both programs depending on collaboration and the integration of information collected to ensure adaptive management. Protected Areas staff implementing management activities targeted at maintaining and improving the viability of conservation targets need to have a clear understanding of the reasons behind these activities, with these activities being guided by the Science Programme, in close collaboration with the Protected Areas Director.

The **Site and Infrastructure Sub-Programme** covers activities such as the maintenance of present infrastructure and equipment, and planning for future infrastructure and equipment needs.

The SEA office is located in Placencia, and is well equipped as an administrative headquarters, though would benefit from being relocated to a SEA-owned property, to reduce overheads.

The Ranger Station at Laughing Bird Caye needs substantial upgrading. SEA is moving towards installing solar power systems at all the Ranger Stations, including Laughing Bird Caye, and upgrading water storage capacity.

Currently (2010), a small Visitors Centre exists on the caye, with plans to upgrade and extend the Centre to provide greater interpretive information for visitors, during the 5-year implementation period for this management plan.

Visitor facilities also include mooring buoys, placed at key mooring and dive sites, which are serviced monthly, throughout the year.

Protected Areas Programme	
Surveillance and Enforcement Sub-Programme	

Surveillance and Enforcement	▪ Enforce all relevant rules and regulations under the National Parks System Act (1981)
	▪ Ensure all LBCNP staff are aware of the rules and regulations of the protected area
	▪ Ensure effective demarcation of park boundaries to enable visual recognition of boundaries at all points
	▪ Enforce recreational policies and regulations e.g.
	  ▪ Divers / snorkelers: licensed guide ratio (in collaboration with BTB)
	  ▪ Exclusion of jet-ski and water-ski use within National Park
	  ▪ Mooring buoy use regulations at dive sites and caye
	▪ Increase night patrols within LBCNP
	▪ Strengthen collaboration with Belize Tourism Board for effective enforcement of Tourism Legislation within LBCNP
	▪ Ensure enforcement of research regulations within protected area in coordination with SEA staff and local authorities
	▪ Work closely with Port Authority towards mitigation of potential groundings including the installation of mooring buoys where necessary for reducing boat impacts on reef
	▪ Ensure access to northern part of LBCNP and turtle nesting areas is restricted
	▪ Increase surveillance and enforcement effort for fisheries infractions in SBRC hotspot areas identified using SEA's enforcement data
	▪ Support and uphold Fisheries regulations relevant to maintenance of commercial species within the SBRC
	▪ Continue to collaborate with Police Department, Belize Coastguard, and Fisheries Department for surveillance and enforcement within the SBRC

Staff	▪ Ensure adequate surveillance and enforcement staff on site at LBCNP at all times ▪ Ensure adequate surveillance and enforcement staff for Special Enforcement Unit ▪ Engage and train local fishermen and tour guides in fisheries legislation and regulations to increase enforcement presence
Equipment and Training	▪ Ensure patrols are fully equipped and rangers trained for effective surveillance and enforcement (including night patrols and reliable radios installed on boats) ▪ Ensure LBCNP staff building is equipped for effective enforcement activities – adequate communications, high staff satisfaction with facilities ▪ Increase staff awareness of the benefits of marine protected areas – and specifically LBCNP
Reporting	▪ Maintain patrol log books for LBCNP ▪ Produce quarterly reports, and submit to Forest Department and SEA Board ▪ Produce annual State of the Park reports and submit to Forest Department, Fisheries Department and SEA Board of Directors ▪ Produce maps using GIS for incorporation into relevant reports

Protected Areas Programme	
Surveillance and Enforcement Sub-Programme	
Awareness of Regulations	▪ Increase awareness of visiting live-aboard boats on the rules and regulations of Laughing Bird Caye National Park - specifically the non-extractive designation ▪ Inform all visitors of rules and regulations when visiting the National Park through signage on Laughing Bird Caye, distribution of brochures and other educational material
Public Use Management Sub-Programme	

General Visitor Management	▪ Maintain accurate visitor records (local and International), as well as records of visitor origin, tour operator, activities, and any enforcement action needed in respect to tourism visitation
	▪ Promote awareness of LBCNP public use regulations, including:
	  ▪ Enforce 'no take' regulations for tourists and tourism operations in the National Park
	  ▪ Ensure dive boats fly ' divers down' flag when divers are in the water
	  ▪ Ensure that dive boats follow the legislated diver : guide ratio of 8:1
	  ▪ Ensure that snorkel groups follow the recommended guide : snorkeler ratio
	  ▪ Ensure boat captains follow anchor-use / mooring regulations
	  ▪ Exclusion of jet ski and water-ski use
	▪ Ensure visitors in independent sailboats visiting Laughing Bird Caye National Park are aware of rules and regulations, mooring buoy locations and mooring regulations
	▪ Work with tour guides to promote the 'code of conduct' for reef based activities
	▪ Develop and implement a 'Limits of Acceptable Change' programme for effective tourism management at Laughing Bird Caye, especially for primary dive and snorkel sites
	▪ Develop conflict resolution mechanisms and in-house skills for dealing with public use conflicts
	▪ Ensure all relevant fees are collected and recorded

Interpretation	▪ Equip Visitors Centre / Information Centre with interpretive information designed to raise awareness of the environmental and socio-economic benefits and services of the National Park, and its World Heritage status ▪ Provide information on sea turtles, turtle nesting and turtle conservation during nesting time, when access to nesting beaches are restricted ▪ Install a no-entry sign at start of buffer zone on Laughing Bird Caye, with information on mangrove, caye vegetation and bird species ▪ Erect clear signs indicating rules and regulations, entry and exit points for snorkelling, and ensure awareness through brochures, handouts and other educational material related to regulations

Protected Areas Programme	
Public Use Management Sub-Programme	
Visitor Safety	▪ Equip Ranger Station with good radio communications / satphone ▪ Equip Ranger's Station with first aid kit with extensive first aid kit, life-jackets, fire extinguishers (boat and Ranger Station), flares, satphone). ▪ Ensure all rangers based on Laughing Bird Caye are trained in first aid and CPR, and dealing with marine-based first aid (including lionfish stings) ▪ Ensure there is an emergency plan in place
Infrastructure Management Sub-Programme	
On-site Staff Facilities	▪ Upgrade the current on-site staff facilities, with restructuring of bathroom facilities ▪ Ensure the LBC Ranger Station is adequate for high staff satisfaction ▪ Install solar power to supply the LBC Ranger Station ▪ Improve water storage and system at the LBC Ranger Station

On-site Visitor Facilities	▪ Renovate and extend Visitor Centre
	▪ Ensure visitor facilities are adequate for visitation levels and for maintaining high visitor satisfaction (picnic tables, barbecue grills, bathrooms)
	▪ Ensure sufficient mooring buoys are installed for visitation requirements
	▪ Ensure adequate signage e.g:
	  ▪ Large "Welcome" / rules and regulations signs
	  ▪ WHS status sign
	  ▪ No-entry / info on terrestrial biodiversity at start of buffer zone
	  ▪ Temporary turtle nesting signs (for nesting sites) – no-entry and info
	▪ Ensure adequate visitor interpretive information on Laughing Bird Caye National Park in the Visitor Centre, with changing displays each quarter

Visitor Impacts	▪ Research mechanisms for monitoring the regulation of waste generated by visiting boats (solid / grey water waste) in collaboration with Port Authority and DoE ▪ Strengthen links with Department of the Environment for rapid response to pollution events
Maintenance	▪ Ensure visitor facilities (barbecue stands, picnic tables, bathrooms and palapa) are adequately maintained ▪ Ensure ranger facilities / equipment (boats, engines, radio equipment, generators, compressor) is adequately maintained ▪ Ensure mooring buoys are adequately maintained
Conservation Target Management	
Coral Reef	▪ Investigate potential for designating Marine Preservation Zones in identified high resilience areas, in response to climate change research outputs ▪ Designate and enforce specific mooring sites to reduce mechanical impacts on corals by boats / anchors ▪ Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions

Protected Areas Programme	
Conservation Target Management	
Herbaceous Beach Vegetation / Mangroves	▪ Protect nesting and roosting bird populations through control of visitor access
Sandy Beaches	▪ Identify, adopt and implement guidelines for managing marine turtle nesting on the caye, with training for rangers, visitor awareness, and demarcation of turtle nesting areas, to prevent direct impacts from tourism (WIDECAST Technical Report No. 9: Best Practices for Sea Turtle Nesting Beaches) ▪ Ensure all external lights used on facilities at Laughing Bird Caye are kept to a minimum
Sharks	▪ Continue to fully enforce the no feeding of sharks regulation
Water Contamination	▪ Research mechanisms for monitoring the regulation of waste generated by visiting boats (solid / grey water waste) in collaboration with Port Authority and DoE ▪ Strengthen links with Department of the Environment for rapid response to pollution events
Development and Best Practices	▪ Collaborate with Forest Dept and DoE to ensure compliance with development legislations in SBRC adjacent to LBCNP
Petrochemical Issues	▪ Lobby for exclusion of marine protected areas from oil exploration concession areas ▪ Create / adopt Contingency Plan in collaboration with DoE for addressing oil or chemical spills within the SBRC
Inter-programme Communication	
Inter-Programme Communication	▪ Develop systems to ensure consistent communication between programmatic areas to support overall adaptive management of LBCNP and the SBRC ▪ Strengthen mechanisms to ensure consistent communication between programmatic areas to support overall adaptive management of LBCNP and the SBRC ▪ Ensure staff are aware of the conservation targets and the role of enforcement and surveillance in ensuring their effective management

3.5.2 Science Programme

Research and monitoring are essential activities to ensure informed, effective management, and to assess the effectiveness of the National Park in achieving its objectives. The Science Programme comes under the responsibility of the Science Program Director (Figure 34), and is administered under five sub-programmes:

- **Research**
- **Monitoring**
- **Data Management and Dissemination of information**
- **Collaboration with national / international partners**
- **Inter-programme communication**

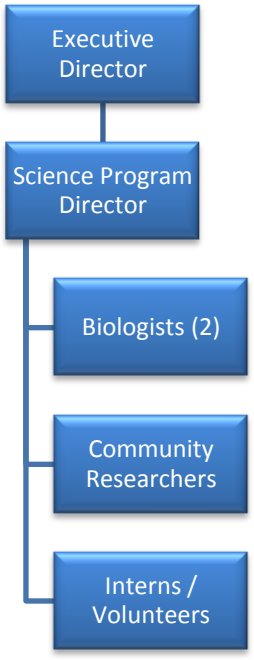


Figure 34: SEA Science Programme staff structure

The **Research Sub-Programme** focuses on those areas identified as information gaps during the management planning process, and the conservation planning process for the larger SBRC. Many of the research activities can be effectively met through engaging research partners for targeted project areas. This is particularly important in research for informing climate change adaptation.

Laughing Bird Caye National Park has been the focus of a number of recent and ongoing research initiatives, and has been chosen as Belize's first reef restoration site, through the project 'Fragments of Hope', primarily due to its no-take protection, which is critical for the maintenance of a healthy coral reef ecosystem.

Another, recently completed initiative under the Conservation International Marine Management Area Science Programme, focused on providing a framework for long-term monitoring of the Belize reef system, with Laughing Bird Caye National Park identified as one of five survey sites. In the long term, this has the potential to provide important feedback into the adaptive management of the marine protected area, with data on the current status of the reef at all five sites (Shank et al., 2010).

For independent researchers, research proposals are reviewed by the Forest and Fisheries Departments, and SEA, and if approved, a research license is granted, valid for one year.

The **Monitoring Sub-Programme** is the main focus of the Science activities, and is guided in part by the SEA Marine Monitoring Manual (SEA, 2010). The Manual standardizes monitoring strategies to improve SEA's monitoring efforts, and provides the biological monitoring strategy for all three of the SEA managed protected areas. It identifies monitoring protocols and responsibilities for each MPA, and incorporates the monitoring and research goals of the Southern Belize Reef Complex Conservation Action Plan (Wildtracks, 2008). Whilst this is comprehensive in terms of current monitoring protocols, there is still a need to incorporate a mechanism to assess the resilience of the three marine protected areas and the wider SBRC to climate change and identify critical source areas, and ensure the integration of these into future planning.

Many of the methods within the Monitoring Plan were developed under the Mesoamerican Barrier Reef System (MBRS) Synoptic Monitoring Programme, the Belize Fisheries Department and the 'LAMP' (Long-term Atoll Monitoring Protocol) protocol developed by Dr. Charles Acosta and revised by Wildlife Conservation Society.

Of particular importance is monitoring of in-water nutrient levels, important in guiding strategies to address the impacts of land run-off contaminants from agriculture and industry.

The **Data Management and Dissemination of Information Sub-Programme** ensures that information from research and monitoring is available for guiding management decision making. Dissemination of the results is also identified as key, as effective management depends on ensuring clear understanding of the reasons behind targeted management or enforcement strategies by stakeholders.

The **Collaboration with National / International Partners Sub-Programme** recognizes that SEA does not operate in a vacuum, but as part of a national and global effort to conserve marine resources, with collaboration at all levels to share information and inputs into effective management of Laughing Bird Caye National Park, particularly in the face of climate change.

SEA is an active member of The Belize National Spawning Aggregation Working Group and the National Coral Reef Monitoring Network, both of which work to improve data collection and collaboration between organizations working in the marine protected area system.

The **Inter-programme Communication Sub-Programme** recognizes the importance of communication and collaboration between the Science team and the other programme areas for effective management of the conservation targets. This is particularly true in the active engagement of the science team in the activities of the Education and Outreach Sub-Programmes, to ensure increased public awareness and involvement in the management of Laughing Bird Caye National Park.

Priority Areas

Several areas have been identified as priorities for research and monitoring activities, either through the development of conservation planning actions, or in response to specific research or monitoring requirements:

1. To develop specific research and monitoring activities and strategies to address climate change issues

2. To develop standards for the Limits of Acceptable Change (LAC) Programme and implement a dedicated LAC monitoring programme

3. To communicate and collaborate effectively with other SEA programmes, for sharing of information and to link enforcement activities and environmental impacts

4. To increase communication, cooperation and coordination with other conservation organisations and research partners involved in management, research and monitoring on the Belize reef – particularly in the Southern Belize Reef Complex

5. To ensure effective dissemination of results in formats that are accessible to a wide variety of stakeholders

Science Programme	
General	▪ Ensure the SEA Science Programme is equipped and staffed for effective programme management and strategy implementation ▪ Ensure all staff are aware of, and can articulate, research and monitoring outputs ▪ Ensure any new biologists are trained in monitoring protocols (for all monitoring techniques), species identification and data management ▪ Train staff and rangers in identification of key species (particularly nesting birds and turtles) ▪ Consolidate information on the cultural and archaeological resources of the protected area
Research Sub-Programme	
General Research	▪ Collaborate with Fisheries Department in the process of granting research permits ▪ Develop a written agreement for use of the area by external researchers, including rules, regulations and guidelines, to be signed by all researchers using the National Park ▪ Ensure all research conducted within Laughing Bird Caye National Park keeps to the park rules and regulation and agreed research protocols ▪ Ensure all researchers are aware of the rules and regulations of the National Park, and under the Fisheries Act and the National Park Systems Act ▪ Integrate monitoring and research results into the adaptive management process ▪ Ensure information on cultural and archaeological resources within the GSSCMR and SBRC generally are collated and accessible, including position and condition of wrecks
Priority Research	▪ Update ecosystem mapping for Laughing Bird Caye National Park ▪ Continue to update baseline species lists for fish, corals, birds and other vertebrates and invertebrates within the park and surrounding area ▪ Establish a transect across the faro for assessment of changes in reef health, coral / marine biodiversity (a replicate of the previous CEDAM transect would be preferred, if the previous results can be located, for comparison) ▪ Identify priority research activities in LBCNP from conservation planning and adaptive management requirements, and identify (national/international) partners / locate funding for implementation ▪ Disseminate list of priority research activities to research stakeholders active within Laughing Bird Caye National Park ▪ Assess the diversity and abundance of shark species within LBC, as part of the larger SBRC initiative
Monitoring Sub-Programme	
General Monitoring	▪ Continue implementing effective, standardized regular monitoring, data management and data analysis for LBC and the wider SBRC area, as outlined by SEA's Monitoring Plan ▪ Engage SEA rangers in monitoring and research activities wherever possible ▪ Integrate monitoring of Conservation Planning indicators into the existing SEA monitoring framework

Science Programme	
Monitoring Sub-Programme	
General Monitoring	▪ Integrate monitoring for climate change within SEA's monitoring framework ▪ Integrate monitoring for SBRC indicators within SEA's monitoring framework ▪ Integrate monitoring of Acceptable Change parameters within SEA's monitoring framework ▪ Strengthen monitoring of birds (nesting / resident and migratory) with integrated training in species recognition for SEA biologists and rangers ▪ Develop mechanisms for tour guides and other stakeholders to participate in monitoring activities of turtles, coral bleaching and lionfish ▪ Provide information and training to tour guides on faro structure, conservation targets, climate change, coral bleaching, bird use of the cayes, caye vegetation, sharks and other topical subjects to assist them to provide accurate information to their visitors ▪ Implement effective water quality monitoring programme in LBCNP and the wider SBRC
Monitoring of Impacts	▪ Develop rapid assessment mechanisms that engage staff and stakeholders, for assessing and monitoring impacts such as ship groundings, hurricane / earthquake damage, disease outbreaks, oil spills etc. ▪ Ensure post impact assessments are conducted and reports produced and disseminated for all impact events – e.g. earthquakes, hurricanes, boat groundings ▪ Monitor run-off from the southern coastal plain and northern Honduras / Guatemala during extreme storm events using remote sensing information (NOAA website / SERVIR, ICRAN-MAR)to assess impacts on LBCNP ▪ Prioritize monitoring of agrochemical contamination in water / organism tissue samples ▪ Monitor in-water nutrient levels and relative algal growth on a regular basis to monitor anthropogenic impacts, particularly in high visitor-use areas, using methods such as stable isotope analysis - adjacent to the caye, mooring buoys and popular dive sites (also in no-impact control sites). ▪ Increase communication and sharing of information through inter-programme collaboration mechanisms for strategy integration and greater adaptive management effectiveness ▪ Monitor presence and density of lionfish population

Science Programme	
Monitoring Sub-Programme	
Monitoring for Climate Change	▪ Continue monitoring coral bleaching (degree of bleaching and species affected), with input into Mesoamerican Coral Reef Watch Programme (through ECOMAR) for early reporting of bleaching episodes ▪ Identify resilient areas within SEA's Marine Protected Areas (MPAs) in the context of the greater Southern Belize Reef Complex (SBRC) ▪ Review and re-evaluate MPA boundaries and zoning in the SBRC ▪ Identify coral recruitment sources for LBCNP, and identify mechanisms to ensure that these are adequately protected, if necessary ▪ Characterize water currents critical for larval dispersal (for coral and fish recruitment) at LBCNP ▪ Establish monitoring protocols that inform management for building reef resilience ▪ Investigate mechanisms for direct interventions – e.g. coral nurseries, , promoting higher herbivore densities through fishing regulations ▪ Integrate collection of coral fragments into post-impact (hurricane, boat grounding) assessment activities for incorporation into coral restoration programme
Monitoring of Conservation Action Planning Indicators	▪ Number of *Casuarina* trees ▪ Number of red mangroves ▪ Density / size of conch ▪ Density / size of lobster ▪ Abundance / size / diversity of specific finfish ▪ Number of fishing incursions ▪ Number of turtle nests ▪ Number of successful turtle nest hatchesNet loss / gain of remaining herbaceous vegetation per year ▪ Number of Laughing Gull nests ▪ Number of beach nesting bird species using the caye ▪ Number of birds using trees for nesting ▪ Diversity, size and abundance of species sharks/rays recorded per year ▪ Number of whale sharks recorded per year ▪ Maximum number of whale sharks recorded at one time per year ▪ Percentage live coral cover (as a proportion of overall benthic cover) ▪ Coral diversity ▪ Recent coral mortality (percentage and species affected) ▪ Recent coral recruitment ▪ Herbivorous fish population (diversity, size, abundance) ▪ *Diadema antillarum* (long-spined sea urchin) density ▪ Extent of seagrass ▪ Condition of seagrass ▪ % of seagrass area impacted by anthropogenic activities

Science Programme	
Data Management and Dissemination of Information Sub-Programme	
Data management	▪ Maintain database of research and monitoring information in order to enhance the level of coordination between researchers, help identify gaps in information, and provide a platform from which the results can be communicated to a wider audience ▪ Improve mechanisms to integrate surveillance and enforcement and biological monitoring information ▪ Strengthen mechanisms for accessing monitoring and research outputs, through the use of querieable databases, specifically for SEA's data and also at a national / regional level where appropriate
Dissemination of Information Dissemination of Information	▪ Ensure mechanisms are in place for easy access to monitoring data, quarterly and annual data summaries ▪ Continue presenting monitoring results in SEA's newsletters / annual reports, and integrate into the adaptive management cycle ▪ Use available forums for dissemination of results (e.g. stakeholder visits, workshops, conferences, school visits, tour guide meetings etc. ▪ Develop digital library of all published work on Laughing Bird Caye National Park and make available, where feasible, for download on line (through SEA's website) ▪ Provide quarterly information to tour guides on interesting activities, research outputs, educational activities etc. that can be incorporated into their interpretation during tours ▪ Production of annual State of the Park / SBRC reports including monitoring / research output for SBRC area
Collaboration Sub-Programme	
Collaboration	▪ Increase communication and sharing of information through national and regional working groups ▪ Work closely with national and international partners to monitor climate change effects and identify appropriate national and regional management strategies ▪ Strengthen communication and collaboration with current and future (national and international) research partners ▪ Develop mechanisms for tour guides and other stakeholders to participate in monitoring activities of turtles, coral bleaching and lionfish ▪ Engage Belize Tourism Board and Belize Tourism Industry Association in climate change adaptation planning
Inter-Programme Collaboration	
Inter-Programme Communication	▪ Develop systems to ensure consistent communication between programmatic areas to support overall adaptive management of LBCNP and the SBRC ▪ Increase communication and sharing of information through inter-programme collaboration mechanisms for strategy integration and greater adaptive management effectiveness ▪ Ensure results of monitoring and research outputs are available to staff at LBCNP and to other SEA Program Managers

3.5.3 Education and Outreach Programme

Community participation is a critical component of protected areas management in Belize, and one of the foundations on which management of Laughing Bird Caye National Park has been built. The Education and Outreach Programme focuses on stakeholder engagement and building awareness among stakeholders of all ages about the importance of marine conservation and marine protected area management. The Education and Outreach Programme comes under the responsibility of the Education and Outreach Program Director (Figure 35), and is administered under four sub-programmes:

- **Stakeholder EngagementEnvironmental Education**
- **Dissemination of Information**
- **Sustainable Livelihoods and Training**
- **Inter-Programme Communication**

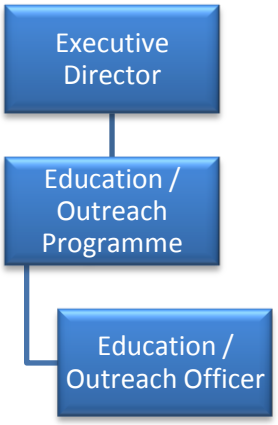


Figure 35: SEA Education and Outreach Programme staff structure

The **Stakeholder Engagement / Environemental Education Sub-Programme** is essential for effective management of Laughing Bird Caye National Park, and will depend on informed and engaged stakeholder groups. SEA has worked closely with stakeholder communities to ensure to help target priority issues relating to marine protected areas management, livelihoods and organizational capacity. An engaged education and outreach strategy to empower local people and organizations will support management by enhancing capacity to implement and support a variety of projects. Engagement of tour guides, fishermen and the educational sector has been a key focus of management strategies since the establishment of the National Park, with stakeholder representation and participation in management decisions at Board level, and training for participation in management activities such as surveillance and enforcement, and monitoring and research, increasing stakeholder support for the management activities of Laughing Bird Caye National Park.

Environmental education was always a core component of the activities of both FoN and TASTE, and has illustrated the impact that hands-on experience of the coral reefs can have on participants of all ages – but particularly for upper primary level students. School activities within the National Park provide students with valuable hands-on experiences and an increased understanding of marine resource management. These activities build supportive stakeholder components within the community, motivated towards a more positive impact on

the environment. Built on the successes of past initiatives to strengthen understanding of marine ecology and stewardship, the programme increases collaboration with stakeholder schools, and builds the understanding and capacity of local teachers and parents. SEA has been successful in developing a cadre of trained adult "field directors" in the schools and communities who have the capacity to participate in field visits to the National Park, increasing SEAs capacity to reach out to its younger stakeholders, and to other community members. In 2010, SEA trained 60 Field Directors, and took over 400 students from twelve schools to the reef.

Also critical is the **Dissemination of Information Sub-Programme,** which provides mechanisms to ensure that stakeholders are kept informed, and understand the complexities of biodiversity management, as well as the reasons behind management decisions.

Under the **Sustainable Livelihoods and Training Sub-Programme,** the development of a comprehensive understanding of local needs will allow for better adaptive management. This will include the development of alternative economic incentives for local stakeholders and other programs targeted to increase the sustainability of natural resources within Belize.

Education and Outreach Programme	
Socio Economic Background	▪ Effectively access and use baseline information from Conservation International on the socio-economic context of the protected area (CI / Catzim et. al. 2009) ▪ Maintain and update accurate socio-economic data on stakeholder communities
Stakeholder Engagement / Environmental Education Sub-Programme	
Stakeholder Engagement and Participation	▪ Develop a Stakeholder Engagement Plan to guide activities within a framework of goals, objectives and targets aligned to target audiences, with input from other SEA programme managers ▪ Engage tourism and fishing stakeholders from key communities through increased awareness, participation and communication ▪ Engage schools in key stakeholder communities through increased awareness, participation and communication ▪ Engage the market - Investigate certification system for local restaurants that follow best practices in purchasing lobster, conch and fin-fish species (size, season and species regulations), with information for tourists on how
Participation	▪ Encourage active participation of the Board of Directors in outreach activities and events ▪ Engage tour guides in surveillance activities ▪ Engage new sectors – the hotel industry, restaurants, and other businesses, within the stakeholder footprint ▪ Promote best practices for companies, tour operators, restaurants, liveaboard operators through SEA information flyers and other mechanisms
Environmental Education - Schools	▪ Give presentations targeting primary and secondary schools in stakeholder communities on the SEA marine protected areas and their environmental and socio economic benefits ▪ Liaise and collaborate with local NGOs and other SBRC partners (SWCMR, TIDE, Fisheries Department) for joint educational outreach to schools in stakeholder communities ▪ Ensure continued communication and collaboration with schools, to build on past successes ▪ Provide ongoing field trips for students to the reef, to invest in the engagement of future decision-makers ▪ Strengthen SEA's environmental club programme within stakeholder communities ▪ Strengthen SEA's scholarship programme
Environmental Education - General	▪ Encourage greater visitation by local visitors and school groups through organized and guided day trips, school visits and other mechanisms ▪ Increase good practice awareness among dive/snorkel groups through skills training, annual refresher courses on rules, regulations and tourism policies, and development and dissemination of best practices information (e.g. from Coral Reef Alliance (www.coral.org)) ▪ Develop outreach program specifically for the live-aboard companies, employees and clients with literature on rules, guidelines and maps relevant to all SEA protected areas

Education and Outreach Programme	
Stakeholder Engagement / Environmental Education Sub-Programme	

Public Awareness - General	▪ Develop and implement targeted public awareness programmes that address specific issues including, but not limited to increasing awareness among stakeholders of the:
	  ▪ Goals and Objectives of Laughing Bird Caye National Park
	  ▪ Goals and Objectives of the Southern Environmental Association
	  ▪ The Southern Belize Reef Complex
	  ▪ Lionfish
	  ▪ Coral Bleaching
	  ▪ Climate Change
	  ▪ Manatee Conservation
	  ▪ Marine Protected Areas (MPAs) and maintenance of sustainable fish stocks
	▪ The biodiversity value and importance of mangrove, and encourage protection – especially in areas identified as important nursery sites for LBCNP
	▪ Continued education and awareness activities in stakeholder communities, focussing on the value of LBCNP as a no-take area and its ability to help maintain the sustainability of commercial species , including:
	  ▪ Managed access and no-take areas
	  ▪ Sharks
	  ▪ Sea turtles
	▪ Increase awareness among fishermen on proper disposal of oil / lube containers, and effects of pollution on the marine environment
	▪ Ensure there is awareness of Laughing Bird Caye National Park and the environmental services and benefits it provides to the general public through use of ongoing media opportunities and posters (focusing particularly on biodiversity protection, fisheries production and tourism)
	▪ Encourage greater visitation by local visitors and school groups through organized and guided day trips, school visits and other mechanisms
	▪ Increase general awareness of SEA and Laughing Bird Caye National Park through participation in national events - displays and exhibits at events such as the Agriculture & Trade Show, Earth Day etc.
	▪ Ensure continued production and distribution of brochures on Laughing Bird Caye National Park, incorporating key biodiversity and ecosystem values, goals and rules and regulations

Awareness - Development	▪ Promote guidelines and best management practices among staff, resource users, and visitors ▪ Engage landowners of adjacent cayes in management, protection and restoration of littoral forest, mangrove and beach vegetation ▪ Identify and implement best means of liaising with caye developers and landowners of cayes adjacent to the LBCNP / in the wider SBRC - areas of conflict and mutual assistance

Education and Outreach Programme	
Stakeholder Engagement / Environmental Education Sub-Programme	
Awareness - Development	▪ Raise awareness of role of mangroves, littoral forest, seagrass, corals, and methods of limiting development impacts (sedimentation - erosion following land clearance; wastewater, sewage and solid waste disposal) targeted at cayes adjacent to LBCNP and in the wider SBRC ▪ Engage land owners, leaseholders and developers within the wider SBRC, and lobby for stakeholder management of turtle nesting beaches, with implementation of WIDECAST Best Practices
Awareness - Lionfish	▪ Increase awareness in staff, and tour guides of the potential impacts of lionfish ▪ Strengthen stakeholder and staff engagement, support and participation in lionfish removal and use ▪ Promote lionfish as a marketable species ▪ Increase staff and tourism stakeholder awareness of invasive nature of *Casuarina,* and remove any individuals of this species from LBCNP, particularly on identified turtle nesting beaches
Dissemination of Information Sub-Programme	
Dissemination of Information	▪ Produce an annual flier summarizing activities and achievements to be distributed to residents, tour guides, tour operators and fishermen ▪ Hold annual stakeholder meetings to present SEA's achievements, including income and expenditures for increased awareness and transparency ▪ Equip Visitors Centre / Information Centre with interpretive information designed to raise awareness of the environmental and socio-economic benefits and services of the National Park, and its World Heritage Site status ▪ Provide quarterly information to tour guides on interesting activities, research outputs, educational activities etc. that can be incorporated into their interpretation during tours ▪ Regularly maintain and update SEA website and other social media ▪ Ensure all awareness documents relevant to Laughing Bird Caye National Park are available for download from the website (brochures, leaflets, regulations, posters etc.) ▪ Increase general awareness of SEA and Laughing Bird Caye National Park through participation in national events - displays and exhibits at events such as the Agriculture & Trade Show, Earth Day etc. ▪ Ensure continued production and distribution of brochures on Laughing Bird Caye National Park, incorporating key biodiversity and ecosystem values, goals and rules and regulations
Sustainable Livelihoods and Training Sub-Programme	
Sustainable Livelihood and Training	▪ Identify and implement effective mechanisms for decreasing incursions through reducing local community dependence on marine resources, through skills training for other occupations and facilitation of opportunities and incentives ▪ Engage and train local fishermen and tour guides in fisheries legislation and regulations to increase enforcement presence ▪ Provision of training opportunities based on a needs assessment to enhance stakeholder skills

Education and Outreach Programme	
Inter-Programme Communication	
Inter-Programme Communication	▪ Develop systems to ensure consistent communication between programmatic areas to support overall adaptive management of LBCNP and the SBRC ▪ Increase communication and sharing of information through inter-programme collaboration mechanisms for strategy integration and greater adaptive management effectiveness ▪ Ensure results of education and outreach outputs are available to staff at LBCNP and to other SEA Program Managers

3.5.4 Administrative Programme

The Administration Programme is centralized in Placencia, with a sub-office in Punta Gorda. It focuses on management of three marine protected areas, including Laughing Bird Caye National Park. As a larger NGO, SEA has developed an Administration and Policy Manual to ensure that all staff and members of the Board of Directors are aware of the administrative procedures and policies of the organization.

A Financial Plan, developed in 2010, guides implementation of mechanisms towards greater financial sustainability.

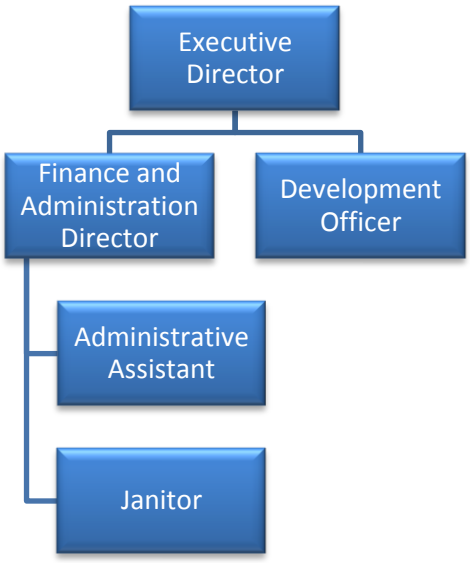


Figure 36: SEA Administration Management Programme staff structure

Activities fall under four sub-programmes:

- **Administrative Procedures**
- **Human Resource Management**
- **Development**
- **Inter-programme Communication**

Administration Programme	
Administrative Procedures Sub- Programme	
Administration Procedures	▪ Ensure adequate equipment and staff for effective administration ▪ Preparation of annual workplan and budget by the management team in October of each year . ▪ Produce quarterly reports and submit to Board of Directors ▪ Improve the internal financial system, and link expenditures to programme areas ▪ Ensure an effective Emergency Plan is in place (to include natural and anthropogenic disasters), and staff are trained in implementation
Office Facilities	▪ Maintain and replace office equipment as necessary for ensuring effective operations ▪ Identify equipment gaps and locate funds for equipment purchase Ensure SEA has sufficient vehicles and boats for effective operations ▪ Ensure all Programme Directors / Managers are fully equipped for effective implementation of their programme areas ▪ Investigate the feasibility of purchase of land and design and construction of SEA office, and locate funds for implementation ▪ Incorporate solar power and other green initiatives into the design and operation of the SEA Office
Human Resource Management Sub- Programme	
Human reasource management	▪ Ensure all employees are familiar with organizational policies and procedures, as outlined in SEA's Policy and Administration Manual ▪ Equip staff with uniforms ▪ Ensure staff have sufficient administrative training for effective general management, fundamental accounting, budget and proposal / workplan preparation and implementation ▪ Ensure surveillance and enforcement staff have sufficient surveillance and enforcement training to be effective ▪ Ensure all on-site and operational staff members are trained in operation and maintenance of reserve equipment (boat handling, outboard engine repair etc.) ▪ Ensure staff have sufficient training in monitoring protocols for effective monitoring ▪ Ensure staff are trained in conflict resolution, consensus building, public relations and communications skills ▪ Ensure staff are trained in CPR, First Aid and use of the oxygen kit ▪ Ensure on-site staff have adequate support ▪ Annual evaluation of staff performance ▪ Identify human resource skills gaps and implement training programme to build capacity where required Continue encouraging participation of local stakeholders through community rangers programme – local fishermen and tour guides

Administration Programme	
Development Sub- Programme	
Development	▪ Conduct an economic evaluation of the commercial and environmental services of Laughing Bird Caye National Park ▪ Increase promotion and marketing of Laughing Bird Caye through media such as video, posters etc. ▪ Implement SEA's Financial Plan
Financial Plan Implementation	▪ Implement SEA's Financial Plan ▪ Establish an 'honorary Board' to assist with fundraising ▪ Investigate mechanisms to diversify funding base ▪ Seek funding for establishing an endowment fund for long term sustainability ▪ Market SEA, with increased brand name recognition locally, nationally and internationally ▪ Seek to reduce variable costs through strategic partnerships
Communication and Collaboration	▪ Strengthen links with other organisations and Government agencies involved in marine protected areas management ▪ Ongoing communication and dissemination of information to all stakeholder sectors ▪ Board, ▪ Staff ▪ Forest Department ▪ Surveillance and enforcement and research partners, ▪ Funding partners ▪ Stakeholder partners – tour guides, fishermen, schools ▪ Government agencies (especially Coast Guard, Port Authority, Department of the Environment, and Department of Geology and Petroleum) ▪ Local decision makers
Inter-Programme Communication	
Inter-Programme Communication	▪ Develop systems to ensure consistent communication between programmatic areas to support overall adaptive management of SCMR and the SBRC ▪ Increase communication and sharing of information through inter-programme collaboration mechanisms for strategy integration and greater adaptive management effectiveness

3.5.5 Management Policies

SEA has developed an Administration and Policies Manual to ensure that all staff and members of the Board of Directors are aware of the administrative procedures and policies of the organization. This is being reviewed by the Ministry of Labour for approval (2010).

On-site staff at Laughing Bird Caye National Park are trained as Fisheries Officers, and as such follow the policies of the Belize Fisheries Department. These include the Fisheries Department Weapons Policy, and the Enforcement Plan - an official Fisheries Department policy to guide Fisheries Officers through standardized procedures for approaching and apprehending offenders in contravention of the protected area regulations.

3.6 Timeline, Evaluation, and Review

It is suggested that the activities of each programme area are expanded to form an implementation matrix, including present and desired status, responsible parties, a timeline based on the 5-year implementation period, and highlighting any limitations or context conditions that would need to be taken into consideration for successful implementation (Table 28).

Monitoring and evaluation are integral components of any management system and annual evaluations of protected area management are recommended. In the development of this management plan, the action areas are relatively specific, simplifying the process of monitoring success of implementation, and providing a mechanism for continual tracking of management activities, through annual review by the Board members and management staff of the Southern Environmental Association.

The management plan should not be considered static, and the annual review should ensure that strategies and activities are still relevant for the changing socio-economic and climatic contexts. Some management strategies may become obsolete, whilst new management activities may need to be included.

Example of Implementation Table: A. Protected Areas Programme									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Sueveillance and Enforcement Sub-Programme			1	2	3	4	5		
Enforce all relevant rules and regulations under the National Parks System Act (1981)									
Ensure all LBCNP staff are aware of the rules and regulations of the protected area									
Effective demarcation of park boundaries to ensure visual recognition of boundaries at all points									
Enforce recreational policies and regulations e.g. ▪ Divers / snorkelers: licensed guide ratio (in collaboration with BTB) ▪ Exclusion of jet-ski and water-ski use within National Park ▪ Mooring buoy use regulations at dive sites and caye									

Table 28: Example of Implementation Table, for integration into Annual Operational / Workplan

It is suggested that a monitoring and evaluation tracking matrix be developed for the activities under the management programme, using the following criteria (Table 29), and following the outline example (Table 30).

Criteria	Score	Criteria Description
Not Started	1	Activities for achieving this result have not been started
Ongoing (-)	2	Whilst project activities are ongoing, implementation is slower than planned, with delays and limitations, and the result has not yet been achieved
Ongoing (+)	3	Activity implementation towards these results is ongoing as planned, but with some limitations, with partial result achievement
Completed / On schedule	4	Activity implementation is on schedule and/or activities have been completed successfully and achieved the relevant result

Table 29: Criteria for tracking implementation

Management evaluation is also achieved by an assessment of management effectiveness. An initial management effectiveness evaluation was conducted in 2006 (Walker and Walker, 2006), to provide a baseline for assessment, and again in 2009 (Walker and Walker, 2010).

Example: Tracking of Management Action Implementation							
Management Actions	**Present Status**	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**	**5th Year**	**Desired Status**
Effective demarcation of park boundaries to ensure visual recognition of boundaries at all points	Boundary marker buoys are far apart, and can be hard for fishermen to see from dories						Boundaries clearly defined by sufficient, highly visible marker buoys
Ensure infrastructure is in place to minimize tourism infractions	Entrance / exit points from cayes, some mooring buoys in place						Information on rules and regulations posted on caye, sufficient mooring buoys in place, dissemination of information on tourism rules and regulations
Ensure all LBCNP staff are aware of the rules and regulations of the protected area, and trained for effective surveillance and enforcement	Training as Fisheries Officers, handling evidence and court procedures. Will be receiving training In tourism enforcement						Ongoing
Ratings: 1: Not started 2: Started, but some limitations to implementation				3. Ongoing but behind schedule 4. On schedule			

Table 30: Example of Implementation Tracking Table Layout

3.7 Financing

A recent financial analysis (part of the development of SEA's Financial Plan (Bravo, 2010)), estimated that the organization presently requires approximately Bz$1,530,000 to cover operational costs for the four important programs:

- Education and Outreach Programme
- Protected Areas Programme
- Science Programme
- Administration Programme

Current Expenses Per Programme	Education and Outreach	Protected Areas		Science	Administration	Total Organization
		Special Enforcement	Site Management			
Variable Expenses	102,176	119,060	173,890	138,834	167,518	701,477
Fixed Expenses						
Personnel	74,662	47,062	241,218	128,125	146,295	637,363
General Overhead	6,575	3,716	21,522	11,571	131,407	174,791
Marketing	15,000	0	0	0	1,471	16,471
Total Fixed Expenses	96,237	50,779	262,740	139,696	279,173	828,625
TOTAL EXPENSES	198,413	169,838	436,630	278,530	446,691	1,530,102

Table 31: Current Expenses per Programme (SEA Financial Plan / P. Bravo, 2010)

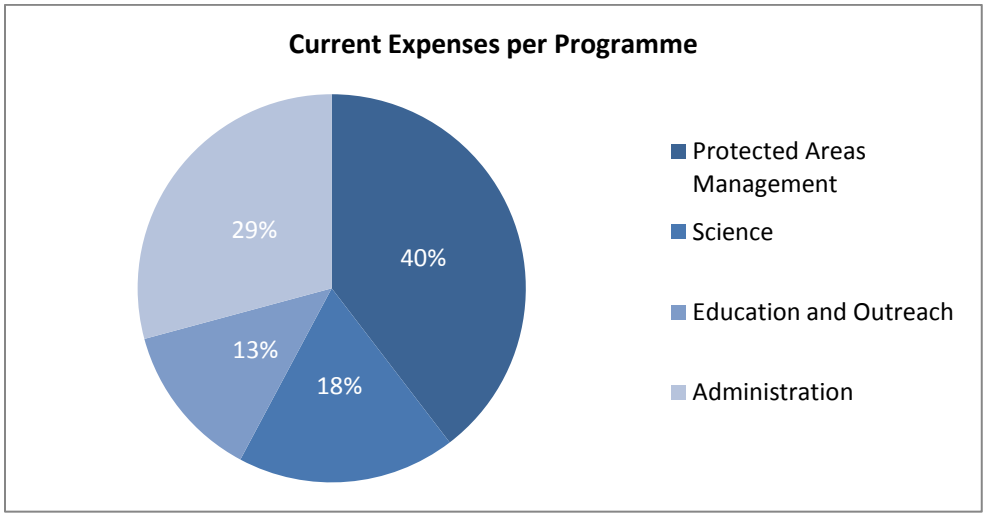


Figure 37: Breakdown of Total Current Expenses per Programme
(SEA Financial Plan / P. Bravo, 2010)

A breakdown of the expenditures shows that 29% goes towards the administration of the organization and the three protected areas, closely followed by Protected Area Management (Figure 37), with the majority of fixed expenses being administrative overheads and personnel

(principally park staff). Currently only the Administration Programme is considered to be fully funded for basic core operations, with the largest funding gap identified in the Science Programme.

Income is primarily from grant funding – foundations, private contributions, US Federal funds and United Nations funding (through COMPACT). In both 2009 and 2010, grant funding was responsible for between 80% and 82.5% of income, with internal revenues (ticket sales/entrance fees, souvenir sales etc.) providing the balance of available funding. Laughing Bird Caye National Park generated Bz$118,739 in internal revenue through ticket sales in 2009 (SEA Financial Plan, 2010), almost 44% of total ticket revenues for SEA.

SEA has already shown that management at system level is more efficient than management at site level, reducing core costs and overlap in areas such as biodiversity monitoring and education and outreach. However, the organization still has a significant gap between financial requirements for core operational costs, and income. The recently completed financial planning process identifies potential financial mechanisms to allow the organization to work towards future financial sustainability in its programme areas. Six strategic recommendations have been highlighted for increased revenue generation in order to close funding gaps and bring the organization to a sustainable financial level.

Recommended Strategies for Financial Sustainability

- Promote endowments
- Improve Internal Financial System
- Reduce variable cost through strategic partnerships
- Increase ticket revenue generation
- Brand name recognition to attract individual donations
- Diversify funding base

Southern Environmental Association Financial Plan P. Bravo, 2010

Whilst the promotion of endowments is considered to be the most effective mechanism for financial sustainability, with the greatest financial impact, it is also one of the more complex mechanisms, requiring intensive efforts in terms of lobbying. It is recognized that a mature relationship with donors, and open, ongoing and transparent communication with potential endowment sponsors are essential for success in establishing an endowment fund (SEA Financial Plan, Bravo, 2010).

The easiest mechanism identified for achieving better financial sustainability is the improvement of the organizational capacity to adequately record, analyze and manage financial resources by improving the internal financial system. Re-organization of the financial system to link expenditures to programme areas will facilitate identification of income and expenditure per programme, increasing SEA's capacity to analyse programme expenditures, and strengthen financial resource management.

Diversifying the funding base is also considered an important strategy for the future, providing greater stability to the funding of the organization. The Financial Plan recommends that SEA

should focus on a small number of large donors – currently, 73% of total revenue is from one donor, supported by a number of small proposals. It is recommended that there be a shift away from small proposals, and a greater concentration on increasing engagement of larger grant-giving organizations, with the development of medium to long term funding partnerships (SEA Financial Plan, Bravo, 2010).

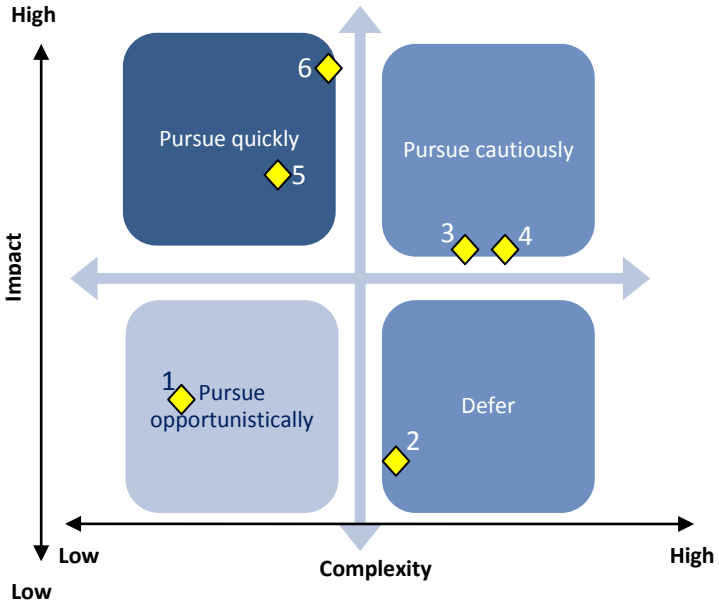
Reducing core costs per programme area through strategic partnerships with national and international organizations is also recommended as a mechanism for increasing financial sustainability, through sharing of costs.

Developing partnerships with UB, or international research / environmental organizations is highlighted in the Financial Plan as a viable mechanism for achieving programme goals whilst minimizing costs. This is particularly targeted at the Science Programme, to increase the level of monitoring and research outputs available on which to base management decisions. The success of this as a mechanism for achieving conservation strategies can be seen with the Conservation International MMAS initiative, and Fragments of Hope.

Past experience, however, has shown that engaging partners is most successful if they are able to be logistically independent to a certain degree - use of volunteer groups such as Earthwatch, for example, may require more staff-time than is economically viable. It is also very important that these initiatives and the results are integrated into the organization, with constant communication, collaboration, skill-transfer and access to results.

This strategy is also viable when reaching out to stakeholders under the Education and Outreach Programme. Partnering with TIDE, for example, for education and outreach activities in Punta Gorda would be of benefit to both organizations, reducing costs per organization when both require a similar output.

A cost-benefit analysis has been conducted for each of the primary strategies highlighted by the Financial Plan, based on fundraising impact and level of complexity to provide strategy prioritisation (Figure 38).



Pursue Quickly

1. Diversify Funding Base
2. Promote endowments

Pursue Opportunistically

3. Improve internal financial system

Pursue Cautiously

4. Increase ticket revenue generation
5. Brand name recognition to attract individual donations

Defer

6. Reduce variable costs through strategic partnerships

Figure 38: Results of Cost / Benefit analysis based on complexity and impacts

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ANNEX 1:

LEGISLATION – LAUGHING BIRD CAYE NATIONAL PARK

CHAPTER 215

NATIONAL PARK RESERVATION (LAUGHING BIRD CAYE) ORDER

ARRANGEMENT OF PARAGRAPHS

SCHEDULE

CAP. 215

94 of 1996.
Ch. 181A.

NATIONAL PARK RESERVATION (LAUGHING BIRD CAYE) ORDER

(Section 3)

[20th July, 1996.]

1. This Order may be cited as the

Short title.

NATIONAL PARK RESERVATION (LAUGHING BIRD CAYE) ORDER.

2. The area 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 8th day of July, 1996.

(HON. EDUARDO JUAN)
Minister of Natural Resources

SCHEDULE
[Paragraph 2]

LAUGHING BIRD CAYE NATIONAL PARK

ALL THAT portion of the Caribbean Sea comprising approximately 10,119 acres in the Stann Creek District, situate within and surrounding the Laughing Bird Caye Faro and being part thereof and being described as follows:

Commencing at a Point 'A' Northeast of Laughing Bird Caye having the scaled U.T.M. coordinates of 375 904 East and 1821 478 North;

thence in a Northwesterly direction to a Point 'B' North-Northwest of Laughing Bird Caye having the scaled U.T.M. coordinates of 374 630 East and 1825 363 North;

thence in a general Westerly direction to a Point 'C' North of Laughing Bird Caye having the scaled U.T.M. coordinates of 372 904 East and 1825 363 North;

thence in a Southwesterly direction to a point 'D' West-Northwest of Laughing Bird Caye and having the scaled U.T.M. coordinates of 368 860 East and 1819 430 North;

thence in a general Southerly direction to a Point 'E' Southwest of Laughing Bird Caye and having the scaled U.T.M. coordinates of 368 860 East and 1815 416 North;

thence in an Easterly direction to a Point 'F' having the scaled U.T.M. coordinates of 371 073 East and 1815 416 North;

thence in a Northeasterly direction to the point of commencement.

ANNEX 2:

INDICATORS – SOUTHERN BELIZE REEF COMPLEX CAP OUTPUTS

Monitoring Framework for the Southern Belize Reef Complex							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Very High Priority							
% decrease in illegal fishing	**Targets** Commercial / Recreational Species Spawning Aggregations **Threats** Fishing pressure Poor fishing practices	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	Proportion of prosecutions to capture: Capture logs vs. Prosecution NB: Suggest Name and Shame digital log per infraction as a mechanism to reduce infractions	**Priority** Very High **Status** Ongoing	Quarterly / Annual summary	All MPAs	PA managers Fisheries Dept
Biomass of commercial fish	Commercial / Recreational Species	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	LAMP protocol / AGGRA /MBRS	**Priority** Very High **Status** Ongoing	Four times a year (February, May, Sept., Dec.)	Inside and outside each protected area	Ranger, biologist , community researchers. SEA, Fisheries Dept

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Very High Priority (continued)							
Water quality	**Targets** Mangroves Coastal Lagoon and Estuaries Seagrass Coral Reefs **Threats** Coastal / caye development Aquaculture Agricultural runoff Climate change Oil spills	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected. ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	Water parameters Including: Total dissolved oxygen Nutrients (PO4) – total, inorganic, organic Nitrogen (NO4) - total, inorganic, organic Phytoplankton – remote sensing – chlorophyll spectrum in the water Mangroves: Turbidity, DO2, nitrates, phosphates (3), chlorophyll, E. coli, pesticides Already partly underway: SEA partnerships (Sean Ledwin, etc.) , need to define parameters and methodologies Coral: Water sampling Dissolved oxygen, Salinity, Turbidity, pH, Chlorophyll Coral: Water temperature Data loggers	**Priority** Very High **Status** Some ongoing Some planned	General: First flux rain fall, Dry season Mangroves: Twice yearly Coral: Weekly, and in times of flooding (extremes) Temperature: Daily	Seagrass: Current monitoring sites – 30 sites within PL Monitoring in other highlighted lagoon / estuary areas Mangroves: Pelican Cayes, Gladden Spit (re. Rendezvous), Hopkins / Sittee River coast, Blueground Range, Saps, South of Mango Creek Coral / Temperature: 2 in each marine reserve	SEA Fisheries Dept DOE CZMAI ?

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Very High Priority (continued)							
Conch density	**Targets** Commercial / Recreational Species **Threats** Poor fishing practices Fishing pressure	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	Modified LAMP protocol	**Priority** Very High **Status** Ongoing	Four times a year - February, May, Sept., December	Inside and outside each protected area	Ranger, biologist , community researchers. SEA, Fisheries Dept
Extent of coastal vegetation on Placencia Lagoon	**Targets** Coastal Lagoons and Estuaries **Threats** Coastal / cay development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Needs baseline Presence absence mapped from aerial photos / satellite imagery	**Priority** Very High **Status** Planned	Every two years	Placencia Lagoon (and other coastal lagoons)	SEA
Average Catch per man-hour (Catch per unit effort)	Commercial / Recreational Species	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	Monitoring of landings, direct interviews with fishermen particularly those that are focused on a single fishery , direct counts of fish lobster, conch catch. Fisheries CPUE of Mutton and Yellow Tail Snapper for SPAG site monitoring	**Priority** Very High **Status** Planned	Monthly (TBD for Mutton and YT Snapper)	Everywhere inside and outside marine reserves. For SPAG sites, Gladden Spit and Sapodilla Cayes	SEA; Fisheries Dept, UB/ERI

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority							
% live coral cover	**Targets** Coral Reef Communities **Threats** Coastal / caye development Agricultural runoff Aquaculture Oil spills Poor fishing practices Fishing pressure	▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected. ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	MBRS Methodology Recent and old	**Priority** High **Status** Ongoing	Annual	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA SWCMR Fisheries Dept
% seagrass cover	**Targets** Coastal Lagoon and Estuaries Seagrass **Threats**	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application	Seagrass monitoring protocol:% cover of sea grass in shallow marine areas, coastal lagoons and estuaries Baseline: Accurate mapping of seagrass extent through satellite imagery and groundtruthing	**Priority** High **Status** Ongoing	Biannual	Placencia Lagoon (and other coastal lagoons) Marine Seagrass	SEA, SeagrassNet

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
Biomass of adult fish	**Targets** Coral Reef Communities Commercial / Recreational Species Spawning Aggregations **Threats** Poor fishing practices Fishing pressure	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	LAMP protocol / AGGRA / Modified MBRS protocol	**Priority** High **Status** Ongoing	Annual	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA Fisheries Dept
Diadema density	**Targets** Coral Reef Communities **Threats**	▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	Modified MBRS protocol	**Priority** High **Status** Ongoing	Annual	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
% recent coral mortality	**Targets** Coral Reef Communities **Threats** Coastal / caye development Agricultural runoff Aquaculture Oil spills Poor fishing practices Fishing pressure	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application ▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected. ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	MBRS methodology / AGGRA / Bar drop	**Priority** High **Status** Ongoing	Annual	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA Fisheries Dept.
% increase in fish abundance from designated baseline	**Targets** Spawning Aggregation Sites **Threats** Poor fishing practices Fishing pressure Visitor impacts	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	MBRS Spawning Aggregation Site Monitoring Protocols - Focused on Cubera*, Dog , Mutton* and Yellow-tail* Snapper, Nassau Grouper, Jack (*revision of protocol for these species)	**Priority** High **Status** Ongoing	Annually, May to October. Six days a month based on lunar phase and species	Gladden Spit and Sapodilla Cayes	SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
Number of petroleum associated activities that comply with international and national environmental standards	**Targets** Littoral Forest Coastal Lagoons and Estuaries Seagrass Coral Reef Communities **Threats** Oil Spill Oil Exploration and Drilling	▪ By 2010, all petroleum-associated activities -transportation, exploration and extraction - within SBRC will comply with international and national environmental regulations and safety standards	Annual assessment of petroleum associated activities and whether they comply with international and national environmental regulations	**Priority** High **Status** Planned	Annual assessment	SBRC	SEA; DoE
Number of large, adult fish species at SPAG sites	**Targets** Spawning Aggregation Sites **Threats** Poor fishing practices Fishing pressure Visitor impacts	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	MBRS Spawning Aggregation Site Monitoring Protocols - Focused on Cubera*, Dog , Mutton* and Yellow-tail* Snapper, Nassau Grouper, Jack (*revision of protocol for these species)	**Priority** High **Status** Ongoing	Monthly: 6 days based on lunar phase and species	Gladden Spit and Sapodilla Cayes	SEA; Fisheries Dept, UB/ERI

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
Number of petroleum associated activities that comply with international and national environmental standards	**Targets** Littoral Forest Coastal Lagoons and Estuaries Seagrass Coral Reef Communities **Threats** Oil Spill Oil Exploration and Drilling	▪ By 2010, all petroleum-associated activities -transportation, exploration and extraction - within SBRC will comply with international and national environmental regulations and safety standards	Annual assessment of petroleum associated activities and whether they comply with international and national environmental regulations	**Priority** High **Status** Planned	Annual assessment	SBRC	SEA; DoE
Parrotfish Density	**Targets** Coral Reef Communities **Threats** Poor fishing practices	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	Modified MBRS protocol / LAMP/ AGGRA	**Priority** High **Status** Ongoing	Annual	SCMR 3 NTZ etc.	SEA
% agricultural industry that has changed behaviour since public awareness	**Targets** Coastal Lagoons and Estuaries Seagrass **Threats** Agricultural runoff	▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application	Pre and post survey, working with terrestrial partners Assumption: Assume they are telling the truth	**Priority** High **Status** Planned	Every Two Years	Southern Coastal Plain farming sector	Terrestrial focused partners

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
% area in natural condition	**Targets** Littoral Forest / Sandy Beaches **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Aerial photography – interpretation. Field reports / inspections (site level) from ongoing MPA patrols. Done at same time as for mangrove monitoring	**Priority** High **Status** Planned	Annually	SBRC...all coastal areas and cayes	SEA
% sampling sites where agricultural contamination levels are lower than baseline (TBD)	**Targets** Coastal Lagoons and Estuaries Mangroves Sea grass Coral Reef Communities Commercial and Recreational Species Spawning Aggregations Wide Ranging Large Marine Vertebrates **Threats** Agricultural runoff	▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application	Tissue sampling of mangrove oysters / sediment feeders (crabs species - Calinectis) for contaminants (Wriscs?). Sediment sampling. Assumption is that there is a baseline available – WWF – that can be shared WWF; MBRS	**Priority** High **Status** Planned	Once every two years	Sampling sites along two transects from shore to east Monkey River - Sapodilla Cayes Sittee River – east cayes	SEA, UB, WWF

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
% vertical evasion in relation to visitor activities	**Targets** Spawning Aggregation Sites **Threats** Visitor	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	Video monitoring in relation to boat/diver activities – methodologies to be developed	**Priority** High **Status** Planned	Annual during March - June	Gladden Spit	SEA
Abundance of juvenile fish	**Targets** Coastal Lagoons and Estuaries Commercial / Recreational Species Mangroves Spawning Aggregations **Threats** Coastal / caye development Fishing pressure	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	3 seine net trawls per site, identification to general type (not species)..photographs for more accurate species information. MBRS (need to re-visit to cover relevant species: snappers, grouper, grunts, etc. Recruit data sheet. AGRRA – ditto	**Priority** High **Status** Planned	Twice a year – once during wet season, once during dry season, time with spawning cycle	Coastal: Seine Bight area? Mango Creek area? West of airstrip, Placencia Lagoon Drunken Caye area, immediate top of PL, Monkey River area. Specific mangrove nursery sites Cayes: False Caye, Frank's Caye (Saps), Twin Cayes + Blueground Range, Pelican Cayes, Tobacco Range, Specific mangrove nursery sites	SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
Abundance of juvenile fish (nursery functionality)	**Targets** Commercial / recreational species Spawning Aggregations **Threats** Coastal / caye development Fishing pressure Poor fishing practices	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	3 seine net trawls per site, identification to general type (not species)..photographs for more accurate species information. MBRS (need to re-visit to cover relevant species: snappers, grouper, grunts, etc. Recruit data sheet. AGRRA – ditto No current status / baseline	**Priority** High **Status** Planned	Twice a year – once during wet season, once during dry season, time with spawning cycle	Coastal: Seine Bight area? Mango Creek area? West of airstrip, Placencia Lagoon (and mouth), Drunken Caye area, immediate top of PL, Monkey River Specific mangrove nursery sites Cayes: False Caye, Frank's Caye (Saps), Twin Cayes + Blueground Range, Pelican Cayes, Tobacco Range	SEA
Abundance of turtle nests	**Targets** Littoral Forest / Sandy Beaches Wide Ranging Large Marine Vertebrates **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Nest & crawl counts, Needs a big public awareness programme in tandem with monitoring, to bring in extensive public reporting, guidelines for best practices, etc. Involve interested citizens	**Priority** High **Status** Planned	Annual, May-October	All known nesting beaches	Fisheries SEA WCS Wildlife Trust GPWS Management Team Tour guides

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
High Priority (continued)							
Total area of littoral forest / sandy beaches	**Targets** Littoral Forest / Sandy Beaches **Threats** Coastal / Caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Aerial photography – interpretation. Field reports / inspections (site level) from ongoing MPA patrols. Done at same time as for mangrove monitoring	**Priority** High **Status** Planned	Annual	SBRC – entire area All coastal land and cayes Overflight with ground truthing. Quarterly meeting/ Fisheries reports. Concerned citizens	MPA staff SEA Fisheries FD DOE Geology / Petroleum
Total area of mangrove ecosystems	**Targets** Mangroves **Threats** Coastal / Caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Aerial photography – interpretation. Spectral analysis of satellite mapping – if done correctly Field reports / inspections (site level) from ongoing MPA patrols	**Priority** High **Status** Planned	Annually Quarterly meeting / reports from patrols.	SBRC – entire area All coastal land and cayes	SEA
Medium Priority							
Abundance per shark species (including whale sharks)	**Targets** Wide Ranging Large Marine Vertebrates **Threats** Poor fishing practices Fishing pressure		Long line, drum line and set line surveys. For whale sharks - Photo ID, Ecocean. Average number of whale shark sightings at Gladden Spit per unit effort on key days	**Priority** Medium **Status** Ongoing	Every five years (next survey in 2010)	Throughout SBRC	WCS

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Medium Priority							
Number of licensed commercial fishers commonly found in and out MPA´s	**Targets** Commercial / Recreational Species **Threats** Fishing pressure Poor fishing practices	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	From rangers reports / logs	**Priority** Medium **Status** Ongoing	Monthly	In every marine reserve in SBRC;	Rangers; Fisheries Dept
% coastal / caye developments that meet best practices standards	**Targets** Littoral Forest / Sandy Beach Mangrove **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2019 restore 20% of the current degraded areas in the littoral forest & sandy beaches within the SBRC ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	***Aquaculture Industry:*** Data from independent certifier (SEA?) under WWF, Wegmans, Whole foods. See WWF indicators...can we use these? ***Residential / Hotel best practices standards:*** Which standards? e.g World Heritage Alliance or sustainable tourism, WCS Best Practices guidelines, Rainforest Alliance, BEST, URI (as developed for Quintana Roo) Ref. clearance of vegetation, use of native species in landscaping, etc.	**Priority** Medium **Status** Ongoing	Once every three years	Office-based plus site visits with a structured assessment tool. Coastal and caye	SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Medium Priority							
% coastal / caye developments that meet best practices standards (continued)	**Targets** Littoral Forest / Sandy Beach Mangrove **Threats** Coastal / caye development	By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2019 restore 20% of the current degraded areas in the littoral forest & sandy beaches within the SBRC ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	% of lagoon-side properties with adequate solid waste and water treatment. Door to door survey of lagoon-side properties (questionnaire)...could be incorporated into socio-economic survey. Adequate = septic tank / soak away meet standards Grey water disposal system...or better. WCS? URI / Quintana Roo. Coral / ICRAN Assumption that the system is working well	**Priority** Medium **Status** Ongoing	Once every three years	Office-based plus site visits with a structured assessment tool. Coastal and caye	SEA
Average Catch per Year per boat - Recreational (Bonefish, permit)	**Targets** Commercial / Recreational Species **Threats** Poor fishing practices Fishing pressure	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	Direct reports collected from fishing guides.	**Priority** Medium **Status** Planned	Monthly	In every marine reserve in SBRC	Biologists; SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Medium Priority							
% SBRC MPAs considered to have >75% effective management	**Targets** Mangrove Coastal Lagoons and Estuaries Coral Reef Communities Commercial / Recreational Species Spawning Aggregations Wide Ranging Large Marine Vertebrates **Threats** Poor fishing practices Fishing pressure	▪ By 2013, all marine protected areas within SBRC will be able to obtain 50% of their annual budget through a secured diversified funding base (user fees, government, endowment, concessions, and environmental tax) ▪ By 2013, the management agencies of the SBRC will have the legal framework and institutional capacity to undertake effective management of marine resources	NPAPSP assessment of management effectiveness MBRS protocol	**Priority** Medium **Status** Planned	Once every two years	All MPAs of the SBRC	SEA, Fisheries Dept
% survey sites that show an increased Integrated Healthy Reef Index	**Targets** Coral Reef Communities **Threats** Coastal / caye development Agricultural runoff Aquaculture Oil spills Poor fishing practices Fishing pressure	▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected.	Evaluation of the IRHI Index (protocol includes ten indicators)	**Priority** Medium **Status** Planned	Every two years	SCMR 3 NTZ 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA Healthy Reefs

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Medium Priority							
Abundance and diversity of resident and migratory birds	**Targets** Littoral Forest / Sandy Beaches **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Point counts and transects Nest counts e.g. for osprey	**Priority** Medium **Status** Planned	Twice yearly: fall & spring migration	Saps: Hunting Caye, Little Water Caye, Pelican Cayes, Bird Caye, Blueground Range, Hopkins, Sittee Point, Placencia	SEA, community participants, birders, BAS, PfB, FD, UB, Lee Jones to guide process
Number of coral recruits	**Targets** Coral Reef Communities Commercial / Recreational Species **Threats** Poor fishing practices Climate change Fishing pressure	▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected. ▪ By 2019, the condition and extent of coral reef communities will be improved by 10% , through development and implementation of a coral reef restoration programme and associated public awareness activities	AGGRA / modified MBRS methodology	**Priority** Medium **Status** Planned	Annual	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA biologists SWCMR – Fisheries Dept
% degraded Littoral Forest /Sandy Beach restored	**Targets** Littoral Forest / Sandy Beaches Wide Ranging Marine Vertebrates (Marine Turtles) **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Site visits, mapping	**Priority** Medium **Status** Not Planned	Annual	At all site-restoration project sites	SEA FD Fisheries Developers

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Low Priority							
% whale sharks showing site fidelity at Gladden Spit across the years	**Targets** Wide Ranging Large Marine Vertebrates **Threats** Visitor Impacts		Photo ID; Acoustic Tagging	**Priority** Low **Status** Ongoing	Annual during March - June (to October)	Gladden Spit	SEA, WCS, PTGA
Number of shark species (diversity)	**Targets** Wide Ranging Large Marine Vertebrates Commercial / Recreational Species **Threats** Poor fishing practices Fishing pressure	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	Long line, drum line and set line surveys	**Priority** Low **Status** Ongoing	Every five years (next survey in 2010)	Throughout SBRC	WCS
% increase in abundance of goliath grouper in coastal lagoons from baseline	**Targets** Coastal Lagoons and Estuaries **Threats** Poor fishing practices Fishing pressure	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2019, populations of commercial / rec. species will be increased by 20%, based on assessment of current stocks and effective management	Baseline: 2006 / 2007 Placencia Lagoon / Sapodilla Lagoon Using R. Graham's protocols and sample sites	**Priority** Low **Status** Ongoing	Every five years	Placencia Lagoon Sapodilla Lagoon	WCS, SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Low Priority							
Diversity of species at SPAG sites	**Targets** Spawning Aggregation Sites Commercial / Recreation Species **Threats** Poor fishing practices Fishing pressure	▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management ▪ By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices	MBRS Spawning Aggregation Site Monitoring Protocols - Focused on Cubera*, Dog , Mutton* and Yellow-tail* Snapper, Nassau Grouper, Jack (*revision of protocol for these species)	**Priority** Low **Status** Ongoing	Annual May to October	All targeted locations	SEA Fisheries Dept
% survey sites showing coral reef bleaching	**Targets** Coral Reef Communities **Threats** Climate Change	▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected.	Assumption: Baseline data is available from WWF that can be shared	**Priority** Low **Status** Planned	2011 and 2015	CMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA, WWF
% resilient reefs identified in 2006 WWF/TNC rapid reef assessment that are included in no take zones	Coral Reef Communities	▪ By 2015 at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected.	GIS analysis, WWF mapping info	**Priority** Low **Status** Planned	2011 and 2015	SCMR 3 NTZ (no take zone), 3 GUZ (general use zone), 3 out: GSMR 2 ntz, 3, guz, 3 outside; LBC 2 in 2 outside; SWCMR 3 ntz, 3 guz, 3 outside	SEA, TNC, WWF

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Low Priority (continued)							
Average travel distance recorded per wide ranging sharks and turtles	**Targets** Wide Ranging Large Marine Vertebrates **Threats** Poor fishing practices		Data from WCS Acoustic tagging programme (Rachel Graham)	**Priority** Low **Status** Planned ongoing	Ongoing for whale sharks	WCS Acoustic tagging programme sites	WCS
Number of feeding areas/source for whale sharks	**Targets** Wide Ranging Large Marine Vertebrates **Threats**		Maintain updated records of known feeding locations for whale sharks. Observation, field reports (biologists, tourism sector, MPA staff). Need protocol for reporting	**Priority** Low **Status** Planned		SBRC	SEA WCS Other stakeholders
% epiphytic cover of seagrass	**Targets** Coastal Lagoon and Estuaries Seagrass **Threats** Agricultural runoff	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application	% algal and other epiphyte cover of seagrass See MBRS protocol Underwater camera shots of half meter square	**Priority** Low **Status** Planned	4 times a year	Placencia Lagoon Two sites – Bugle Caye and off Placencia coastline. Two sites in areas of concern – Pelican Cayes, river mouth (Monkey River / Sittee River)	SEA

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Low Priority (continued)							
Number of manatee in Placencia Lagoon	**Targets** Coastal Lagoons and Estuaries **Threats** Coastal / Caye Development Visitor Impacts	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Aerial and boat surveys. Survey by overflight (Lighthawk?), though turbid conditions make it hard to get an accurate count	**Priority** Low **Status** Planned	Annual	Coastal areas including Placencia Lagoon and other coastal lagoons	SEA
Number of warnings per patrolling unit effort (per hour of patrol) in newly defined no-take zones	**Targets** Commercial / Recreational Species **Threats** Poor fishing practices Fishing pressure	▪ By 2013 illegal fishing activities within the Southern Belize Reef Complex will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level. ▪ By 2019, populations of commercial / recreational species will be increased by 20%, based on assessment of current stocks and effective management	Ranger reports; In new no-take zones	**Priority** Low **Status** Planned	Monthly	Reports from throughout the SBRC	Rangers; Fisheries Dept.

Monitoring Framework for the Southern Belize Reef Complex (continued)							
Indicators	Conservation Targets / Threats	Objectives	Methods	Priority / Status	Frequency and Timing	Location	Who monitors
Low Priority (continued)							
Seagrass density (site level)	**Targets** Coastal Lagoon and Estuaries Seagrass **Threats** Coastal / caye development Agricultural runoff	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place ▪ By 2013, the level of agricultural contamination impacting the SBRC will be reduced from the current 2008 levels to x (TBD by other organizations - WWF) through collaboration with other organizations that influence agro-chemical use and application	% cover sea grass + biomass (0.5m square quadrat) for coastal lagoons and estuaries. Ongoing at 2 locations but needs to be expanded SeagrassNet protocol for % cover and biomass	**Priority** Low **Status** Planned	4 times a year Two sites – Bugle Caye and off Placencia coastline. Two sites in areas of concern – Pelican Cayes, river mouth (Monkey River / Sittee River)	Placencia Lagoon Two sites – Bugle Caye and off Placencia coastline. Two sites in areas of concern – Pelican Cayes, river mouth (Monkey River / Sittee River)	SEA
Level of fragmentation within littoral forest system	**Targets** Littoral Forest / Sandy Beaches **Threats** Coastal / caye development	▪ By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet EIA ECP and best practices standards, with independent monitoring in place	Aerial photography – interpretation. Field reports / inspections (site level) from ongoing MPA patrols. Done at same time as for mangrove monitoring	**Priority** Low **Status** Not Planned	Annual (costly, as includes cayes as well) Quarterly meeting / reports.	SBRC – entire area...all coastal land and cayes	SEA

ANNEX 3:

STRATEGIES – SOUTHERN BELIZE REEF COMPLEX CAP OUTPUTS

Strategies - Southern Belize Reef Complex	
Objective 1	**By 2013, illegal fishing activities within the SBRC will be reduced to a level comparable with the Gladden Spit Marine Reserve's 2008 level.**
Strategic action	Develop and implement public awareness programme
Strategic action	Implement / enforce policies & regulations
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Strategic action	Create an alternative livelihood program for fisher folk within the SBRC
Objective 2	**By 2013, 15% of current and 75% of future coastal developments impacting the SBRC will meet Environmental Impact Assessment, Environmental Compliance Plan and best practices standards, with independent monitoring in place**
Strategic action	Develop or adopt best practices guidelines and certification programmes relating to coastal developments, and engage relevant stakeholders for implementation
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Implement / enforce policies & regulations
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Strategic action	Develop and implement public awareness programme
Objective 3	**By 2013, all marine protected areas within SBRC will be able to obtain 50% of their annual budget through a secured diversified funding base - user fees, government, endowment, concessions, and environmental tax**
Strategic action	Develop and implement financial sustainability mechanisms
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Develop and implement public awareness programme

Objective 4	**By 2013, the level of agricultural contamination impacting the SBRC will be reduced from 2008 levels, through collaboration with other organizations and agencies that influence agro-chemical use and application**
Strategic action	Ensure support of initiatives towards reducing agrochemical contamination of runoff into SBRC
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Strategic action	Develop and implement public awareness programme
Strategic action	Implement / enforce policies & regulations
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Develop or adopt best practices guidelines and certification programmes relating to coastal developments, and engage relevant stakeholders for implementation
Objective 5	**By 2013, the management agencies of the SBRC will have the legal framework and institutional capacity to undertake effective management of marine resources**
Strategic action	Review and enhance administrative structure of co-management institution
Strategic action	Engaging APAMO/NPAC in completing the development of the legal co-management framework and standard co-management agreement.
Strategic action	Development of mechanisms for integrating local participation and capacity building of local expertise
Strategic action	Implement / enforce policies & regulations
Strategic action	Develop and implement financial sustainability mechanisms
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Objective 6	**By 2015, at least 50% of coral reefs and mangroves resilient to climate change located within the SBRC will be effectively protected.**
Strategic action	Develop and implement coral reef and mangrove restoration programmes
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Identify and protect nursery grounds (for all marine species) from extraction / damage
Strategic action	Implement / enforce policies & regulations
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Develop and implement public awareness programme
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area

Objective 7	**By 2019, 20% of the current area of degraded littoral forest & sandy beaches within the SBRC will be restored**
Strategic action	Implement a restoration process for littoral forest and beach communities
Strategic action	Identify and protect nursery grounds (for all marine species) from extraction / damage
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Develop or adopt best practices guidelines and certification programmes relating to coastal developments, and engage relevant stakeholders for implementation
Strategic action	Implement / enforce policies & regulations
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Develop and implement public awareness programme
Objective 8	**By 2019, populations of commercial / recreational species are increased by 20% from current stock assessments as a result of effective management**
Strategic action	Conduct an assessment of the fish stock within the SBRC
Strategic action	Implement / enforce policies & regulations
Strategic action	Identify and protect nursery grounds (for all marine species) from extraction / damage
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Create an alternative livelihood program for fisher folk within the SBRC
Strategic action	Develop and implement coral reef and mangrove restoration programmes
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Strategic action	Develop and implement public awareness programme
Objective 9	**By 2019, populations of fish at Spawning Aggregation Sites will be stabilized & sustained within the SBRC through good resource-use practices**
Strategic action	Implement / enforce policies & regulations
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Identify and protect nursery grounds (for all marine species) from extraction / damage
Strategic action	Create an alternative livelihood program for fisher folk within the SBRC
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Strategic action	Develop and implement public awareness programme

Objective 10	**By 2019, the condition and extent of coral reef communities will be improved by 10%, through development and implementation of a coral reef restoration programme and associated public awareness activities**
Strategic action	Implement / enforce policies & regulations
Strategic action	Identify and protect nursery grounds (for all marine species) from extraction / damage
Strategic action	Develop and implement public awareness programme
Strategic action	Develop and implement coral reef and mangrove restoration programmes
Strategic action	Create an alternative livelihood program for fisher folk within the SBRC
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Strategic action	Production of Annual state of the park / SBRC reports including monitoring / research output for SBRC area
Objective 11	**By 2014, all marine protected areas within the Southern Belize Reef Complex will have at least 20% of their area designated as no-take**
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Develop and implement public awareness programme
Strategic action	Implement / enforce policies & regulations
Strategic action	Implement an effective, standardized monitoring and data management programme for the SBRC area
Objective 12	**By 2010, all petroleum-associated activities -transportation, exploration and extraction - within SBRC will comply with international and national environmental regulations and safety standards**
Strategic action	Lobby for creation / adoption of navigation and oil exploration / extraction standards as needed, and enforce all such regulations
Strategic action	Develop or adopt best practices guidelines and certification programmes relating to coastal developments, and engage relevant stakeholders for implementation
Strategic action	Implement / enforce policies & regulations
Strategic action	Lobby CZMAI, local and national Gov. Representatives and agencies for policy and zoning for the SBRC area
Strategic action	Develop and implement public awareness programme
Strategic action	Create and adopt Contingency Plan for oil spills within the SBRC

ANNEX 4:

Species Lists

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Acanthuridae	*Acanthurus bahianus*	Ocean surgeonfish	
	Acanthurus chirurgicus	Doctorfish	
	Acanthurus coerulus	Blue tang	
Albulidae	*Albula vlupes*	Bonefish	
Apogonidae	*Apogon bintatus*	Barred Cardinalfish	
	Apogon lachneri	Whitestar cardinalfish	
	Apogon maculatus	Flamefish	
	Apogon townsendi	Twospot cardinalfish	
	Apogon robinsi	Roughlip Cardinalfish	
	Apogon stellatus	Conchfish	
Aulostomidae	*Aulostomus maculatus*	Trumpetfish	
Balistidae	*Aluterus schoepfi*	Orange filefish	
	Balistes vetula	Queen triggerfish	VU
	Cantherdermis sufflamen	Ocean triggerfish	
	Cantherhines macrocerus	Whitespotted filefish	
	Cantherhines pullus	Orangespotted filefish	
	Melichthys niger	Black durgon	
	Monocanthus tuckeri	Slender filefish	
	Xanthichthys ringens	Sargassum triggerfish	
Batrachoides	*Batrachoides gilberti*	Large eye toadfish	
	Sanopus barbatus	Bearded toadfish	
	Sanopus greenfieldorum	Whitelined toadfish	VU
	Sanopus splendidus	Splendid toadfish	VU
Belonidae	*Ablennes hiannes*	Flat needlefish	
	Strongylura notata	Redfin needlefish	
	Tylosurus crocodilus	Houndfish	
Bothidae	*Bothus lunatus*	Peacock flounder	
Carangidae	*Caranx batholomaei*	Yellow jack	
	Caranx crysos	Blue runner	
	Caranx hippos	Crevalle jack	
	Caranx latus	Horse-eye jack	
	Caranx ruber	Bar jack	
	Decapterus macarellus	Mackerel scad	
	Elagatis bipinnulata	Rainbow runner	
	Trachinotus falcatus	Permit	
	Trachinotus goodei	Palometa	

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Carcharhinidae	*Carcharhinus leucas*	Bull shark	
	Carcharhinus perezi	Caribbean Reef Shark	
	Carcharhinus falciformis	Silky shark	
	Negaprion brevirostris	Lemon shark	
Centropomidae	*Centropomus undecimalis*	Common snook	
Chaenopsidae	*Emblemariopsis dianae*	Orangeflag blenny	
Chaetodontidae	*Chaetodon aculeatus*	Longsnout butterflyfish	
	Chaetodon capistratus	Foureye butterflyfish	
	Chaetodon ocellatus	Spotfin butterflyfish	
	Chaetodon sedentarius	Reef butterflyfish	
	Chaetodon striatus	Banded butterflyfish	
Cirrhitidae	*Amblycirrhitus pinos*	Red-spotted hawkfish	
Clinidae	*Acanthemblemaria spinosa*	Spinyhead blenny	
	Chaenopsis ocellata	Bluethroat pike blenny	
	Emblemaria pandionts	Sailfin blenny	
	Lucayablennius zingaro	Arrow blenny	
	Malacoctenus boehlkei	Diamond blenny	
	Malacoctenus macropus	Rosy blenny	
	Malacoctenus triangulatus	Saddled blenny	
	Ophioblennius atlanticus	Redlip blenny	
Congridae	*Heteroconger halis*	Garden eel	
Dasyatidae	*Dasyatis americana*	Southern stingray	
	Dasyatis gutatta	Longnose stingray	
	Himantura schmardae	Chupare stingray	
Diodontidae	*Diodon holocanthus*	Balloonfish	
	Diodon hystrix	Porcupinefish	
Echeneidae	*Echeneis neucratoides**	Whitefin sharksucker	
Elopidae	*Megalops atlanticus*	Tarpon	
Ephippidae	*Chaetodipterus faber*	Atlantic spadefish	
Exocoetidae	*Hirundichthys speculiger*	Mirrorwing flyingfish	
Gerreidae	*Eucinostomus lefroyi*	Mottled mojarra	
	Gerres cinereus	Yellowfin mojarra	
Ginglymostomidae	*Ginglymostoma cirratum*	Nurse shark	
Gobiidae	*Ctenogobius saepapellans*	Dash goby	
	Coryphopterus dicrus	Colon goby	
	Coryphopterus eidolon	Pallid goby	
	Coryphopterus galucofraenum	Bridled goby	
	Coryphopterus lipernes	Peppermint goby	
	Gnatholepsis thompsoni	Goldspot goby	

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Gobiidae	*Gobionellus saepepallens*	Dash goby	
	Gobiosom evelynae	Sharknose goby	
	Gobiosoma genie	Cleaning goby	
	Cleaning goby	Tellowline goby	
	Yellowline goby	Barsnout goby	
	Barsnout goby	Broadstripe goby	
	Lophogobius cyprinoides	Crested goby	
Gramistinidae	*Gramma loreto*	Fairy basslet	
	Gramma melacara	Blackcap basslet	
	Liopropoma rubre	Peppermint basslet	
Haemulidae	*Anisotremus surinamensis*	Black margate	
	Anisotremus virginicus	Porkfish	
	Haemulon album	White margate	
	Haemulon aurolineatum	Tomtate	
	Haemulon carbonarium	Caesar grunt	
	Haemulon chrysargyreum	Smallmouth grunt	
	Haemulon flavolineatum	French grunt	
	Haemulon macrostomum	Spanish grunt	
	Haemulon melanurum	Cottonwick	
	Haemulon parra	Sailor's choice	
	Haemulon plumieri	White grunt	
	Haemulon sciurus	Bluestriped grunt	
	Haemulon striatum	Striped grunt	
Hemiramphidae	*Hemiramphus brasiliensis*	Ballyhoo	
Holocentridae	*Holocentrus adscensionis*	Squirrelfish	
	Holocentrus rufus	Longspine squirrelfish	
	Sargocentron coruscum	Reef squirrelfish	
	Sargocentron vexillarium	Dusky squirrelfish	
	Neoniphon marianus	Longjaw squirrelfish	
	Priacanthus arenatus	Bigeye	
Inermiidae	*Emmelichthyops atlanticus*	Bonnetmouth	
	Inermia vittata	Boga	
Kyphosidae	*Kyphosus sectatrix*	Bermuda chub	
Labridae	*Bodianus pulchellus*	Spotfin hogfish	
	Bodianus rufus	Spanish hogfish	
	Clepticus parrae	Creole wrasse	
	Doratonatus megalepis	Dwarf wrasse	
	Halichoeres bivittatus	Slippery dick	
	Halichoeres cyanocephalus	Yellowcheek wrasse	

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Labridae	*Halichoeres garnoti*	Yellowhead wrasse	
	Halichoeres maculipinna	Clown wrasse	
	Halichoeres radiatus	Puddingwife	
	Hemipteronotus novacula	Pearly razorfish	
	Lachnolaimus maximus	Hogfish	
	Thalassoma bifasciatum	Bluehead wrasse	
	Xyrichtys martinicensis	Rosy razorfish	VU
	Xyrichtys spendens	Green razorfish	
Labridomidae	*Malacoctenus triangulatus*	Saddled blenny	
Lutjanidae	*Lutjanus analis*	Mutton snapper	
	Lutjanus apodus	Schoolmaster	
	Lutjanus cyanopterus	Cubera snapper	VU
	Lutjanus griseus	Grey Snapper	
	Lutjanus jocu	Dog snapper	VU
	Lutjanus mahogani	Mahogany snapper	
	Lutjanus synagris	Lane Snapper	
	Ocyurus chrysurus	Yellowtail snapper	
Malacanthidae	*Malacanthus plumieri*	Sand tilefish	
Mobulidae	*Manta birostris*	Atlantic manta	
	Mobula hypostoma	Devil ray	
Monacanthidae	*Cantherhines macrocerus*	Whitespotted filefish	
	Aluterus scriptus	Scrawled filefish	
Muglidae	*Mugil curema*	White mullet	
Mullidae	*Mulloidiochthys martinicus*	Yellow goatfish	
	Pseudopeneus maculatus	Spotted goatfish	
Muraenidae	*Enchelycore carychroa*	Chestnut moray	
	Gymnothorax funebris	Green moray	
	Gymnothorax miliaris	Goldentail moray	
	Gymnothorax moringa	Spotted moray	
	Gymnothorax vicinus	Purplemouth moray	
Myliobatidae	*Aetobatus narinari*	Spotted eagle ray	
Ophicthidae	*Myrichthys breviceps*	Sharptail eel	
Opisthognatidae	*Opistognathus aurifrons*	Yellowhead jawfish	
	Opistognathus macrognathus	Banded jawfish	
	Opistognathus whitehurstii	Dusky jawfish	
Ostraciidae	*Acanthostracion polygonia*	Honeycomb cowfish	
	Acanthostracion quadricornis	Scrawled cowfish	
	Lactophrys bicaudalis	Spotted trunkfish	
	Lactophrys trigonus	Buffalo trunkfish	

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Ostraciidae	*Lactophrys triqueter*	Smooth trunkfish	
Pempheridae	*Pempheris schomburgki*	Glassy sweeper	
Pomacanthidae	*Holacanthus ciliaris*	Queen angelfish	
	Holacanthus tricolor	Rock beauty	
	Pomacanthus arcuatus	Grey angelfish	
	Pomacanthus paru	French angelfish	
	Holacanthus ciliaris	Queen angelfish	
Pomacentridae	*Abudefduf saxatilis*	Sergeant major	
	Abudefduf taurus	Night sergeant	
	Chromis cyanea	Blue chromis	
	Chromis insolata	Sunshinefish	
	Chromis multilineata	Brown chromis	
	Microspathodon chrysurus	Yellowtail damselfish	
	Stegastes diencaeus	Longfin damselfish	
	Stegastes adustus[8]	Dusky damselfish	
	Stegastes leucostictus	Beaugregory	
	Stegastes partitus	Bicolor damselfish	
	Stegastes planifrons	Threespot damselfish	
	Stegastes variabilis	Cocoa damselfish	
Priacanthidae	*Priacanthus arenatus*	Bigeye	
	Priacanthus cruentatus	Glasseye snapper	
Rhincodontidae	*Rhincodon typus*	Whale shark	
Scaridae	*Scarus coelestinus*	Midnight parrotfish	
	Scarus coeruleus	Blue parrotfish	
	Scarus guacamaia	Rainbow parrotfish	
	Scarus iserti	Striped parrotfish	
	Scarus taeniopterus	Princess parrotfish	VU
	Scarus vetula	Queen parrotfish	
	Sparisoma atomarium	Greenblotch parrotfish	
	Sparisoma aurofrenatum	Redband parrotfish	
	Sparisoma chrysopterum	Redtail parrotfish	
	Sparisoma rubripinne	Yellowtail parrotfish	
	Sparisoma viride	Stoplight parrotfish	
	Cryptotomus roseus	Bluelip parrotfish	
Sciaenidae	*Equetus punctatus*	Spotted drum	
	Equetus umbrosus	Cubbyu	

[8] Formerly classified as *S. fuscus*, but now considered to be a separate species

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Scombridae	*Scomberomorus regala*	Cero	
Scorpaenidae	*Scorpaena plumieri*	Spotted scorpionfish	
Serranidae	*Alphestes afer*	Mutton hamlet	
	Cephalopholis fulvus	Coney	
	Cephalopholis s cruentatus	Graysby	
	Epinephelus adscensionis	Rock hind	
	Epinephelus guttatus	Red hind	
	Epinephelus itajara	Goliath grouper	
	Epinephelus morio	Red grouper	
	Epinephelus striatus	Nassau grouper	CR
	Hypoplectrus aberrans	Yellowbelly hamlet	
	Hypoplectrus chlorurus	Yellowtail hamlet	EN
	Hypoplectrus gemma	Blue hamlet	
	Hypoplectrus gummingatta	Golden hamlet	
	Hypoplectrus indigo	Indigo hamlet	
	Hypoplectrus nigricans	Black hamlet	
	Hypoplectrus puella	Barred hamlet	
	Mycteroperca bonaci	Black grouper	
	Mycteroperca interstitialis	Yellowmouth grouper	
	Mycteroperca rubra	Comb grouper	CR
	Mycteroperca tigris	Tiger grouper	
	Mycteroperca venenosa	Yellowfin grouper	
	Paranthias furcifer	Creole-fish	
	Rypticus saponaceus	Greater soapfish	
	Serranus baldwini	Lantern bass	
	Serranus flaviventris	Twinspot bass	
	Serranus tabacarius	Tobaccofish	
	Serranus tigrinus	Harlequin bass	
	Serranus tortugarium	Chalk bass	
Sparidae	*Calamus bajonado*	Jolthead porgy	
	Calamus calamus	Saucereye porgy	
Sphyraenidae	*Sphyraena barracuda*	Barracuda	
	Sphyraena picudilla	Southern sennet	
Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead	
	Sphyrna tiburo	Bonnethead	
Synodontidae	*Synodus intermedius*	Sand diver	VU
	Synodus saurus	Bluestriped lizardfish	
Tetraodontidae	*Canthigaster rostrata*	Sharpnose puffer	
	Chilomycterius antennatus	Bridled burrfish	

Laughing Bird Caye National Park: Fish Species			
Family	**Species**	**Common name**	**IUCN**
Tetraodontidae	*Chilomycterius antillarum*	Web burrfish	
	Diodon holocanthus	Balloonfish	
	Diodon hystrix	Porcupinefish	
	Sphoeroides spengleri	Bandtail puffer	
	Sphoeroides testudineus	Checkered pufferfish	
Urolophidae	*Urolophus jamaicensis*	Yellow stingray	

AGGRA data, SEA / MBRS / LAMP data
Annelise Hagan, Christina Garcia and Reylando Castro and Linda Garcia, 2010

Laughing Bird caye National Park: Bird Species		
Family	**Species**	
Sulidae	Brown Booby	*Sula leucogastor*
Pelecanidae	Brown Pelican	*Pelecanus occidentalis*
Fregatidae	Magnificent Frigatebird	*Fregata magnificens*
Ardeidae	Great Blue Heron	*Ardea herodias*
	Green Heron	*Butorides virescens*
Accipitridae	Osprey	*Pandion haliaetus*
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*
Laridae	Laughing Gull	*Larus atricilla*
	Sandwich Tern	*Thalasseus sandvicensis*
	Bridled Tern	*Onychoprion anaethetus*
Parulidae	Yellow Warbler	*Dendroica petechia*
	Magnolia Warbler	*Dendroica petechia*
	Bay-breasted Warbler	*Dendroica castanea*
	Common Yellowthroat	*Geothlypis trichas*
	Mourning Warbler	*Oporornis philadelphia*
	Blackburnian Warbler	*Oporornis philadelphia*
	American Redstart	*Setophaga ruticilla*
Turdidae	Swainson's Thrush	*Catharus ustulatus*
Icteridae	Melodius Blackbird	*Dives dives*
	Great-tailed Grackle	*Quiscalus mexicanus*
L. Jones, 1998 *Z. Walker, site visit, 2010*		